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Terence Parr
parrt@cs.usfca.edu
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Because of this blurred distinction, using the ordinary General Public License for libraries did not effectively promote software sharing, because most developers did not use the libraries. We concluded that weaker conditions might promote sharing better.

However, unrestricted linking of non-free programs would deprive the users of those programs of all benefit from the free status of the libraries themselves. This Library General Public License is intended to permit developers of non-free programs to use free libraries, while preserving your freedom as a user of such programs to change the free libraries that are incorporated in them. (We have not seen how to achieve this as regards changes in header files, but we have achieved it as regards changes in the actual functions of the Library.) The hope is that this

will lead to faster development of free libraries.

The precise terms and conditions for copying, distribution and modification follow. Pay close attention to the difference between a "work based on the library" and a "work that uses the library". The former contains code derived from the library, while the latter only works together with the library.

Note that it is possible for a library to be covered by the ordinary General Public License rather than by this special one.

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0. This License Agreement applies to any software library which contains a notice placed by the copyright holder or other authorized party saying it may be distributed under the terms of this Library General Public License (also called "this License"). Each licensee is addressed as "you".

A "library" means a collection of software functions and/or data prepared so as to be conveniently linked with application programs (which use some of those functions and data) to form executables.

The "Library", below, refers to any such software library or work which has been distributed under these terms. A "work based on the Library" means either the Library or any derivative work under copyright law: that is to say, a work containing the Library or a portion of it, either verbatim or with modifications and/or translated straightforwardly into another language. (Hereinafter, translation is included without limitation in the term "modification".)

"Source code" for a work means the preferred form of the work for making modifications to it. For a library, complete source code means all the source code for all modules it contains, plus any associated interface definition files, plus the scripts used to control compilation and installation of the library.

Activities other than copying, distribution and modification are not covered by this License; they are outside its scope. The act of running a program using the Library is not restricted, and output from such a program is covered only if its contents constitute a work based on the Library (independent of the use of the Library in a tool for writing it). Whether that is true depends on what the Library does and what the program that uses the Library does.

1. You may copy and distribute verbatim copies of the Library's complete source code as you receive it, in any medium, provided that you conspicuously and appropriately publish on each copy an appropriate copyright notice and disclaimer of warranty; keep intact all the notices that refer to this License and to the absence of any warranty; and distribute a copy of this License along with the Library.

You may charge a fee for the physical act of transferring a copy, and you may at your option offer warranty protection in exchange for a fee.

2. You may modify your copy or copies of the Library or any portion of it, thus forming a work based on the Library, and copy and distribute such modifications or work under the terms of Section 1 above, provided that you also meet all of these conditions:

- a) The modified work must itself be a software library.
- b) You must cause the files modified to carry prominent notices stating that you changed the files and the date of any change.
- c) You must cause the whole of the work to be licensed at no charge to all third parties under the terms of this License.

d) If a facility in the modified Library refers to a function or a table of data to be supplied by an application program that uses the facility, other than as an argument passed when the facility is invoked, then you must make a good faith effort to ensure that, in the event an application does not supply such function or table, the facility still operates, and performs whatever part of its purpose remains meaningful.

(For example, a function in a library to compute square roots has a purpose that is entirely well-defined independent of the application. Therefore, Subsection 2d requires that any application-supplied function or table used by this function must be optional: if the application does not supply it, the square root function must still compute square roots.)

These requirements apply to the modified work as a whole. If identifiable sections of that work are not derived from the Library, and can be reasonably considered independent and separate works in themselves, then this License, and its terms, do not apply to those sections when you distribute them as separate works. But when you distribute the same sections as part of a whole which is a work based on the Library, the distribution of the whole must be on the terms of this License, whose permissions for other licensees extend to the entire whole, and thus to each and every part regardless of who wrote it.

Thus, it is not the intent of this section to claim rights or contest your rights to work written entirely by you; rather, the intent is to exercise the right to control the distribution of derivative or collective works based on the Library.

In addition, mere aggregation of another work not based on the Library with the Library (or with a work based on the Library) on a volume of a storage or distribution medium does not bring the other work under the scope of this License.

3. You may opt to apply the terms of the ordinary GNU General Public License instead of this License to a given copy of the Library. To do this, you must alter all the notices that refer to this License, so that they refer to the ordinary GNU General Public License, version 2, instead of to this License. (If a newer version than version 2 of the ordinary GNU

General Public License has appeared, then you can specify that version instead if you wish.) Do not make any other change in these notices.

Once this change is made in a given copy, it is irreversible for that copy, so the ordinary GNU General Public License applies to all subsequent copies and derivative works made from that copy.

This option is useful when you wish to copy part of the code of the Library into a program that is not a library.

4. You may copy and distribute the Library (or a portion or derivative of it, under Section 2) in object code or executable form under the terms of Sections 1 and 2 above provided that you accompany it with the complete corresponding machine-readable source code, which must be distributed under the terms of Sections 1 and 2 above on a medium customarily used for software interchange.

If distribution of object code is made by offering access to copy from a designated place, then offering equivalent access to copy the source code from the same place satisfies the requirement to distribute the source code, even though third parties are not compelled to copy the source along with the object code.

5. A program that contains no derivative of any portion of the Library, but is designed to work with the Library by being compiled or linked with it, is called a "work that uses the Library". Such a work, in isolation, is not a derivative work of the Library, and therefore falls outside the scope of this License.

However, linking a "work that uses the Library" with the Library creates an executable that is a derivative of the Library (because it contains portions of the Library), rather than a "work that uses the library". The executable is therefore covered by this License. Section 6 states terms for distribution of such executables.

When a "work that uses the Library" uses material from a header file that is part of the Library, the object code for the work may be a derivative work of the Library even though the source code is not. Whether this is true is especially significant if the work can be linked without the Library, or if the work is itself a library. The threshold for this to be true is not precisely defined by law.

If such an object file uses only numerical parameters, data structure layouts and accessors, and small macros and small inline functions (ten lines or less in length), then the use of the object file is unrestricted, regardless of whether it is legally a derivative work. (Executables containing this object code plus portions of the Library will still fall under Section 6.)

Otherwise, if the work is a derivative of the Library, you may distribute the object code for the work under the terms of Section 6. Any executables containing that work also fall under Section 6, whether or not they are linked directly with the Library itself.

6. As an exception to the Sections above, you may also compile or link a "work that uses the Library" with the Library to produce a work containing portions of the Library, and distribute that work under terms of your choice, provided that the terms permit modification of the work for the customer's own use and reverse engineering for debugging such modifications.

You must give prominent notice with each copy of the work that the Library is used in it and that the Library and its use are covered by this License. You must supply a copy of this License. If the work during execution displays copyright notices, you must include the copyright notice for the Library among them, as well as a reference directing the user to the copy of this License. Also, you must do one of these things:

a) Accompany the work with the complete corresponding machine-readable source code for the Library including whatever changes were used in the work (which must be distributed under

Sections 1 and 2 above); and, if the work is an executable linked with the Library, with the complete machine-readable "work that uses the Library", as object code and/or source code, so that the user can modify the Library and then relink to produce a modified executable containing the modified Library. (It is understood that the user who changes the contents of definitions files in the Library will not necessarily be able to recompile the application to use the modified definitions.)

b) Accompany the work with a written offer, valid for at least three years, to give the same user the materials specified in Subsection 6a, above, for a charge no more than the cost of performing this distribution.

c) If distribution of the work is made by offering access to copy from a designated place, offer equivalent access to copy the above specified materials from the same place.

d) Verify that the user has already received a copy of these materials or that you have already sent this user a copy.

For an executable, the required form of the "work that uses the Library" must include any data and utility programs needed for reproducing the executable from it. However, as a special exception, the source code distributed need not include anything that is normally distributed (in either source or binary form) with the major components (compiler, kernel, and so on) of the operating system on which the executable runs, unless that component itself accompanies the executable.

It may happen that this requirement contradicts the license restrictions of other proprietary libraries that do not normally accompany the operating system. Such a contradiction means you cannot use both them and the Library together in an executable that you distribute.

7. You may place library facilities that are a work based on the Library side-by-side in a single library together with other library facilities not covered by this License, and distribute such a combined library, provided that the separate distribution of the work based on the Library and of the other library facilities is otherwise permitted, and provided that you do these two things:

- a) Accompany the combined library with a copy of the same work based on the Library, uncombined with any other library facilities. This must be distributed under the terms of the Sections above.
- b) Give prominent notice with the combined library of the fact that part of it is a work based on the Library, and explaining where to find the accompanying uncombined form of the same work.

8. You may not copy, modify, sublicense, link with, or distribute the Library except as expressly provided under this License. Any attempt otherwise to copy, modify, sublicense, link with, or distribute the Library is void, and will automatically terminate your rights under this License. However, parties who have received copies, or rights, from you under this License will not have their licenses terminated so long as such parties remain in full compliance.

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11. If, as a consequence of a court judgment or allegation of patent infringement or for any other reason (not limited to patent issues), conditions are imposed on you (whether by court order, agreement or otherwise) that contradict the conditions of this License, they do not excuse you from the conditions of this License. If you cannot distribute so as to satisfy simultaneously your obligations under this License and any other pertinent obligations, then as a consequence you may not distribute the Library at all. For example, if a patent license would not permit royalty-free redistribution of the Library by all those who receive copies directly or indirectly through you, then the only way you could satisfy both it and this License would be to refrain entirely from distribution of the Library.

If any portion of this section is held invalid or unenforceable under any particular circumstance, the balance of the section is intended to apply, and the section as a whole is intended to apply in other circumstances.

It is not the purpose of this section to induce you to infringe any patents or other property right claims or to contest validity of any such claims; this section has the sole purpose of protecting the integrity of the free software distribution system which is implemented by public license practices. Many people have made generous contributions to the wide range of software distributed through that system in reliance on consistent application of that system; it is up to the author/donor to decide if he or she is willing to distribute software through any other system and a licensee cannot impose that choice.

This section is intended to make thoroughly clear what is believed to be a consequence of the rest of this License.

12. If the distribution and/or use of the Library is restricted in certain countries either by patents or by copyrighted interfaces, the original copyright holder who places the Library under this License may add an explicit geographical distribution limitation excluding those countries,

so that distribution is permitted only in or among countries not thus excluded. In such case, this License incorporates the limitation as if written in the body of this License.

13. The Free Software Foundation may publish revised and/or new versions of the Library General Public License from time to time. Such new versions will be similar in spirit to the present version, but may differ in detail to address new problems or concerns.

Each version is given a distinguishing version number. If the Library specifies a version number of this License which applies to it and "any later version", you have the option of following the terms and conditions either of that version or of any later version published by the Free Software Foundation. If the Library does not specify a license version number, you may choose any version ever published by the Free Software Foundation.

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END OF TERMS AND CONDITIONS

Appendix: How to Apply These Terms to Your New Libraries

If you develop a new library, and you want it to be of the greatest possible use to the public, we recommend making it free software that everyone can redistribute and change. You can do so by permitting redistribution under these terms (or, alternatively, under the terms of the ordinary General Public License).

To apply these terms, attach the following notices to the library. It is safest to attach them to the start of each source file to most effectively convey the exclusion of warranty; and each file should have at least the "copyright" line and a pointer to where the full notice is found.

<one line to give the library's name and a brief idea of what it does.>

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This library is free software; you can redistribute it and/or

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Also add information on how to contact you by electronic and paper mail.

You should also get your employer (if you work as a programmer) or your school, if any, to sign a "copyright disclaimer" for the library, if necessary. Here is a sample; alter the names:

Yoyodyne,
Inc., hereby disclaims all copyright interest in the
library 'Frob' (a library for tweaking knobs) written by James Random Hacker.

<signature of Ty Coon>, 1 April 1990
Ty Coon, President of Vice

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Version 3, 29 June 2007

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The licenses for most software and other practical works are designed
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your programs, too.

When we speak of free software,
we are referring to freedom, not
price. Our General Public Licenses are designed to make sure that you
have the freedom to distribute copies of free software (and charge for
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want it, that you can change the software or use pieces of it in new
free programs, and that you know you can do these things.

To protect your rights, we need to prevent others from denying you
these rights or asking you to surrender the rights. Therefore, you have
certain responsibilities if you distribute copies of the software, or if
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For example, if you distribute copies of such a program, whether
gratis or for a fee, you must pass on to the recipients the same
freedoms that you received. You must make sure that they, too, receive
or can get the source code. And you must show them these terms so they
know their rights.

Developers
that use the GNU GPL protect your rights with two steps:
(1) assert copyright on the software, and (2) offer you this License
giving you legal permission to copy, distribute and/or modify it.

For the developers' and authors' protection, the GPL clearly explains that there is no warranty for this free software. For both users' and authors' sake, the GPL requires that modified versions be marked as changed, so that their problems will not be attributed erroneously to authors of previous versions.

Some devices are designed to deny users access to install or run modified versions of the software inside them, although the manufacturer can do so. This is fundamentally incompatible with the aim of protecting users' freedom to change the software. The systematic pattern of such abuse occurs in the area of products for individuals to use, which is precisely where it is most unacceptable. Therefore, we have designed this version of the GPL to prohibit the practice for those products. If such problems arise substantially in other domains, we stand ready to extend this provision to those domains in future versions of the GPL, as needed to protect the freedom of users.

Finally, every program is threatened constantly by software patents. States should not allow patents to restrict development and use of software on general-purpose computers, but in those that do, we wish to avoid the special danger that patents applied to a free program could make it effectively proprietary. To prevent this, the GPL assures that patents cannot be used to render the program non-free.

The precise terms and conditions for copying, distribution and modification follow.

TERMS AND CONDITIONS

0. Definitions.

"This License" refers to version 3 of the GNU General Public License.

"Copyright" also means copyright-like laws that apply to other kinds of works, such as semiconductor masks.

"The Program" refers to any copyrightable work licensed under this License. Each licensee is addressed as "you". "Licensees" and "recipients" may be individuals or organizations.

To "modify" a work means to copy from or adapt all or part of the work in a fashion requiring copyright permission, other than the making of an exact copy. The resulting work is called a "modified version" of the earlier work or a work "based on" the earlier work.

A "covered work" means either the unmodified Program or a work based on the Program.

To "propagate" a work means to do anything with it that, without permission, would make you directly or secondarily liable for infringement under applicable copyright law, except executing it on a computer or modifying a private copy. Propagation includes copying, distribution (with or without modification), making available to the public, and in some countries other activities as well.

To "convey" a work means any kind of propagation that enables other parties to make or receive copies. Mere interaction with a user through a computer network, with no transfer of a copy, is not conveying.

An interactive user interface displays "Appropriate Legal Notices" to the extent that it includes a convenient and prominently visible feature that (1) displays an appropriate copyright notice, and (2) tells the user that there is no warranty for the work (except to the extent that warranties are provided), that licensees may convey the work under this License, and how to view a copy of this License. If the interface presents a list of user commands or options, such as a menu, a prominent item in the list meets this criterion.

1. Source Code.

The "source code" for a work means the preferred form of the work for making modifications to it. "Object code" means any non-source form of a work.

A "Standard Interface" means an interface that either is an official standard defined by a recognized standards body, or, in the case of interfaces specified for a particular programming language, one that is widely used among developers working in that language.

The "System Libraries" of an executable work include anything, other than the work as a whole, that (a) is included in the normal form of packaging a Major Component, but which is not part of that Major Component, and (b) serves only to enable use of the work with that Major Component, or to implement a Standard Interface for which an implementation is available to the public in source code form. A "Major Component", in this context, means a major essential component (kernel, window system, and so on) of the specific operating system (if any) on which the executable work runs, or a compiler used to produce the work, or an object code interpreter used to run it.

The "Corresponding Source" for a work in object code form means all

the source code needed to generate, install, and (for an executable work) run the object code and to modify the work, including scripts to control those activities. However, it does not include the work's System Libraries, or general-purpose tools or generally available free programs which are used unmodified in performing those activities but which are not part of the work. For example, Corresponding Source includes interface definition files associated with source files for the work, and the source code for shared libraries and dynamically linked subprograms that the work is specifically designed to require, such as by intimate data communication or control flow between those subprograms and other parts of the work.

The Corresponding Source need not include anything that users can regenerate automatically from other parts of the Corresponding Source.

The Corresponding Source for a work in source code form is that same work.

2. Basic Permissions.

All rights granted under this License are granted for the term of copyright on the Program, and are irrevocable provided the stated conditions are met. This License explicitly affirms your unlimited permission to run the unmodified Program. The output from running a covered work is covered by this License only if the output, given its content, constitutes a covered work. This License acknowledges your rights of fair use or other equivalent, as provided by copyright law.

You may make, run and propagate covered works that you do not convey, without conditions so long as your license otherwise remains in force. You may convey covered works to others for the sole purpose of having them make modifications exclusively for you, or provide you with facilities for running those works, provided that you comply with the terms of this License in conveying all material for which you do not control copyright. Those thus making or running the covered works for you must do so exclusively on your behalf, under your direction and control, on terms that prohibit them from making any copies of your copyrighted material outside their relationship with you.

Conveying under any other circumstances is permitted solely under the conditions stated below. Sublicensing is not allowed; section 10 makes it unnecessary.

3. Protecting Users' Legal Rights From Anti-Circumvention Law.

No covered work shall be deemed part of an effective technological measure under any applicable law fulfilling obligations under article 11 of the WIPO copyright treaty adopted on 20 December 1996, or similar laws prohibiting or restricting circumvention of such measures.

When you convey a covered work, you waive any legal power to forbid circumvention of technological measures to the extent such circumvention is effected by exercising rights under this License with respect to the covered work, and you disclaim any intention to limit operation or modification of the work as a means of enforcing, against the work's users, your or third parties' legal rights to forbid circumvention of technological measures.

4. Conveying Verbatim Copies.

You may convey verbatim copies of the Program's source code as you receive it, in any medium, provided that you conspicuously and appropriately publish on each copy an appropriate copyright notice; keep intact all notices stating that this License and any non-permissive terms added in accord with section 7 apply to the code; keep intact all notices of the absence of any warranty; and give all recipients a copy of this License along with the Program.

You may charge any price or no price for each copy that you convey, and you may offer support or warranty protection for a fee.

5. Conveying Modified Source Versions.

You may convey a work based on the Program, or the modifications to produce it from the Program, in the form of source code under the terms of section 4, provided that you also meet all of these conditions:

- a) The work must carry prominent notices stating that you modified it, and giving a relevant date.
- b) The work must carry prominent notices stating that it is released under this License and any conditions added under section 7. This requirement modifies the requirement in section 4 to "keep intact all notices".
- c) You must license the entire work, as a whole, under this License to anyone who comes into possession of a copy. This License will therefore apply, along with any applicable section 7 additional terms, to the whole of the work, and all its parts, regardless of how they are packaged. This License gives no

permission to license the work in any other way, but it does not invalidate such permission if you have separately received it.

d) If the work has interactive user interfaces, each must display

Appropriate Legal Notices; however, if the Program has interactive interfaces that do not display Appropriate Legal Notices, your work need not make them do so.

A compilation of a covered work with other separate and independent works, which are not by their nature extensions of the covered work, and which are not combined with it such as to form a larger program, in or on a volume of a storage or distribution medium, is called an "aggregate" if the compilation and its resulting copyright are not used to limit the access or legal rights of the compilation's users beyond what the individual works permit. Inclusion of a covered work in an aggregate does not cause this License to apply to the other parts of the aggregate.

6. Conveying Non-Source Forms.

You may convey a covered work in object code form under the terms of sections 4 and 5, provided that you also convey the machine-readable Corresponding Source under the terms of this License, in one of these ways:

a) Convey the object code in, or embodied in, a physical product (including a physical distribution medium), accompanied by the Corresponding Source fixed on a durable physical medium customarily used for software interchange.

b) Convey the object code in, or embodied in, a physical product (including a physical distribution medium), accompanied by a written offer, valid for at least three years and valid for as long as you offer spare parts or customer support for that product model, to give anyone who possesses the object code either (1) a copy of the Corresponding Source for all the software in the product that is covered by this License, on a durable physical medium customarily used for software interchange, for a price no more than your reasonable cost of physically performing this conveying of source, or (2) access to copy the Corresponding Source from a network server at no charge.

c) Convey individual copies of the object code with a copy of the written offer to provide the Corresponding Source. This alternative is allowed only occasionally and noncommercially, and

only if you received the object code with such an offer, in accord with subsection 6b.

d) Convey the object code by offering access from a designated place (gratis or for a charge), and offer equivalent access to the Corresponding Source in the same way through the same place at no further charge. You need not require recipients to copy the Corresponding Source along with the object code. If the place to copy the object code is a network server, the Corresponding Source may be on a different server (operated by you or a third party) that supports equivalent copying facilities, provided you maintain clear directions next to the object code saying where to find the

Corresponding Source. Regardless of what server hosts the Corresponding Source, you remain obligated to ensure that it is available for as long as needed to satisfy these requirements.

e) Convey the object code using peer-to-peer transmission, provided you inform other peers where the object code and Corresponding Source of the work are being offered to the general public at no charge under subsection 6d.

A separable portion of the object code, whose source code is excluded from the Corresponding Source as a System Library, need not be included in conveying the object code work.

A "User Product" is either (1) a "consumer product", which means any tangible personal property which is normally used for personal, family, or household purposes, or (2) anything designed or sold for incorporation into a dwelling. In determining whether a product is a consumer product, doubtful cases shall be resolved in favor of coverage.

For a particular product received by a particular user, "normally used" refers to a typical or common use of that class of product, regardless of the status of the particular user or of the way in which the particular user actually uses, or expects or is expected to use, the product. A product is a consumer product regardless of whether the product has substantial commercial, industrial or non-consumer uses, unless such uses represent the only significant mode of use of the product.

"Installation Information" for a User Product means any methods, procedures, authorization keys, or other information required to install and execute modified versions of a covered work in that User Product from a modified version of its Corresponding Source. The information must suffice to ensure that the continued functioning of the modified object code is in no case prevented or interfered with solely because modification has been made.

If you convey an object code work under this section in, or with, or specifically for use in, a User Product, and the conveying occurs as part of a transaction in which the right of possession and use of the User Product is transferred to the recipient in perpetuity or for a fixed term (regardless of how the transaction is characterized), the Corresponding Source conveyed under this section must be accompanied by the Installation Information. But this requirement does not apply if neither you nor any third party retains the ability to install modified object code on the User Product (for example, the work has been installed in ROM).

The requirement to provide Installation Information does not include a requirement to continue to provide support service, warranty, or updates for a work that has been modified or installed by the recipient, or for the User Product in which it has been modified or installed. Access to a network may be denied when the modification itself materially and adversely affects the operation of the network or violates the rules and protocols for communication across the network.

Corresponding Source conveyed, and Installation Information provided, in accord with this section must be in a format that is publicly documented (and with an implementation available to the public in source code form), and must require no special password or key for unpacking, reading or copying.

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```
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under certain conditions; type 'show c' for details.
```

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GNU LIBICONV - character set conversion library

This library provides an iconv() implementation, for use on systems which don't have one, or whose implementation cannot convert from/to Unicode.

It provides support for the encodings:

European languages

ASCII, ISO-8859-{1,2,3,4,5,7,9,10,13,14,15,16},
 KOI8-R, KOI8-U, KOI8-RU,
 CP{1250,1251,1252,1253,1254,1257}, CP{850,866,1131},
 Mac{Roman,CentralEurope,Iceland,Croatian,Romania},
 Mac{Cyrillic,Ukraine,Greek,Turkish},
 Macintosh
 Semitic languages
 ISO-8859-{6,8}, CP{1255,1256}, CP862, Mac{Hebrew,Arabic}
 Japanese
 EUC-JP, SHIFT_JIS, CP932, ISO-2022-JP, ISO-2022-JP-2, ISO-2022-JP-1
 Chinese
 EUC-CN, HZ, GBK, CP936, GB18030, EUC-TW, BIG5, CP950, BIG5-HKSCS,
 BIG5-HKSCS:2004, BIG5-HKSCS:2001, BIG5-HKSCS:1999, ISO-2022-CN,
 ISO-2022-CN-EXT
 Korean
 EUC-KR, CP949, ISO-2022-KR, JOHAB
 Armenian

 ARMSII-8
 Georgian
 Georgian-Academy, Georgian-PS
 Tajik
 KOI8-T
 Kazakh
 PT154, RK1048
 Thai
 ISO-8859-11, TIS-620, CP874, MacThai
 Laotian
 MuleLao-1, CP1133
 Vietnamese
 VISCII, TCVN, CP1258
 Platform specifics
 HP-ROMAN8, NEXTSTEP
 Full Unicode
 UTF-8
 UCS-2, UCS-2BE, UCS-2LE
 UCS-4, UCS-4BE, UCS-4LE
 UTF-16, UTF-16BE, UTF-16LE
 UTF-32, UTF-32BE, UTF-32LE
 UTF-7
 C99, JAVA
 Full Unicode, in terms of 'uint16_t' or 'uint32_t'
 (with machine dependent endianness and alignment)
 UCS-2-INTERNAL, UCS-4-INTERNAL
 Locale dependent, in terms of 'char' or 'wchar_t'
 (with machine dependent endianness and alignment, and with OS and
 locale dependent semantics)
 char, wchar_t

The empty encoding name "" is equivalent to "char": it denotes the locale dependent character encoding.

When configured with the option --enable-extra-encodings, it also provides support for a few extra encodings:

European languages

CP{437,737,775,852,853,855,857,858,860,861,863,865,869,1125}

Semitic languages

CP864

Japanese

EUC-JISX0213, Shift_JISX0213, ISO-2022-JP-3

Chinese

BIG5-2003 (experimental)

Turkmen

TDS565

Platform specifics

ATARIST, RISCOS-LATIN1

It can convert from any of these encodings to any other, through Unicode conversion.

It has also some limited support for transliteration, i.e. when a character cannot be represented in the target character set, it can be approximated through one or several similarly looking characters. Transliteration is activated when "//TRANSLIT" is appended to the target encoding name.

libiconv is for you if your application needs to support multiple character encodings, but that support lacks from your system.

Installation

As usual for GNU packages:

```
$ ./configure --prefix=/usr/local
```

```
$ make
```

```
$ make install
```

After installing GNU libiconv for the first time, it is recommended to recompile and reinstall GNU gettext, so that it can take advantage of libiconv.

On systems other than GNU/Linux, the iconv program will be internationalized only if GNU gettext has been built and installed before GNU libiconv. This

means that the first time GNU libiconv is installed, we have a circular dependency between the GNU libiconv and GNU gettext packages, which can be resolved by building and installing either

- first libiconv, then gettext, then libiconv again,

or (on systems supporting shared libraries, excluding AIX)

- first gettext, then libiconv, then gettext again.

Recall that before building a package for the second time, you need to erase the traces of the first build by running "make distclean".

This library can be built and installed in two variants:

- The library mode. This works on all systems, and uses a library 'libiconv.so' and a header file '<iconv.h>'. (Both are installed through "make install".)

To use it, simply #include <iconv.h> and use the functions.

To use it in an autoconfiguring package:

- If you don't use automake, append m4/iconv.m4 to your aclocal.m4 file.
- If you do use automake, add m4/iconv.m4 to your m4 macro repository.
- Add to the link command line of libraries and executables that use the functions the placeholder @LIBICONV@ (or, if using libtool for the link, @LTLIBICONV@). If you use automake, the right place for these additions are the *_LDADD variables.

Note that 'iconv.m4' is also part of the GNU gettext package, which installs it in /usr/local/share/aclocal/iconv.m4.

- The libc plug/override mode. This works on GNU/Linux, Solaris and OSF/1

systems only. It is a way to get good iconv support without having glibc-2.1.

It installs a library 'preloadable_libiconv.so'. This library can be used with LD_PRELOAD, to override the iconv* functions present in the C library.

On GNU/Linux and Solaris:

```
$ export LD_PRELOAD=/usr/local/lib/preloadable_libiconv.so
```

On OSF/1:

```
$ export _RLD_LIST=/usr/local/lib/preloadable_libiconv.so:DEFAULT
```

A program's source need not be modified, the program need not even be recompiled. Just set the LD_PRELOAD environment variable, that's it!

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Download

<http://ftp.gnu.org/gnu/libiconv/libiconv-1.14.tar.gz>

Homepage

<http://www.gnu.org/software/libiconv/>

Bug

reports to

<bug-gnu-libiconv@gnu.org>

Bruno Haible <bruno@clisp.org>

1.5 lua 5.1.5

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1.6 libpcap 1.2.1

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1.7 freetype-ttf 20100919

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1.8 pm-utils 1.4.1

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1.9 speex 1.2

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1.10 protobuf 2.4.1

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1.11 bzip2 1.0.6

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bzip2/libbzip2 version 1.0.2 of 30 December 2001

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/*

minibz2

libbz2.dll test program.

by Yoshioka Tsuneo (tsuneo@rr.iij4u.or.jp)

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usage: minibz2 [-d] [-{1,2,...9}] [[srcfilename] destfilename]

*/

1.12 lua 5.1.4

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1.16 libpcap 1.7.4

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1.17 dhcp 4.1-ESV-R9

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1.19 libnfnetwork 1.0.1

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1.20 libxml2 2.9.4

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/*

* hash.c: chained hash tables

*

* Reference: Your favorite introductory book on algorithms

*

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*

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1.21 d-bus 1.10.8

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1.22 glib 2.48.1

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That's all there is to it!

/* This is the public header file for the PCRE library, to be #included by applications that call the PCRE functions.

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June 26, 2010

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(For example, a function in a library to compute square roots has a purpose that is entirely well-defined independent of the application. Therefore, Subsection 2d requires that any application-supplied function or table used by this function must be optional: if the application does not supply it, the square root function must still compute square roots.)

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Any executables

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#

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#

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#

docs/FTL.TXT

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#

include/freetype/internal/fthash.h

#

src/base/fthash.c

src/base/md5.c

src/base/md5.h

#

src/bdf/bdf.c

src/bdf/bdf.h

src/bdf/bdfdrivr.c

src/bdf/bdfdrivr.h

src/bdf/bdferror.h

src/bdf/bdflib.c

src/bdf/module.mk

src/bdf/README

src/bdf/rules.mk

#

src/pcf/module.mk

src/pcf/pcf.c

src/pcf/pcf.h

src/pcf/pcfdrivr.c

src/pcf/pcfdrivr.h

src/pcf/pcferror.h

src/pcf/pcfread.c

src/pcf/pcfread.h

```
src/pcf/pcfutil.c
src/pcf/pcfutil.h
src/pcf/README
src/pcf/rules.mk
#
src/gzip/adler32.c
src/gzip/infblock.c
src/gzip/infblock.h
src/gzip/infcodes.c
src/gzip/infcodes.h
src/gzip/inffixed.h
src/gzip/inflate.c
src/gzip/inftrees.c
src/gzip/inftrees.h
src/gzip/infutil.c
src/gzip/infutil.h
src/gzip/zconf.h
src/gzip/zlib.h
src/gzip/zutil.c
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#
src/tools/apinames.c
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1.27 e2fsprogs 1.43.7

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It is part of the main e2fsprogs distribution, which can be found at:

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Index: tdbsa/tdb.c

--- tdbsa.orig/tdb.c

+++ tdbsa/tdb.c

@@ -4,11 +4,11 @@ Rev: 23371

Last Changed Date: 2007-06-06 20:14:06 -0400 (Wed, 06 Jun 2007)

*/

/*

- Unix SMB/CIFS implementation.
- + trivial database library - standalone version

- trivial database library - private includes

-

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```
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```

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```
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```

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```
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```


<signature of Ty Coon>, 1 April 1989

Ty Coon, President of Vice

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This is the Debian GNU/Linux prepackaged version of the EXT2 file system utilities (e2fsck, mke2fs, etc.). The EXT2 utilities were written by Theodore Ts'o <tytso@mit.edu> and Remy Card <card@masi.ibp.fr>.

Sources were obtained from <http://sourceforge.net/projects/e2fsprogs>

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This package was added to the e2fsprogs debian source package by Theodore Ts'o <tytso@mit.edu> on Sat Mar 15 15:33:37 EST 2003

It is part of the main e2fsprogs distribution, which can be found at:

<http://sourceforge.net/projects/e2fsprogs>

Upstream Author: Theodore Ts'o <tytso@mit.edu>

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#

This is a Makefile stub which handles the creation of BSD shared
libraries.

#

In order to use this stub, the following makefile variables must be defined.

#

BSDLIB_VERSION = 1.0

BSDLIB_IMAGE = libce

BSDLIB_MYDIR = et

BSDLIB_INSTALL_DIR = \$(SHLIBDIR)

#

all:: image

real-subdirs:: Makefile

@echo " MKDIR pic"

@mkdir -p pic

BSD_LIB = \$(BSDLIB_IMAGE).so.\$(BSDLIB_VERSION)

BSDLIB_PIC_FLAG = -fpic

image: \$(BSD_LIB)

```
$(BSD_LIB): $(OBS)
(cd pic; ld -Bshareable -o $(BSD_LIB) $(LDFLAGS_SHLIB) $(OBS))
$(MV) pic/$(BSD_LIB) .
$(RM) -f ../$(BSD_LIB)
(cd ..; $(LN) $(LINK_BUILD_FLAGS) \
`echo $(my_dir) | sed -e 's;lib/;;'~/'$(BSD_LIB) $(BSD_LIB))
```

```
install-shlibs install:: $(BSD_LIB)
@echo " INSTALL_PROGRAM $(BSDLIB_INSTALL_DIR)/$(BSD_LIB)"
@$(INSTALL_PROGRAM) $(BSD_LIB) \
$(DESTDIR)$$(BSDLIB_INSTALL_DIR)/$(BSD_LIB)
@-$(LDCONFIG)
```

install-strip: install

install-shlibs-strip: install-shlibs

```
uninstall-shlibs uninstall::
$(RM) -f $(DESTDIR)$$(BSDLIB_INSTALL_DIR)/$(BSD_LIB)
```

```
clean::
$(RM)
-rf pic
$(RM) -f $(BSD_LIB)
$(RM) -f ../$(BSD_LIB)
```

This is the Debian GNU/Linux prepackaged version of the ss command-line interface parsing library. It is currently distributed together with the EXT2 file system utilities, which are otherwise packaged as "e2fsprogs".

This package was put together by Yann Dirson <dirson@debian.org>, from sources obtained from a mirror of:
tsx-11.mit.edu/pub/linux/packages/ext2fs/

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before you ship. The release schedules for this package are flexible, if you give me enough lead time.

Theodore Ts'o
23-June-2007

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```
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of author>
```

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```
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Gnomovision comes
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This is free software, and you are welcome to redistribute it
under certain conditions; type `show c' for details.
```

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```
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```

```
<signature of Ty Coon>, 1 April 1989
Ty Coon, President of Vice
```

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Ty Coon, President of Vice

That's all there is to it!

This is the Debian GNU/Linux prepackaged version of the Common Error Description library. It is currently distributed together with the EXT2 file system utilities, which are otherwise packaged as "e2fsprogs".

This package was put together by Yann Dirson <dirson@debian.org>, from sources obtained from a mirror of:
tsx-11.mit.edu:/pub/linux/packages/ext2fs/

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1.28 apr-util 1.6.1

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```
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1.29 pcre 8.42

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Written by: Philip Hazel

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Version 1.1

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1.31 boost 1.67.0

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1.32 curl 7.62.0

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=====

libcurl can be built to use a fair amount of various third party libraries, libraries that are written and provided by other parties that are distributed using their own licenses. Even libcurl itself contains code that may cause problems to some. This document attempts to describe what licenses libcurl and the other libraries use and what possible dilemmas linking and mixing them all

can lead to for end users.

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##

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OpenLDAP

(Used for LDAP support) Uses a Modified BSD-style license. Since libcurl uses OpenLDAP as a shared library only, I have not heard of anyone that ships OpenLDAP linked with libcurl in an app.

libssh2

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1.33 latencyutils 2.0.3

1.34 python 3.7.3

1.34.1 Available under license :

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A. HISTORY OF THE SOFTWARE

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Python was created in the early 1990s by Guido van Rossum at Stichting Mathematisch Centrum (CWI, see <http://www.cwi.nl>) in the Netherlands as a successor of a language called ABC. Guido remains Python's principal author, although it includes many contributions from others.

In 1995, Guido continued his work on Python at the Corporation for National Research Initiatives (CNRI, see <http://www.cnri.reston.va.us>) in Reston, Virginia where he released several versions of the software.

In May 2000, Guido and the Python core development team moved to BeOpen.com to form the BeOpen PythonLabs team. In October of the same year, the PythonLabs team moved to Digital Creations, which became Zope Corporation. In 2001, the Python Software Foundation (PSF, see <https://www.python.org/psf/>) was formed, a non-profit organization created specifically to own Python-related Intellectual Property. Zope Corporation was a sponsoring member of the PSF.

All

Python releases are Open Source (see <http://www.opensource.org> for the Open Source Definition). Historically, most, but not all, Python releases have also been GPL-compatible; the table below summarizes the various releases.

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1.3 thru 1.5.2	1.2	1995-1999	CNRI	yes
1.6	1.5.2	2000	CNRI	no
2.0	1.6	2000	BeOpen.com	no
1.6.1	1.6	2001	CNRI	yes (2)
2.1	2.0+1.6.1	2001	PSF	no
2.0.1	2.0+1.6.1	2001	PSF	yes
2.1.1	2.1+2.0.1	2001	PSF	yes
2.1.2	2.1.1	2002	PSF	yes
2.1.3	2.1.2	2002	PSF	yes
2.2 and above	2.1.1	2001-now		
PSF	yes			

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In 1995, Guido continued his work on Python at the Corporation for National Research Initiatives (CNRI, see <https://www.cnri.reston.va.us/>) in Reston, Virginia where he released several versions of the software.

In May 2000, Guido and the Python core development team moved to BeOpen.com to form the BeOpen PythonLabs team. In October of the same year, the PythonLabs team moved to Digital Creations (now Zope Corporation; see <http://www.zope.com/>). In 2001, the Python Software Foundation (PSF, see <https://www.python.org/psf/>) was formed, a non-profit organization created specifically to own Python-related Intellectual Property. Zope Corporation is a sponsoring member of the PSF.

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Mersenne Twister

The `:mod:`_random`` module includes code based on a download from <http://www.math.sci.hiroshima-u.ac.jp/~m-mat/MT/MT2002/emt19937ar.html>. The following are the verbatim comments from the original code::

A C-program for MT19937, with initialization improved 2002/1/26.
Coded by Takuji Nishimura and Makoto Matsumoto.

Before using, initialize the state by using `init_genrand(seed)`
or `init_by_array(init_key, key_length)`.

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<http://www.math.sci.hiroshima-u.ac.jp/~m-mat/MT/emt.html>

email: m-mat @ math.sci.hiroshima-u.ac.jp (remove space)

Sockets

The `:mod:`socket``

module uses the functions, `:func:`getaddrinfo``, and

`:func:`getnameinfo``, which are coded in separate source files from the WIDE

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Asynchronous socket services

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Modified by Jack Jansen, CWI, July 1995:

- Use binascii module to do the actual line-by-line conversion between ascii and binary. This results in a 1000-fold speedup. The C version is still 5 times faster, though.
- Arguments more compliant with Python standard

XML Remote Procedure Calls

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SipHash24

The file :file:`Python/pyhash.c` contains Marek

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Original location:

<https://github.com/majek/csiphash/>

Solution inspired by code from:

Samuel Neves (supercop/crypto_auth/siphash24/little)

djb (supercop/crypto_auth/siphash24/little2)

Jean-Philippe Aumasson

(<https://131002.net/siphash/siphash24.c>)

strtod and dtoa

The file :file:`Python/dtoa.c`, which supplies C functions dtoa and strtod for conversion of C doubles to and from strings, is derived from the file of the same name by David M. Gay, currently available from <http://www.netlib.org/fp/>. The original file, as retrieved on March 16, 2009, contains the following copyright and licensing notice::

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zlib

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Jean-loup Gailly Mark Adler
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cfuhash

The implementation of the hash table used by the `:mod:`tracemalloc`` is based on the cfuhash project::

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1.35 freerdp 2.0.0-rc4

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1.36 bzip2 1.0.8

1.37 Idns 1.7.1

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libtool (GNU libtool) 2.4.6

Provide generalized library-building support services.

Written by Gordon Matzigkeit <gord@gnu.ai.mit.edu>, 1996

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/*

* FILE: sha2.c

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*

* Modified by Jelte Jansen to fit in ldns, and not clash with any

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* Changes:

* - Renamed (external) functions and constants to fit ldns style

* - Removed _End and _Data functions

* - Added ldns_shaX(data, len, digest) convenience functions

* - Removed prototypes of _Transform functions and made those static

*

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sha2.c,v 1.1 2001/11/08 00:01:51 adg Exp adg \$

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/* from openssh 4.3p2 compat/strncpy.c */

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1.39 zlib 1.2.8

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```
/* zlib.h -- interface of the 'zlib' general purpose compression library
   version 1.2.11, January 15th, 2017
```

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Jean-loup Gailly	Mark Adler
jloup@zip.org	madler@alumni.caltech.edu

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1.40 dmidecode 3.5

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1.42 pcre 8.39

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1.43 libiconv 1.14

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Version 2, June 1991

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[This is the first released version of the library GPL. It is
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However, unrestricted linking of non-free programs would deprive the users of those programs of all benefit from the free status of the

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Note that it is possible for a library to be covered by the ordinary General Public License rather than by this special one.

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This option is useful when you wish to copy part of the code of the
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If distribution of object code is made by offering access to copy

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END OF TERMS AND CONDITIONS

Appendix: How to Apply These Terms to Your New Libraries

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To apply these terms, attach the following notices to the library. It is safest to attach them to the start of each source file to most effectively convey the exclusion of warranty; and each file should have at least the "copyright" line and a pointer to where the full notice is found.

<one line to give the library's name and a brief idea of what it does.>

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Version 3, 29 June 2007

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Some devices are designed to deny users access to install or run modified versions of the software inside them, although the manufacturer can do so. This is fundamentally incompatible with the aim of protecting users' freedom to change the software. The systematic pattern of such abuse occurs in the area of products for individuals to use, which is precisely where it is most unacceptable. Therefore, we have designed this version of the GPL to prohibit the practice for those products. If such problems arise substantially in other domains, we stand

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Finally, every program is threatened constantly by software patents. States should not allow patents to restrict development and use of software on general-purpose computers, but in those that do, we wish to avoid the special danger that patents applied to a free program could make it effectively proprietary. To prevent this, the GPL assures that patents cannot be used to render the program non-free.

The precise terms and conditions for copying, distribution and modification follow.

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The "source code" for a work means the preferred form of the work for making modifications to it. "Object code" means any non-source form of a work.

A "Standard Interface" means an interface that either is an official standard defined by a recognized standards body, or, in the case of interfaces specified for a particular programming language, one that is widely used among developers working in that language.

The

"System Libraries" of an executable work include anything, other than the work as a whole, that (a) is included in the normal form of packaging a Major Component, but which is not part of that Major Component, and (b) serves only to enable use of the work with that Major Component, or to implement a Standard Interface for which an implementation is available to the public in source code form. A "Major Component", in this context, means a major essential component (kernel, window system, and so on) of the specific operating system (if any) on which the executable work runs, or a compiler used to produce the work, or an object code interpreter used to run it.

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1.45 json-c 0.12.1

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1.46 glibc 2.23

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```
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```

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```
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```

```
<signature of Ty Coon>, 1 April 1989
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1.56 apr 1.6.5

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```
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```

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```
* Based on libdl (dlfcn.c/dlfcn.h) which is
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```

From strings/apr_strnatcmp.c,

include/apr_strings.h:

strnatcmp.c -- Perform 'natural order' comparisons of strings in C.
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strings/apr_snprintf.c:

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1.58 audit 2.8.4-3

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1.60 lua 5.2.3

1.61 libvmtools 9.4.0.25793

1.61.1 Available under license :

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Any executables

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1.62 acpid 2.0.27

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```
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under certain conditions; type `show c' for details.
```

The hypothetical commands ``show w'` and ``show c'`
should show the appropriate
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```
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```

```
<signature of Ty Coon>, 1 April 1989
Ty Coon, President of Vice
```

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1.63 swagger-annotations 1.5.22

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*/

package io.swagger.annotations;

import java.lang.annotation.ElementType;

import java.lang.annotation.Retention;

import java.lang.annotation.RetentionPolicy;

import java.lang.annotation.Target;

/**

* License metadata available within the info section of a Swagger definition, see

* <https://github.com/OAI/OpenAPI-Specification/blob/master/versions/2.0.md#licenseObject>

*

* @since 1.5.0

*/

@Target(ElementType.ANNOTATION_TYPE)

@Retention(RetentionPolicy.RUNTIME)

```

public @interface License {

    /**
     * The name of the license.
     *
     * @return the name of the license
     */
    String name();

    /**
     * An optional URL for the license.
     *
     * @return an optional URL for the license.
     */
    String url() default "";
}

```

1.64 opus 1.1.2

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1.65 libvpx 1.4.0

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Authors: Loren Merritt <lorenm@u.washington.edu>

Anton Mitrofanov <BugMaster@narod.ru>

Jason Garrett-Glaser <darkshikari@gmail.com>

Henrik Gramner <hengar-6@student.ltu.se>

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1.66 e2fsprogs 1.43.1

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*/

Index: tdbsa/tdb.c

=====

--- tdbsa.orig/tdb.c

+++ tdbsa/tdb.c

@@ -4,11 +4,11 @@ Rev: 23371

Last Changed Date: 2007-06-06 20:14:06 -0400 (Wed, 06 Jun 2007)

*/

/*

- Unix SMB/CIFS implementation.
- + trivial database library - standalone version

- trivial database library - private includes

-

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```

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Theodore Ts'o
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```
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```
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```

```
<signature of Ty Coon>, 1 April 1989
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That's all there is to it!

This is the Debian GNU/Linux prepackaged version of the EXT2 file
system utilities (e2fsck, mke2fs, etc.). The EXT2 utilities were
written by Theodore Ts'o <tytso@mit.edu> and Remy Card <card@masi.ibp.fr>.

Sources were obtained from <http://sourceforge.net/projects/e2fsprogs>

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This package was added to the e2fsprogs debian source package by Theodore Ts'o <tytso@mit.edu> on Sat Mar 15 15:33:37 EST 2003

It is part of the main e2fsprogs distribution, which can be found at:

<http://sourceforge.net/projects/e2fsprogs>

Upstream Author: Theodore Ts'o <tytso@mit.edu>

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#

This is a Makefile stub which handles the creation of BSD shared
libraries.

#

In order to use this stub, the following makefile variables must be defined.

```

#
# BSDLIB_VERSION = 1.0
# BSDLIB_IMAGE = libce
# BSDLIB_MYDIR = et
# BSDLIB_INSTALL_DIR = $(SHLIBDIR)
#

all:: image

real-subdirs:: Makefile
@echo " MKDIR pic"
@mkdir -p pic

BSD_LIB = $(BSDLIB_IMAGE).so.$(BSDLIB_VERSION)
BSDLIB_PIC_FLAG = -fpic

image: $(BSD_LIB)

$(BSD_LIB): $(OBJS)
(cd pic; ld -Bshareable -o $(BSD_LIB) $(LDFLAGS_SHLIB) $(OBJS))
$(MV) pic/$(BSD_LIB) .
$(RM) -f ../$(BSD_LIB)
(cd ..; $(LN) $(LINK_BUILD_FLAGS) \
`echo $(my_dir) | sed -e 's;lib/;;'`/$(BSD_LIB) $(BSD_LIB))

install-shlibs install:: $(BSD_LIB)
@echo " INSTALL_PROGRAM $(BSDLIB_INSTALL_DIR)/$(BSD_LIB)"
@$(INSTALL_PROGRAM) $(BSD_LIB) \
$(DESTDIR)$$(BSDLIB_INSTALL_DIR)/$(BSD_LIB)
@-$(LDCONFIG)

install-strip: install

install-shlibs-strip: install-shlibs

uninstall-shlibs uninstall::
$(RM) -f $(DESTDIR)$$(BSDLIB_INSTALL_DIR)/$(BSD_LIB)

clean::
$(RM)
-rf pic
$(RM) -f $(BSD_LIB)
$(RM) -f ../$(BSD_LIB)

```

This is the Debian GNU/Linux prepackaged version of the ss command-line interface parsing library. It is currently distributed together with the EXT2 file system utilities, which are otherwise packaged as "e2fsprogs".

This package was put together by Yann Dirson <dirson@debian.org>,
from sources obtained from a mirror of:
tsx-11.mit.edu:/pub/linux/packages/ext2fs/

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This is the Debian GNU/Linux prepackaged version of the Common Error
Description library. It is currently distributed together with the EXT2 file
system utilities, which are otherwise packaged as "e2fsprogs".

This package was put together by Yann Dirson <dirson@debian.org>,
from sources obtained from a mirror of:
tsx-11.mit.edu:/pub/linux/packages/ext2fs/

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1.67 jline 3.11.0

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1.68 cache-api 1.1.1

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quirc -- QR-code recognition library

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=====

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License for Berkeley SoftFloat Release 3c

John R. Hauser

2017 February 10

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PNG

[illegible]

<?xml version="1.0"?>

<opencv_storage>

<!-- Automatically converted from haarcascade2, window size = 64x16 -->

```
<haarcascade_pltzzz64x16_16STG type_id="opencv-haar-classifier">
```

 $\langle \text{size} \rangle$

64 16</size>

<stages>

 $\langle _ \rangle$

```
<!-- stage 0 -->
```

<trees>

 $\langle _ \rangle$

```
<!-- tree 0 -->
```

 $\langle \quad \rangle$

```
<!-- root node -->
```

<feature>

<rects>

 \angle

32 2 8 6 -1.</_>

< >

32 4 8 2 3.

$$\langle \text{tilted} \rangle 0 \langle / \text{tilted} \rangle \langle / \text{feature} \rangle$$

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 \angle

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  <_>
    <!-- stage 1 -->

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          <!--
root node -->
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    <!-- tree 0 -->
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      <!-- root node -->
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    <!-- tree 1 -->
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```

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          13 4 3 3 3.</_></rects>
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    <!-- tree 4 -->
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      <!-- tree 5 -->
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        <!-- root node -->
        <feature>
          <rects>

```



```

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```

```

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        <_>
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          <!-- root node -->
          <feature>
            <rects>

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    <_>
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<!-- root node -->

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      <!-- root node -->
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          <!-- tree 1 -->
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            <!-- root node -->
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<!-- root node -->
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            3 8 3 7 3.</_></rects>
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<_>
<!-- root node -->
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        <_>
            31 10 1 3 3.</_></rects>
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<!-- root node -->
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        <_>
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    <_>
      <!-- root node -->
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          <_>
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  <_>
    <!-- root node -->
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        <_>
          0 0 6 2 2.</_>
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    <!-- tree 3 -->
  <_>
    <!-- root node -->
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          52 12 9 2 2.</_></rects>
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    <!-- tree 4 -->
  <_>
    <!-- root node -->
    <feature>
      <rects>
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              <!-- root node -->
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                <!-- tree 2 -->
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                    <!-- root node -->
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                          <_>
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                          <_>
                            26 2 2 13 3.</_></rects>
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```

<!-- tree 3 -->
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        <_>
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    <!-- tree 0 -->
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        <!-- root node -->
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                1 3 57 2 2.</_></rects>
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          <!-- tree 1 -->
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              <!-- root node -->
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        54 3 2 10 3.</_></rects>
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    <!-- root node -->

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    <_>
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        <feature>
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            <_>
              43 6 2 8 3.</_></rects>
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                57 9 7 5 2.</_></rects>
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        <_>
          <!-- tree 3 -->
          <_>
            <!-- root node -->
            <feature>

```

```

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      <_>
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    <!-- root node -->
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    <_>
      <!-- root node -->
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            54 0 5 3 2.</_>
          <_>
            59 3 5 3 2.</_></rects>
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        <!-- tree 1 -->
      <_>

```

```

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    <_>
      49 0 2 11 3.</_></rects>
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<!-- root node -->
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      19 3 20 1 2.</_></rects>
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<!-- root node -->
<feature>
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<!-- tree 4 -->
<_>
<!-- root node -->
<feature>
  <rects>
    <_>
      31 9 33 2 -1.</_>
    <_>

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```

        42 9 11 2 3.</_></rects>
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    <next>-1</next></_>
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    <!-- tree 0 -->
    <_>
    <!-- root node -->
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            <_>
            6 3 53 2 3.</_></rects>
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        <right_val>8.4619927406311035e-001</right_val></_></_>
    <_>
    <!-- tree 1 -->
    <_>
    <!-- root node -->
    <feature>
        <rects>
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            49
9 4 6 -1.</_>
            <_>
            49 9 2 3 2.</_>
            <_>
            51 12 2 3 2.</_></rects>
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        <right_val>-8.8221758604049683e-001</right_val></_></_>
    <_>
    <!-- tree 2 -->
    <_>
    <!-- root node -->
    <feature>
        <rects>

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```

    <_>
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    <_>
    10 9 10 7 3.</_></rects>
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    <threshold>1.0838840156793594e-002</threshold>
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    <right_val>6.0648679733276367e-001</right_val></_></_>
<_>
<!-- tree 3 -->
<_>
<!-- root node -->
<feature>
<rects>

<_>
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    <_>
    42 4 2 2 3.</_></rects>
    <tilted>0</tilted></feature>
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    <left_val>-9.0554022789001465e-001</left_val>
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<!-- tree 4 -->
<_>
<!-- root node -->
<feature>
<rects>
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    <_>
    3 9 2 1 3.</_></rects>
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<_>
<!-- tree 5 -->
<_>
<!-- root node -->
<feature>
<rects>
    <_>
    47 3
4 10 -1.</_>
    <_>
    47 8 4 5 2.</_></rects>

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  <feature>
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        41 5 10 11 3.</_></rects>
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</opencv_storage>
This package was debianized by Christopher L Cheney <ccheney@debian.org> on
Fri, 22 Aug 2003 01:33:34 -0500.
```

The current maintainer is Roland Stigge <stigge@antcom.de>

It was downloaded from <http://www.ece.uvic.ca/~mdadams/jasper/>

Upstream Author: Michael Adams <mdadams@ece.uvic.ca>

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1.71 cryptsetup 2.1.0

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John R. Hauser

2017 February 10

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[illegible]

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<_>

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  <!-- root node -->
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      <_>
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  <next>-1</next></_>
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          <_>
            44 7 1 7 2.</_></rects>
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    </_>
  </_>
</_>

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<_>
<!-- tree 2 -->
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  <!-- root node -->
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      <_>
        32 0 15 3 2.</_>
      <_>
        47 3 15 3 2.</_></rects>
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    <!-- root node -->
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        <_>
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    <!-- tree 4 -->
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      <!-- root node -->
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      <!-- tree 5 -->
      <_>

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```

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    <_>
      29 3 8 4 3.</_></rects>
  <tilted>0</tilted></feature>
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<!-- root node -->
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    <_>
      46 3 4 6 3.</_></rects>
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    <!-- tree 0 -->
    <_>
      <!-- root node -->
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          <_>
            59 9 3 6 2.</_></rects>
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<!-- tree 1 -->

```



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<_>
<!-- root node -->
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    <_>
      6 7 1 3 2.</_></rects>
  <tilted>0</tilted></feature>
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<!-- tree 2 -->
<_>
<!-- root node -->
<feature>
  <rects>
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    <_>
      0 0 6 2 2.</_>
    <_>
      6 2 6 2 2.</_></rects>
  <tilted>0</tilted></feature>
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<!-- tree 3 -->
<_>
<!-- root node -->
<feature>
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      52 12 9 2 2.</_></rects>
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<_>
<!-- tree 4 -->
<_>
<!-- root node -->
<feature>
  <rects>

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```

    <_>
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    <_>
      10 5 1 8 2.</_></rects>
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    <!-- tree 0 -->
    <_>
      <!-- root node -->
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          <_>
            3 9 2 3 3.</_></rects>
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          <!-- tree 1 -->
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            <!-- root node -->
            <feature>
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                <_>
                  56 12 2 4 2.</_></rects>
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                <right_val>-9.8322170972824097e-001</right_val></_></_>
              <_>
                <!-- tree 2 -->
                <_>
                  <!-- root node -->

```

```

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    <_>
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<_>
<!-- tree 3 -->
<_>
<!-- root node -->
<feature>
  <rects>
    <_>
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    <_>
      41 7 8 4 3.</_></rects>
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    <!-- tree 0 -->
    <_>
      <!-- root node -->
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            1 3 57 2 2.</_></rects>
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    <!-- tree 1 -->
    <_>

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<!-- root node -->
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      <_>
        3 2 3 14 2.</_></rects>
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<!-- tree 2 -->
  <_>
    <!-- root node -->
      <feature>
        <rects>
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          <_>
            54 3 2 10 3.</_></rects>
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    <_>
    <!-- tree 3 -->
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        <!-- root node -->
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        <_>
        <!-- tree 4 -->
          <_>
            <!-- root node -->
              <feature>
                <rects>
                  <_>
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  <_>
    <!-- tree 0 -->
    <_>
      <!-- root node -->
      <feature>
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          <_>
            22 3 41 2 2.</_></rects>
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          <right_val>7.5645631551742554e-001</right_val></_></_>
        <_>
          <!-- tree 1 -->
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            <!-- root node -->
            <feature>
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                  43 6 2 8 3.</_></rects>
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            <_>
              <!-- tree 2 -->
              <_>
                <!-- root node -->
                <feature>
                  <rects>
                    <_>
                      50 9 14 5 -1.</_>

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    <_>
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<_>
<!-- tree 3 -->
<_>
<!-- root node -->
<feature>
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        <_>
        10 1 6 5 2.</_></rects>
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<_>
<!-- tree 4 -->
<_>
<!-- root node -->
<feature>
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        <_>
        38 9 1 3 3.</_></rects>
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    <_>
    <!-- tree 0 -->
    <_>
    <!-- root node -->
    <feature>
        <rects>
            <_>
            54 0 10 6 -1.</_>

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```

    <_>
    54 0 5 3 2.</_>

    <_>
    59 3 5 3 2.</_></rects>
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  <!-- root node -->
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  <_>
  49 0 2 11 3.</_></rects>
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  <right_val>-7.1949690580368042e-001</right_val></_></_>
  <_>
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  <_>
  <!-- root node -->
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  <_>
  19 3 20 1 2.</_></rects>
  <tilted>0</tilted></feature>
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  <!-- tree 3 -->
  <_>
  <!-- root node -->
  <feature>
  <rects>
  <_>
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  <_>
  17 4 3 11 2.</_></rects>
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<_>
  <!-- tree 4 -->
  <_>
    <!-- root node -->
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        <_>
          42 9 11 2 3.</_></rects>
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  <!-- stage 14 -->
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    <_>
      <!-- tree 0 -->
      <_>
        <!-- root node -->
        <feature>
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            <_>
              6 3 53 2 3.</_></rects>
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          <right_val>8.4619927406311035e-001</right_val></_></_>
        <_>
          <!-- tree 1 -->
          <_>
            <!-- root node -->
            <feature>
              <rects>
                <_>
                  49
9 4 6 -1.</_>
                <_>
                  49 9 2 3 2.</_>
                <_>

```



```

    51 12 2 3 2.</_></rects>
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    <right_val>-8.8221758604049683e-001</right_val></_></_>
<_>
<!-- tree 2 -->
<_>
    <!-- root node -->
    <feature>
    <rects>
    <_>
    0 9 30 7 -1.</_>
    <_>
    10 9 10 7 3.</_></rects>
    <tilted>0</tilted></feature>
    <threshold>1.0838840156793594e-002</threshold>
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    <right_val>6.0648679733276367e-001</right_val></_></_>
<_>
<!-- tree 3 -->
<_>
    <!-- root node -->
    <feature>
    <rects>

<_>
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    <_>
    42 4 2 2 3.</_></rects>
    <tilted>0</tilted></feature>
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    <right_val>6.4213967323303223e-001</right_val></_></_>
<_>
<!-- tree 4 -->
<_>
    <!-- root node -->
    <feature>
    <rects>
    <_>
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    <_>
    3 9 2 1 3.</_></rects>
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    <right_val>8.6384928226470947e-001</right_val></_></_>

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<_>
<!-- tree 5 -->
<_>
  <!-- root node -->
  <feature>
    <rects>
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4 10 -1.</_>
      <_>
        47 8 4 5 2.</_></rects>
      <tilted>0</tilted></feature>
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<_>
<!-- tree 6 -->
<_>
  <!-- root node -->
  <feature>
    <rects>
      <_>
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      <_>
        41 5 10 11 3.</_></rects>
      <tilted>0</tilted></feature>
      <threshold>3.2030208967626095e-003</threshold>
      <left_val>-1.</left_val>
      <right_val>1.0001050233840942e+000</right_val></_></_>
<_>
<!-- tree 7 -->
<_>
  <!-- root node -->
  <feature>
    <rects>
      <_>
        0 0 2 1 -1.</_>
      <_>
1 0 1 1 2.</_></rects>
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      <threshold>0.</threshold>
      <left_val>0.</left_val>
      <right_val>-1.</right_val></_></_>
<_>
<!-- tree 8 -->
<_>
  <!-- root node -->

```

```

<feature>
  <rects>
    <_>
      21 3 42 5 -1.</_>
    <_>
      35 3 14 5 3.</_></rects>
  <tilted>0</tilted></feature>
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<left_val>-1.</left_val>
<right_val>1.0002139806747437e+000</right_val></_></_>
<_>
<!-- tree 9 -->
<_>
<!-- root node -->
<feature>
  <rects>
    <_>
      0 0 2 1 -1.</_>
    <_>
      1 0 1 1 2.</_></rects>
  <tilted>0</tilted></feature>
<threshold>0.</threshold>
<left_val>0.</left_val>
<right_val>-1.</right_val></_></_>
<_>
<!-- tree 10 -->
<_>
<!-- root node -->
<feature>
  <rects>
    <_>
      8 5 30 9 -1.</_>
    <_>
      8 8 30 3 3.</_></rects>
  <tilted>0</tilted></feature>
<threshold>-7.0475979009643197e-004</threshold>
<left_val>1.</left_val>
<right_val>-9.9976968765258789e-001</right_val></_></_>
<_>
<!-- tree 11 -->
<_>
<!-- root node -->
<feature>
  <rects>
    <_>
      3 12 33 3 -1.</_>
    <_>
      14 12 11 3 3.</_></rects>

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```

    <tilted>0</tilted></feature>
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  <_>
  <!-- tree 12 -->
  <_>
    <!-- root node -->
    <feature>
      <rects>
        <_>
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        <_>
          1 0 1 2 3.</_></rects>
      <tilted>0</tilted></feature>
      <threshold>-2.4224430671893060e-004</threshold>
      <left_val>1.</left_val>
      <right_val>-1.</right_val></_></_>
    <_>
    <!-- tree 13 -->
    <_>
      <!-- root node -->
      <feature>
        <rects>
          <_>
            46 4 3 8 -1.</_>
          <_>
            47 4 1 8 3.</_></rects>
        <tilted>0</tilted></feature>
        <threshold>7.4700301047414541e-004</threshold>
        <left_val>-9.9108231067657471e-001</left_val>
        <right_val>9.9941182136535645e-001</right_val></_></_></trees>
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    <next>-1</next></_>
  <_>
  <!-- stage 15 -->
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    <_>
    <!-- tree 0 -->
    <_>
      <!-- root node -->
      <feature>
        <rects>
          <_>
            1 2 6 5 -1.</_>
          <_>
            3 2 2 5 3.</_></rects>

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```

    <tilted>0</tilted></feature>
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<!-- tree 1 -->
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  <feature>
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        0 3 18 5 -1.</_>
      <_>
        6 3 6 5 3.</_></rects>
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  <_>
  <!-- tree 2 -->
  <_>
    <!-- root node -->
    <feature>
      <rects>
        <_>
          3 1 6 14 -1.</_>
        <_>
          6 1 3 14 2.</_></rects>
      <tilted>0</tilted></feature>
      <threshold>-8.9444358309265226e-005</threshold>
      <left_val>1.</left_val>
      <right_val>-9.9264812469482422e-001</right_val></_></_>
    <_>
    <!-- tree 3 -->
    <_>
      <!-- root node -->
      <feature>
        <rects>
          <_>
            3 6 2 10 -1.</_>
          <_>
            3 11 2 5 2.</_></rects>
        <tilted>0</tilted></feature>
        <threshold>-2.7962020249105990e-004</threshold>
        <left_val>8.2833290100097656e-001</left_val>

        <right_val>-9.8444151878356934e-001</right_val></_></_>
      <_>

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<!-- tree 4 -->
<_>
<!-- root node -->
<feature>
  <rects>
    <_>
      42 0 4 6 -1.</_>
    <_>
      42 0 2 3 2.</_>
    <_>
      44 3 2 3 2.</_></rects>
  <tilted>0</tilted></feature>
  <threshold>-2.7560539820115082e-005</threshold>
  <left_val>1.</left_val>
  <right_val>-9.9543339014053345e-001</right_val></_></_></trees>
<stage_threshold>-9.1314977407455444e-001</stage_threshold>
<parent>14</parent>
<next>-1</next></_></stages></haarcascade_pltzzz64x16_16STG>
</opencv_storage>
This package was debianized by Christopher L Cheney <ccheney@debian.org> on
Fri, 22 Aug 2003 01:33:34 -0500.

```

The current maintainer is Roland Stigge <stigge@antcom.de>

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1.74 nio-stream-storage 1.1.3

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1.84 tcpdump 4.9.2

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1.85 json-c 0.12

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1.86 dhcp 4.1

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- * configure.ac, Makefile.am: The original versions were derived from the

ones in the XML Catalog Manager project, version 2.2.

Author: Julio Merino <jmmv@users.sourceforge.net>

* atf-c/ui.c: The format_paragraph and format_text functions were derived from the ones in the Monotone project, revision 3a0982da308228d796df35f98d787c5cff2bb5b6.

Author: Julio Merino <jmmv@NetBSD.org>

* atf-c++/detail/io.hpp, atf-c++/detail/io.cpp, atf-c++/detail/io_test.cpp: These files were derived from the file_handle, systembuf, pipe and pistream classes and tests found in the Boost.Process library.

Author: Julio Merino <jmmv84@gmail.com>

* admin/check-style.sh,
admin/check-style-common.awk,
admin/check-style-cpp.awk, admin/check-style-shell.awk: These files, except the first one, were first implemented in the Buildtool project. They were later adapted to be part of Boost.Process and, during that process, the shell script was created.

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=====
vim: filetype=text:textwidth=75:expandtab:shiftwidth=2:softtabstop=2
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-->

<!-- \$Id\$ -->

<!-- Generate ISC copyright comments from Docbook copyright metadata. -->

<xsl:stylesheet version="1.0"

xmlns:xsl="http://www.w3.org/1999/XSL/Transform"

xmlns:xi="http://www.w3.org/2001/XInclude"

xmlns:db="http://docbook.org/ns/docbook">

<xsl:template name="isc.copyright.format">

<xsl:param name="text"/>

<xsl:value-of select="\$isc.copyright.leader"/>

<xsl:value-of select="normalize-space(substring-before(\$text, '
'))"/>

<xsl:text>
</xsl:text>

<xsl:variable name="rest" select="substring-after(\$text, '
')"/>

<xsl:if test="translate(\$rest, '	 ', '')">

<xsl:call-template name="isc.copyright.format">

<xsl:with-param

```

name="text" select="$rest"/>
  </xsl:call-template>
</xsl:if>
</xsl:template>

<xsl:variable name="isc.copyright.text">
  <xsl:text>
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  </xsl:text>
</xsl:variable>

<xsl:variable name="isc.copyright">
  <xsl:call-template name="isc.copyright.format">
    <xsl:with-param name="text">
      <xsl:for-each select="book/info/copyright | refentry/docinfo/copyright">
        <xsl:text>Copyright (C) </xsl:text>
        <xsl:call-template name="copyright.years">
          <xsl:with-param name="years" select="year"/>
        </xsl:call-template>
        <xsl:text> </xsl:text>
        <xsl:value-of select="holder"/>
        <xsl:value-of select="$isc.copyright.breakline"/>
        <xsl:text>&#10;</xsl:text>
      </xsl:for-each>
    <xsl:value-of select="$isc.copyright.text"/>
    </xsl:with-param>
  </xsl:call-template>
</xsl:variable>
</xsl:stylesheet>

```

<!--

- Local variables:
- mode: sgml
- End:

-->

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1.90 jq 1.4

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The original code is FirewallControl.pas, released April 16, 2007.

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1.104 iproute 3.14.0

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- * Frodo Looijaard
Original author of libsensors, sensors-detect, sensors and isadump.
- * Merlin Hughes
Original author of sensord.
- * Bob Schlaermann
Dynamic chip feature detection (a.k.a. generic chip support) in libsensors and sensors.
- * Mark M. Hoffman

Many improvements to the libsensors configuration file scanner.

* Jean Delvare

New libsensors API, and migration of sensors and sensord thereto.

Many optimizations in libsensors and sensors.

Configuration file converter.

Rewrite of sensors-detect.

Support for multiple configuration files in libsensors.

1.107 unbound 1.5.10

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1.110 gvfs 1.28.2-1ubuntu1~16.04.2

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This option is useful when you wish to copy part of the code of the Library into a program that is not a library.

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b) Accompany

the work with a written offer, valid for at least three years, to give the same user the materials specified in Subsection 6a, above, for a charge no more than the cost of performing this distribution.

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1.112 rpcbind 6.0

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1.113 open-vm-tools 9.4.0

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1.114 libva 1.0.15

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Upstream Author(s):

Waldo Bastian <waldo.bastian@intel.com>

Jonathan Bian <jonathan.bian@intel.com>

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1.116 tftp-hpa 5.2

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1.117 slf4j 1.7.30

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1.118 libcap-ng 0.7.9-2.1build1

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1.119 rtmpdump 2.4+20151223.gitfa8646d.1-2build1

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1.122 keyutils 1.6-6ubuntu1

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The End

1.126 stunnel 5.56

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The
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The initial developer of the original code is Rainer Budde (<http://www.speed-soft.de>).

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1.127 icu 65

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```
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## BSD-specific setup (FreeBSD, OpenBSD, NetBSD, *BSD)
## Copyright (c) 1999-2013, International Business Machines Corporation and
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## Commands to generate dependency files
GEN_DEPS.c= $(CC) -E -MM $(DEFS) $(CPPFLAGS)
GEN_DEPS.cc= $(CXX) -E -MM $(DEFS) $(CPPFLAGS)

## Flags for position independent code
SHAREDLIBCFLAGS = -fPIC
SHAREDLIBCXXFLAGS = -fPIC
SHAREDLIBCPPFLAGS = -DPIC
```

```

## Additional flags when building libraries and with threads
THREADSCPPFLAGS = -D_REENTRANT
LIBCPPFLAGS =

## Compiler switch to embed a runtime search path
LD_RPATH=
LD_RPATH_PRE= -Wl,-rpath,

## Compiler switch to embed a library name
LD_SONAME = -Wl,-soname -Wl,$(notdir $(MIDDLE_SO_TARGET))

## Shared library options
LD_SOOPTIONS= -Wl,-Bsymbolic

## Shared object suffix
SO = so

## Non-shared intermediate object suffix
STATIC_O = ao

## Compilation
rules
%.${STATIC_O}: $(srcdir)/%.c
$(COMPILE.c) $(STATICCPPFLAGS) $(STATICCFLAGS) -o $@ $<
%.o: $(srcdir)/%.c
$(COMPILE.c) $(DYNAMICCPPFLAGS) $(DYNAMICCFLAGS) -o $@ $<

%.${STATIC_O}: $(srcdir)/%.cpp
$(COMPILE.cc) $(STATICCPPFLAGS) $(STATICCXXFLAGS) -o $@ $<
%.o: $(srcdir)/%.cpp
$(COMPILE.cc) $(DYNAMICCPPFLAGS) $(DYNAMICCXXFLAGS) -o $@ $<

## Dependency rules
%.d: $(srcdir)/%.c
@echo "generating dependency information for $<"
@$(SHELL) -ec '$(GEN_DEPS.c) $< \
| sed "s/^(.*)\.o[ :]*/1.o $@ : /g"' > $@; \
[ -s $@ ] || rm -f $@

%.d: $(srcdir)/%.cpp
@echo "generating dependency information for $<"
@$(SHELL) -ec '$(GEN_DEPS.cc) $< \
| sed "s/^(.*)\.o[ :]*/1.o $@ : /g"' > $@; \
[ -s $@ ] || rm -f $@

## Versioned libraries rules

```

```
%. $(SO).$(SO_TARGET_VERSION_MAJOR): %. $(SO).$(SO_TARGET_VERSION)
$(RM) $@ && ln -s ${<F} $@
%. $(SO): %. $(SO).$(SO_TARGET_VERSION_MAJOR)
$(RM) $@ && ln -s ${*F}. $(SO).$(SO_TARGET_VERSION) $@
```

```
## Bind internal references
```

```
# LDflags that pkgdata will use
BIR_LDFLAGS= -Wl,-Bsymbolic
```

```
# Dependencies [i.e. map files] for the final library
BIR_DEPS=
```

```
## Remove shared library 's'
STATIC_PREFIX_WHEN_USED =
STATIC_PREFIX =
```

```
## End BSD-specific setup
COPYRIGHT AND PERMISSION NOTICE (ICU 58 and later)
```

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Found in path(s):

* /dom4j-2-1-3-sources-jar/org/dom4j/tree/ElementQNameIterator.java
 * /dom4j-2-1-3-sources-jar/org/dom4j/tree/ElementIterator.java
 * /dom4j-2-1-3-sources-jar/org/dom4j/ElementHandler.java
 * /dom4j-2-1-3-sources-jar/org/dom4j/CDATA.java
 * /dom4j-2-1-3-sources-jar/org/dom4j/Document.java
 * /dom4j-2-1-3-sources-jar/org/dom4j/rule/Action.java
 * /dom4j-2-1-3-sources-jar/org/dom4j/Comment.java
 * /dom4j-2-1-3-sources-jar/org/dom4j/Entity.java
 * /dom4j-2-1-3-sources-jar/org/dom4j/bean/BeanDocumentFactory.java
 * /dom4j-2-1-3-sources-jar/org/dom4j/tree/FlyweightCDATA.java
 * /dom4j-2-1-3-sources-jar/org/dom4j/IllegalAddException.java
 * /dom4j-2-1-3-sources-jar/org/dom4j/jaxb/JAXBModifier.java
 * /dom4j-2-1-3-sources-jar/org/dom4j/tree/FilterIterator.java
 * /dom4j-2-1-3-sources-jar/org/dom4j/dom/DOMDocumentType.java
 *
 /dom4j-2-1-3-sources-jar/org/dom4j/rule/Pattern.java
 * /dom4j-2-1-3-sources-jar/org/dom4j/rule/Rule.java
 * /dom4j-2-1-3-sources-jar/org/dom4j/tree/NamespaceStack.java
 * /dom4j-2-1-3-sources-jar/org/dom4j/tree/NamespaceCache.java
 * /dom4j-2-1-3-sources-jar/org/dom4j/jaxb/JAXBObjectHandler.java

- * /dom4j-2-1-3-sources-jar/org/dom4j/io/DOMReader.java
- * /dom4j-2-1-3-sources-jar/org/dom4j/QName.java
- * /dom4j-2-1-3-sources-jar/org/dom4j/VisitorSupport.java
- * /dom4j-2-1-3-sources-jar/org/dom4j/InvalidXPathException.java
- * /dom4j-2-1-3-sources-jar/org/dom4j/XPath.java
- * /dom4j-2-1-3-sources-jar/org/dom4j/bean/BeanMetaData.java
- * /dom4j-2-1-3-sources-jar/org/dom4j/dtd/ElementDecl.java
- * /dom4j-2-1-3-sources-jar/org/dom4j/io/XMLWriter.java
- * /dom4j-2-1-3-sources-jar/org/dom4j/rule/pattern/DefaultPattern.java
- * /dom4j-2-1-3-sources-jar/org/dom4j/xpath/XPathPattern.java
- * /dom4j-2-1-3-sources-jar/org/dom4j/tree/DefaultCDATA.java
- * /dom4j-2-1-3-sources-jar/org/dom4j/io/PruningDispatchHandler.java
- *
- /dom4j-2-1-3-sources-jar/org/dom4j/rule/Stylesheet.java
- * /dom4j-2-1-3-sources-jar/org/dom4j/swing/XMLTableColumnDefinition.java
- * /dom4j-2-1-3-sources-jar/org/dom4j/datatype/DatatypeDocumentFactory.java
- * /dom4j-2-1-3-sources-jar/org/dom4j/io/SAXEventRecorder.java
- * /dom4j-2-1-3-sources-jar/org/dom4j/dom/DOMEntityReference.java
- * /dom4j-2-1-3-sources-jar/org/dom4j/tree/FlyweightAttribute.java
- * /dom4j-2-1-3-sources-jar/org/dom4j/DocumentFactory.java
- * /dom4j-2-1-3-sources-jar/org/dom4j/tree/DefaultDocument.java
- * /dom4j-2-1-3-sources-jar/org/dom4j/io/DocumentResult.java
- * /dom4j-2-1-3-sources-jar/org/dom4j/io/SAXModifyElementHandler.java
- * /dom4j-2-1-3-sources-jar/org/dom4j/util/NodeComparator.java
- * /dom4j-2-1-3-sources-jar/org/dom4j/ProcessingInstruction.java
- * /dom4j-2-1-3-sources-jar/org/dom4j/util/UserDataElement.java
- * /dom4j-2-1-3-sources-jar/org/dom4j/util/PerThreadSingleton.java
- * /dom4j-2-1-3-sources-jar/org/dom4j/dom/DOMComment.java
- * /dom4j-2-1-3-sources-jar/org/dom4j/util/XMLErrorHandler.java
- *
- /dom4j-2-1-3-sources-jar/org/dom4j/util/NonLazyElement.java
- * /dom4j-2-1-3-sources-jar/org/dom4j/bean/BeanAttributeList.java
- * /dom4j-2-1-3-sources-jar/org/dom4j/io/DOMWriter.java
- * /dom4j-2-1-3-sources-jar/org/dom4j/tree/FlyweightEntity.java
- * /dom4j-2-1-3-sources-jar/org/dom4j/tree/AbstractProcessingInstruction.java
- * /dom4j-2-1-3-sources-jar/org/dom4j/tree/BackedList.java
- * /dom4j-2-1-3-sources-jar/org/dom4j/io/STAXEventWriter.java
- * /dom4j-2-1-3-sources-jar/org/dom4j/jaxb/JAXBSupport.java
- * /dom4j-2-1-3-sources-jar/org/dom4j/util/IndexedElement.java
- * /dom4j-2-1-3-sources-jar/org/dom4j/io/ElementStack.java
- * /dom4j-2-1-3-sources-jar/org/dom4j/NodeFilter.java
- * /dom4j-2-1-3-sources-jar/org/dom4j/XPathException.java
- * /dom4j-2-1-3-sources-jar/org/dom4j/tree/FlyweightText.java
- * /dom4j-2-1-3-sources-jar/org/dom4j/tree/AbstractCharacterData.java
- * /dom4j-2-1-3-sources-jar/org/dom4j/rule/pattern/NodeTypePattern.java
- * /dom4j-2-1-3-sources-jar/org/dom4j/dtd/ExternalEntityDecl.java
- *


```

/dom4j-2-1-3-sources-jar/org/dom4j/swing/XMLTableDefinition.java
* /dom4j-2-1-3-sources-jar/org/dom4j/io/XPP3Reader.java
* /dom4j-2-1-3-sources-jar/org/dom4j/jaxb/JAXBWriter.java
* /dom4j-2-1-3-sources-jar/org/dom4j/bean/BeanAttribute.java
* /dom4j-2-1-3-sources-jar/org/dom4j/tree/AbstractCDATA.java
* /dom4j-2-1-3-sources-jar/org/dom4j/swing/DocumentTreeModel.java
* /dom4j-2-1-3-sources-jar/org/dom4j/tree/FlyweightProcessingInstruction.java
* /dom4j-2-1-3-sources-jar/org/dom4j/util/ProxyDocumentFactory.java
* /dom4j-2-1-3-sources-jar/org/dom4j/io/PruningElementStack.java
* /dom4j-2-1-3-sources-jar/org/dom4j/DocumentType.java
* /dom4j-2-1-3-sources-jar/org/dom4j/tree/ContentListFacade.java
* /dom4j-2-1-3-sources-jar/org/dom4j/tree/AbstractEntity.java
* /dom4j-2-1-3-sources-jar/org/dom4j/util/UserDataAttribute.java
* /dom4j-2-1-3-sources-jar/org/dom4j/Visitor.java
* /dom4j-2-1-3-sources-jar/org/dom4j/io/SAXWriter.java
* /dom4j-2-1-3-sources-jar/org/dom4j/Node.java
*
/dom4j-2-1-3-sources-jar/org/dom4j/Attribute.java
* /dom4j-2-1-3-sources-jar/org/dom4j/swing/XMLTableModel.java
* /dom4j-2-1-3-sources-jar/org/dom4j/dom/DOMProcessingInstruction.java
* /dom4j-2-1-3-sources-jar/org/dom4j/rule/Mode.java
* /dom4j-2-1-3-sources-jar/org/dom4j/rule/NullAction.java
* /dom4j-2-1-3-sources-jar/org/dom4j/Namespace.java
* /dom4j-2-1-3-sources-jar/org/dom4j/tree/DefaultProcessingInstruction.java
* /dom4j-2-1-3-sources-jar/org/dom4j/tree/FlyweightComment.java
* /dom4j-2-1-3-sources-jar/org/dom4j/io/SAXValidator.java
* /dom4j-2-1-3-sources-jar/org/dom4j/tree/BaseElement.java
* /dom4j-2-1-3-sources-jar/org/dom4j/dom/DOMText.java
* /dom4j-2-1-3-sources-jar/org/dom4j/xpath/DefaultXPath.java
* /dom4j-2-1-3-sources-jar/org/dom4j/tree/AbstractAttribute.java
* /dom4j-2-1-3-sources-jar/org/dom4j/ElementPath.java
* /dom4j-2-1-3-sources-jar/org/dom4j/CharacterData.java
* /dom4j-2-1-3-sources-jar/org/dom4j/bean/BeanElement.java
* /dom4j-2-1-3-sources-jar/org/dom4j/util/SimpleSingleton.java
*
/dom4j-2-1-3-sources-jar/org/dom4j/util/NonLazyDocumentFactory.java
* /dom4j-2-1-3-sources-jar/org/dom4j/datatype/DatatypeAttribute.java
* /dom4j-2-1-3-sources-jar/org/dom4j/tree/DefaultEntity.java
* /dom4j-2-1-3-sources-jar/org/dom4j/tree/AbstractDocument.java
* /dom4j-2-1-3-sources-jar/org/dom4j/tree/QNameCache.java
* /dom4j-2-1-3-sources-jar/org/dom4j/tree/AbstractNode.java
* /dom4j-2-1-3-sources-jar/org/dom4j/jaxb/JAXBRuntimeException.java
* /dom4j-2-1-3-sources-jar/org/dom4j/util/IndexedDocumentFactory.java
* /dom4j-2-1-3-sources-jar/org/dom4j/tree/AbstractBranch.java
* /dom4j-2-1-3-sources-jar/org/dom4j/io/HTMLWriter.java
* /dom4j-2-1-3-sources-jar/org/dom4j/dtd/InternalEntityDecl.java
* /dom4j-2-1-3-sources-jar/org/dom4j/dom/DOMDocumentFactory.java
* /dom4j-2-1-3-sources-jar/org/dom4j/datatype/DatatypeElementFactory.java

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- * /dom4j-2-1-3-sources-jar/org/dom4j/tree/DefaultComment.java
- * /dom4j-2-1-3-sources-jar/org/dom4j/dom/DOMCDATA.java
- * /dom4j-2-1-3-sources-jar/org/dom4j/swing/BranchTreeNode.java
- *
- /dom4j-2-1-3-sources-jar/org/dom4j/io/SAXModifier.java
- * /dom4j-2-1-3-sources-jar/org/dom4j/swing/LeafTreeNode.java
- * /dom4j-2-1-3-sources-jar/org/dom4j/dom/DOMNodeHelper.java
- * /dom4j-2-1-3-sources-jar/org/dom4j/jaxb/JAXBObjectModifier.java
- * /dom4j-2-1-3-sources-jar/org/dom4j/jaxb/JAXBReader.java
- * /dom4j-2-1-3-sources-jar/org/dom4j/io/ElementModifier.java
- * /dom4j-2-1-3-sources-jar/org/dom4j/dom/DOMAttributeNodeMap.java
- * /dom4j-2-1-3-sources-jar/org/dom4j/io/XMLResult.java
- * /dom4j-2-1-3-sources-jar/org/dom4j/io/SAXModifyReader.java
- * /dom4j-2-1-3-sources-jar/org/dom4j/xpp/ProxyXmlStartTag.java
- * /dom4j-2-1-3-sources-jar/org/dom4j/dtd/AttributeDecl.java
- * /dom4j-2-1-3-sources-jar/org/dom4j/io/DocumentInputSource.java
- * /dom4j-2-1-3-sources-jar/org/dom4j/io/STAXEventReader.java
- * /dom4j-2-1-3-sources-jar/org/dom4j/io/SAXContentHandler.java
- * /dom4j-2-1-3-sources-jar/org/dom4j/util/SingletonStrategy.java
- * /dom4j-2-1-3-sources-jar/org/dom4j/tree/AbstractDocumentType.java
- *
- /dom4j-2-1-3-sources-jar/org/dom4j/DocumentException.java
- * /dom4j-2-1-3-sources-jar/org/dom4j/tree/AbstractText.java
- * /dom4j-2-1-3-sources-jar/org/dom4j/dom/DOMNamespace.java
- * /dom4j-2-1-3-sources-jar/org/dom4j/tree/DefaultDocumentType.java
- * /dom4j-2-1-3-sources-jar/org/dom4j/io/SAXModifyException.java
- * /dom4j-2-1-3-sources-jar/org/dom4j/dom/DOMDocument.java
- * /dom4j-2-1-3-sources-jar/org/dom4j/tree/AbstractElement.java
- * /dom4j-2-1-3-sources-jar/org/dom4j/util/UserDataDocumentFactory.java
- * /dom4j-2-1-3-sources-jar/org/dom4j/io/XPPReader.java
- * /dom4j-2-1-3-sources-jar/org/dom4j/tree/DefaultAttribute.java
- * /dom4j-2-1-3-sources-jar/org/dom4j/io/OutputFormat.java
- * /dom4j-2-1-3-sources-jar/org/dom4j/datatype/NamedTypeResolver.java
- * /dom4j-2-1-3-sources-jar/org/dom4j/tree/SingleIterator.java
- * /dom4j-2-1-3-sources-jar/org/dom4j/dom/DOMAttribute.java
- * /dom4j-2-1-3-sources-jar/org/dom4j/rule/RuleManager.java
- * /dom4j-2-1-3-sources-jar/org/dom4j/tree/DefaultElement.java
- *
- /dom4j-2-1-3-sources-jar/org/dom4j/datatype/InvalidSchemaException.java
- * /dom4j-2-1-3-sources-jar/org/dom4j/xpath/DefaultNamespaceContext.java
- * /dom4j-2-1-3-sources-jar/org/dom4j/datatype/DatatypeElement.java
- * /dom4j-2-1-3-sources-jar/org/dom4j/io/DocumentSource.java
- * /dom4j-2-1-3-sources-jar/org/dom4j/tree/ElementNameIterator.java
- * /dom4j-2-1-3-sources-jar/org/dom4j/io/DOMSAXContentHandler.java
- * /dom4j-2-1-3-sources-jar/org/dom4j/dom/DOMELEMENT.java
- * /dom4j-2-1-3-sources-jar/org/dom4j/io/JAXPHelper.java
- * /dom4j-2-1-3-sources-jar/org/dom4j/rule/RuleSet.java
- * /dom4j-2-1-3-sources-jar/org/dom4j/Branch.java

* /dom4j-2-1-3-sources-jar/org/dom4j/Text.java
* /dom4j-2-1-3-sources-jar/org/dom4j/io/DOMDocumentResult.java
* /dom4j-2-1-3-sources-jar/org/dom4j/datatype/SchemaParser.java
* /dom4j-2-1-3-sources-jar/org/dom4j/io/DispatchHandler.java
* /dom4j-2-1-3-sources-jar/org/dom4j/io/SAXModifyContentHandler.java
* /dom4j-2-1-3-sources-jar/org/dom4j/tree/AbstractComment.java
*

/dom4j-2-1-3-sources-jar/org/dom4j/util/AttributeHelper.java
* /dom4j-2-1-3-sources-jar/org/dom4j/tree/DefaultText.java
* /dom4j-2-1-3-sources-jar/org/dom4j/tree/DefaultNamespace.java
* /dom4j-2-1-3-sources-jar/org/dom4j/Element.java

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* /dom4j-2-1-3-sources-jar/org/dom4j/DocumentHelper.java
* /dom4j-2-1-3-sources-jar/org/dom4j/io/SAXReader.java
* /dom4j-2-1-3-sources-jar/org/dom4j/io/SAXHelper.java

1.132 jquery 3.5.1

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1.133 unixsocket-common 2.3.2

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Found in path(s):

```
* /junixsocket-common-2-3-2-sources-jar/org/newsclub/net/unix/Closeables.java
* /junixsocket-common-2-3-2-sources-jar/org/newsclub/net/unix/AFUNIXSocket.java
* /junixsocket-common-2-3-2-sources-jar/org/newsclub/net/unix/AFUNIXSocketCredentials.java
* /junixsocket-common-2-3-2-sources-jar/org/newsclub/net/unix/AFUNIXServerSocket.java
*
* /junixsocket-common-2-3-2-sources-jar/org/newsclub/net/unix/NativeLibraryLoader.java
* /junixsocket-common-2-3-2-sources-jar/org/newsclub/net/unix/AFUNIXSocketCapability.java
* /junixsocket-common-2-3-2-sources-jar/org/newsclub/net/unix/AFUNIXSocketImpl.java
* /junixsocket-common-2-3-2-sources-jar/org/newsclub/net/unix/SuppressFBWarnings.java
* /junixsocket-common-2-3-2-sources-jar/org/newsclub/net/unix/AFUNIXSocketAddress.java
* /junixsocket-common-2-3-2-sources-jar/org/newsclub/net/unix/NativeUnixSocket.java
* /junixsocket-common-2-3-2-sources-jar/org/newsclub/net/unix/AFUNIXSocketFactory.java
```

1.134 junixsocket-native-common 2.3.2

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* /junixsocket-native-common-2-3-2-sources-jar/org/newsclub/lib/junixsocket/common/NarMetadata.java

1.135 commons-fileupload 62

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This code is derived from section 17.1 of Applied Cryptography, second edition, which describes a stream cipher allegedly compatible with RSA Labs "RC4" cipher (the actual description of which is a trade secret). The same algorithm is used as a stream cipher called "arcfour" in Tatu Ylonen's ssh package.

Here the stream cipher has been modified always to include the time when initializing the state. That makes it impossible to regenerate the same random sequence twice, so this can't be used for encryption, but will generate good random numbers.

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This code implements the MD5 message-digest algorithm. The algorithm is due to Ron Rivest. This code was written by Colin Plumb in 1993, no copyright is claimed. This code is in the public domain; do with it what you wish.

Equivalent code is available from RSA Data Security, Inc. This code has been tested against that, and is equivalent, except that you don't need to include two pages of legalese with every copy.

To compute the message digest of a chunk of bytes, declare an MD5Context structure, pass it to MD5Init, call MD5Update as needed on buffers full of bytes, and then call MD5Final, which

will fill a supplied 16-byte array with the digest.

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1.138 jandex 2.1.3.Final

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Found in path(s):

```
*/jandex-2-1-3-final-sources-jar/org/jboss/jandex/PackedDataOutputStream.java
*/jandex-2-1-3-final-sources-jar/org/jboss/jandex/ClassInfo.java
*/jandex-2-1-3-final-sources-jar/org/jboss/jandex/IndexWriter.java
*
/jandex-2-1-3-final-sources-jar/org/jboss/jandex/DotName.java
*/jandex-2-1-3-final-sources-jar/org/jboss/jandex/FieldInternal.java
*/jandex-2-1-3-final-sources-jar/org/jboss/jandex/FieldInfo.java
*/jandex-2-1-3-final-sources-jar/org/jboss/jandex/NameTable.java
*/jandex-2-1-3-final-sources-jar/org/jboss/jandex/CompositeIndex.java
*/jandex-2-1-3-final-sources-jar/org/jboss/jandex/IndexWriterV1.java
*/jandex-2-1-3-final-sources-jar/org/jboss/jandex/IndexView.java
*/jandex-2-1-3-final-sources-jar/org/jboss/jandex/StrongInternPool.java
*/jandex-2-1-3-final-sources-jar/org/jboss/jandex/Indexer.java
*/jandex-2-1-3-final-sources-jar/org/jboss/jandex/JarIndexer.java
*/jandex-2-1-3-final-sources-jar/org/jboss/jandex/JandexAntTask.java
*/jandex-2-1-3-final-sources-jar/org/jboss/jandex/MethodInfo.java
*/jandex-2-1-3-final-sources-jar/org/jboss/jandex/ClassType.java
*/jandex-2-1-3-final-sources-jar/org/jboss/jandex/IndexReaderV1.java
*/jandex-2-1-3-final-sources-jar/org/jboss/jandex/Result.java
*
/jandex-2-1-3-final-sources-jar/org/jboss/jandex/Index.java
*/jandex-2-1-3-final-sources-jar/org/jboss/jandex/MethodParameterInfo.java
*/jandex-2-1-3-final-sources-jar/org/jboss/jandex/UnsupportedVersion.java
```

- * /jandex-2-1-3-final-sources-jar/org/jboss/jandex/AnnotationValue.java
- * /jandex-2-1-3-final-sources-jar/org/jboss/jandex/AnnotationTarget.java
- * /jandex-2-1-3-final-sources-jar/org/jboss/jandex/PrimitiveType.java
- * /jandex-2-1-3-final-sources-jar/org/jboss/jandex/Main.java
- * /jandex-2-1-3-final-sources-jar/org/jboss/jandex/PackedDataInputStream.java
- * /jandex-2-1-3-final-sources-jar/org/jboss/jandex/AnnotationInstance.java
- * /jandex-2-1-3-final-sources-jar/org/jboss/jandex/IndexReader.java
- * /jandex-2-1-3-final-sources-jar/org/jboss/jandex/Type.java

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- * /jandex-2-1-3-final-sources-jar/org/jboss/jandex/Utils.java
- * /jandex-2-1-3-final-sources-jar/org/jboss/jandex/FieldInfoGenerator.java
- *
- /jandex-2-1-3-final-sources-jar/org/jboss/jandex/MethodInfoGenerator.java
- * /jandex-2-1-3-final-sources-jar/org/jboss/jandex/ThrowsTypeTarget.java
- * /jandex-2-1-3-final-sources-jar/org/jboss/jandex/TypeParameterBoundTypeTarget.java
- * /jandex-2-1-3-final-sources-jar/org/jboss/jandex/EmptyTypeTarget.java
- * /jandex-2-1-3-final-sources-jar/org/jboss/jandex/PositionBasedTypeTarget.java
- * /jandex-2-1-3-final-sources-jar/org/jboss/jandex/TypeTarget.java
- * /jandex-2-1-3-final-sources-jar/org/jboss/jandex/AnnotationTargetFilterCollection.java
- * /jandex-2-1-3-final-sources-jar/org/jboss/jandex/IndexWriterImpl.java
- * /jandex-2-1-3-final-sources-jar/org/jboss/jandex/TypeParameterTypeTarget.java
- * /jandex-2-1-3-final-sources-jar/org/jboss/jandex/VoidType.java
- * /jandex-2-1-3-final-sources-jar/org/jboss/jandex/IndexReaderImpl.java
- * /jandex-2-1-3-final-sources-jar/org/jboss/jandex/ArrayType.java
- * /jandex-2-1-3-final-sources-jar/org/jboss/jandex/IndexWriterV2.java
- * /jandex-2-1-3-final-sources-jar/org/jboss/jandex/ClassExtendsTypeTarget.java
- *

/jandex-2-1-3-final-sources-jar/org/jboss/jandex/MethodParameterTypeTarget.java
* /jandex-2-1-3-final-sources-jar/org/jboss/jandex/MethodInternal.java
* /jandex-2-1-3-final-sources-jar/org/jboss/jandex/WildcardType.java
* /jandex-2-1-3-final-sources-jar/org/jboss/jandex/GenericSignatureParser.java
* /jandex-2-1-3-final-sources-jar/org/jboss/jandex/TypeVariable.java
* /jandex-2-1-3-final-sources-jar/org/jboss/jandex/UnresolvedTypeVariable.java
* /jandex-2-1-3-final-sources-jar/org/jboss/jandex/IndexReaderV2.java

1.139 ntp 4.2.8p15

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```

The following individuals contributed in part to the Network Time
Protocol Distribution

Version 4 and are acknowledged as authors of this
work.

1. [1]Takao Abe <takao_abe@xurb.jp> Clock driver for JJY receivers
2. [2]Mark Andrews <mark_andrews@isc.org> Leitch atomic clock
controller
3. [3]Bernd Altmeier <altmeier@atlsoft.de> hopf Elektronik serial line
and PCI-bus devices
4. [4]Viraj Bais <vbais@mailman1.intel.com> and [5]Clayton Kirkwood
<kirkwood@striderfm.intel.com> port to WindowsNT 3.5
5. [6]Michael Barone <michael,barone@lmco.com> GPSVME fixes
6. [7]Karl Berry <karl@owl.HQ.ileaf.com> syslog to file option
7. [8]Greg Brackley <greg.brackley@bigfoot.com> Major rework of WINNT
port. Clean up recvbuf and iosignal code into separate modules.
8. [9]Marc Brett <Marc.Brett@westgeo.com> Magnavox GPS clock driver
9. [10]Piete Brooks <Piete.Brooks@cl.cam.ac.uk> MSF clock driver,
Trimble PARSE support
10. [11]Nelson B Bolyard <nelson@bolyard.me> update and complete

- broadcast and crypto features
- in sntp
11. [12]Jean-Francois Boudreault
<Jean-Francois.Boudreault@viagenie.qc.ca> IPv6 support
 12. [13]Reg Clemens <reg@dwf.com> Oncore driver (Current maintainer)
 13. [14]Steve Clift <clift@ml.csiro.au> OMEGA clock driver
 14. [15]Casey Crellin <casey@csc.co.za> vxWorks (Tornado) port and help
with target configuration
 15. [16]Sven Dietrich <sven_dietrich@trimble.com> Palisade reference
clock driver, NT adj. residuals, integrated Greg's Winnt port.
 16. [17]John A. Dundas III <dundas@salt.jpl.nasa.gov> Apple A/UX port
 17. [18]Torsten Duwe <duwe@immd4.informatik.uni-erlangen.de> Linux port
 18. [19]Dennis Ferguson <dennis@mrbill.canet.ca> foundation code for
NTP Version 2 as specified in RFC-1119
 19. [20]John Hay <jhay@icomtek.csir.co.za> IPv6 support and testing
 20. [21]Dave Hart <davehart@davehart.com> General maintenance, Windows
port interpolation rewrite
 21. [22]Claas Hilbrecht <neoclock4x@linum.com> NeoClock4X
clock driver
 22. [23]Glenn Hollinger <glenn@herald.usask.ca> GOES clock driver
 23. [24]Mike Iglesias <iglesias@uci.edu> DEC Alpha port
 24. [25]Jim Jagielski <jim@jagubox.gsfc.nasa.gov> A/UX port
 25. [26]Jeff Johnson <jbj@chatham.usdesign.com> massive prototyping
overhaul
 26. [27]Hans Lambermont <Hans.Lambermont@nl.origin-it.com> or
[28]<H.Lambermont@chello.nl> ntpswep
 27. [29]Poul-Henning Kamp <phk@FreeBSD.ORG> Oncore driver (Original
author)
 28. [30]Frank Kardel [31]<kardel (at) ntp (dot) org> PARSE <GENERIC>
(driver 14 reference clocks), STREAMS modules for PARSE, support
scripts, syslog cleanup, dynamic interface handling
 29. [32]Johannes Maximilian Kuehn <kuehn@ntp.org> Rewrote sntp to
comply with NTPv4 specification, ntpq saveconfig
 30. [33]William L. Jones <jones@hermes.chpc.utexas.edu> RS/6000 AIX
modifications, HP/UX modifications
 31. [34]Dave Katz <dkatz@cisco.com> RS/6000 AIX port
 32. [35]Craig
Leres <leres@ee.lbl.gov> 4.4BSD port, ppsclock, Magnavox
GPS clock driver
 33. [36]George Lindholm <lindholm@ucs.ubc.ca> SunOS 5.1 port
 34. [37]Louis A. Mamakos <louie@ni.umd.edu> MD5-based authentication
 35. [38]Lars H. Mathiesen <thorinn@diku.dk> adaptation of foundation
code for Version 3 as specified in RFC-1305
 36. [39]Danny Mayer <mayer@ntp.org> Network I/O, Windows Port, Code
Maintenance
 37. [40]David L. Mills <mills@udel.edu> Version 4 foundation, precision
kernel; clock drivers: 1, 3, 4, 6, 7, 11, 13, 18, 19, 22, 36
 38. [41]Wolfgang Moeller <moeller@gwdgv1.dnet.gwdg.de> VMS port

39. [42]Jeffrey Mogul <mogul@pa.dec.com> ntptrace utility
40. [43]Tom Moore <tmoores@fielvel.daytonoh.ncr.com> i386 svr4 port
41. [44]Kamal A Mostafa <kamal@whence.com> SCO OpenServer port
42. [45]Derek Mulcahy <derek@toybox.demon.co.uk> and [46]Damon Hart-Davis <d@hd.org> ARCRON MSF clock driver
43. [47]Rob Neal <neal@ntp.org> Bancomm refclock and config/parse code maintenance
44. [48]Rainer Pruy <Rainer.Pruy@informatik.uni-erlangen.de> monitoring/trap scripts, statistics file handling
45. [49]Dirce Richards <dirce@zk3.dec.com> Digital UNIX V4.0 port
46. [50]Wilfredo Sanchez <wsanchez@apple.com> added support for NetInfo
47. [51]Nick Sayer <mrapple@quack.kfu.com> SunOS streams modules
48. [52]Jack Sasportas <jack@innovativeinternet.com> Saved a Lot of space on the stuff in the html/pic/ subdirectory
49. [53]Ray Schnitzler <schnitz@unipress.com> Unixware1 port
50. [54]Michael Shields <shields@tembel.org> USNO clock driver
51. [55]Jeff Steinman <jss@pebbles.jpl.nasa.gov> Datum PTS clock driver
52. [56]Harlan Stenn <harlan@pfcs.com> GNU automake/autoconfigure makeover, various other bits (see the ChangeLog)
53. [57]Kenneth Stone <ken@sdd.hp.com> HP-UX port
54. [58]Ajit Thyagarajan <ajit@ee.udel.edu> IP multicast/anycast support
55. [59]Tomoaki TSURUOKA <tsuruoka@nc.fukuoka-u.ac.jp> TRAK clock driver
56. [60]Brian Utterback <brian.utterback@oracle.com> General codebase, Solaris issues
57. [61]Loganaden Velvindron <loganaden@gmail.com> Sandboxing (libseccomp) support
58. [62]Paul A Vixie <vixie@vix.com> TrueTime GPS driver, generic TrueTime clock driver
59. [63]Ulrich Windl <Ulrich.Windl@rz.uni-regensburg.de> corrected and validated HTML documents according to the HTML DTD
-

References

1. mailto:%20takao_abe@xurb.jp
2. mailto:%20mark_andrews@isc.org
3. <mailto:%20altmeier@atlsoft.de>
4. <mailto:%20vbais@mailman1.intel.co>
5. <mailto:%20kirkwood@striderfm.intel.com>
6. <mailto:%20michael.barone@lmco.com>
7. <mailto:%20karl@owl.HQ.ileaf.com>
8. <mailto:%20greg.brackley@bigfoot.com>
9. <mailto:%20Marc.Brett@westgeo.com>
10. <mailto:%20Piete.Brooks@cl.cam.ac.uk>
11. <mailto:%20nelson@bolyard.me>
12. <mailto:%20Jean-Francois.Boudreault@viagenie.qc.ca>

13. mailto:%20reg@dwf.com
14. mailto:%20clift@ml.csiro.au
15. mailto:%20casey@csc.co.za
16. mailto:%20Sven_Dietrich@trimble.COM
17. mailto:%20dundas@salt.jpl.nasa.gov
18. mailto:%20duwe@immd4.informatik.uni-erlangen.de
19. mailto:%20dennis@mrbill.canet.ca
20. mailto:%20jhay@icomtek.csir.co.za
21. mailto:%20davehart@davehart.com
22. mailto:%20neoclock4x@linum.com
23. mailto:%20glenn@herald.usask.ca
24. mailto:%20iglesias@uci.edu
25. mailto:%20jagubox.gsfc.nasa.gov
26. mailto:%20jbj@chatham.usdesign.com
27. mailto:%20Hans.Lambermont@nl.origin-it.com
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29. mailto:%20phk@FreeBSD.ORG
30. http://www4.informatik.uni-erlangen.de/%7ekardel
31. mailto:%20kardel%20%28at%29%20ntp%20%28dot%29%20org
32. mailto:kuehn@ntp.org
33. mailto:%20jones@hermes.chpc.utexas.edu
34. mailto:%20dkatz@cisco.com
35. mailto:%20leres@ee.lbl.gov
36. mailto:%20lindholm@ucs.ubc.ca
37. mailto:%20louie@ni.umd.edu
38.
mailto:%20thorinn@diku.dk
39. mailto:%20mayer@ntp.org
40. mailto:%20mills@udel.edu
41. mailto:%20moeller@gwdgv1.dnet.gwdg.de
42. mailto:%20mogul@pa.dec.com
43. mailto:%20tmoore@fievel.daytonoh.ncr.com
44. mailto:%20kamal@whence.com
45. mailto:%20derek@toybox.demon.co.uk
46. mailto:%20d@hd.org
47. mailto:%20neal@ntp.org
48. mailto:%20Rainer.Pruy@informatik.uni-erlangen.de
49. mailto:%20dirce@zk3.dec.com
50. mailto:%20wsanchez@apple.com
51. mailto:%20mrapple@quack.kfu.com
52. mailto:%20jack@innovativeinternet.com
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56. mailto:%20harlan@pfcs.com
57. mailto:%20ken@sdd.hp.com
58. mailto:%20ajit@ee.udel.edu
59. mailto:%20tsuruoka@nc.fukuoka-u.ac.jp

60. mailto:%20brian.utterback@oracle.com
61. mailto:%20loganaden@gmail.com
62. mailto:%20vixie@vix.com
63. mailto:%20Ulrich.Windl@rz.uni-regensburg.de

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1.140 dhcpcd 9.1.1

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1.141 docker 19.03.5-r1

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Data model artifacts for Prometheus.

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1.145 nghttp2 1.40.0-1build1

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set yrange [0:]

set terminal pngcairo font 'Sans, 8' lw 1 size 1400,1024

set xtics rotate by -45

set style histogram errorbars gap 2 lw 1

set style fill solid border -1

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- javaee_web_services_client_1_2.xsd
- javaee_6.xsd
- javaee_web_services_1_3.xsd
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- javaee_web_services_1_4.xsd
- javaee_web_services_client_1_4.xsd
- jsp_2_3.xsd
- web-app_3_1.xsd
- web-common_3_1.xsd

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For the following XML

Schemas for Java EE Deployment Descriptors:

- javaee_5.xsd
- javaee_web_services_1_2.xsd
- javaee_web_services_client_1_2.xsd
- javaee_6.xsd
- javaee_web_services_1_3.xsd
- javaee_web_services_client_1_3.xsd
- jsp_2_2.xsd
- web-app_3_0.xsd
- web-common_3_0.xsd
- web-fragment_3_0.xsd
- javaee_7.xsd
- javaee_web_services_1_4.xsd
- javaee_web_services_client_1_4.xsd
- jsp_2_3.xsd
- web-app_3_1.xsd
- web-common_3_1.xsd
- web-fragment_3_1.xsd
- javaee_8.xsd
- web-app_4_0.xsd
- web-common_4_0.xsd
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The original XML Schemas for Java EE Deployment Descriptors:

- javaee_5.xsd
- javaee_web_services_1_2.xsd
- javaee_web_services_client_1_2.xsd
- javaee_6.xsd
- javaee_web_services_1_3.xsd
- javaee_web_services_client_1_3.xsd
- jsp_2_2.xsd
- web-app_3_0.xsd
- web-common_3_0.xsd
- web-fragment_3_0.xsd

- javaee_7.xsd
- javaee_web_services_1_4.xsd
- javaee_web_services_client_1_4.xsd
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- web-common_4_0.xsd
- web-fragment_4_0.xsd

may be obtained from:

<http://www.oracle.com/webfolder/technetwork/jsc/xml/ns/javaee/index.html>

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- javaee_5.xsd
- javaee_web_services_1_2.xsd
- javaee_web_services_client_1_2.xsd
- javaee_6.xsd
- javaee_web_services_1_3.xsd
- javaee_web_services_client_1_3.xsd
- web-app_3_0.xsd
- web-common_3_0.xsd
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1.147 netty-codec-http 4.1.51.Final

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```
* /netty-codec-http-4-1-51-final-sources-
jar/io/netty/handler/codec/http/websocketx/WebSocketServerProtocolConfig.java
* /netty-codec-http-4-1-51-final-sources-
jar/io/netty/handler/codec/http/websocketx/WebSocketServerHandshaker07.java
* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/websocketx/WebSocketCloseStatus.java
```

```

*
/netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/websocketx/CloseWebSocketFrame.java
* /netty-codec-http-4-1-51-final-sources-
jar/io/netty/handler/codec/http/websocketx/extensions/WebSocketExtensionFilter.java
* /netty-codec-http-4-1-51-final-sources-
jar/io/netty/handler/codec/http/websocketx/WebSocketClientProtocolConfig.java
* /netty-codec-http-4-1-51-final-sources-
jar/io/netty/handler/codec/http/websocketx/WebSocket00FrameDecoder.java
* /netty-codec-http-4-1-51-final-sources-
jar/io/netty/handler/codec/http/websocketx/WebSocketServerHandshakerFactory.java
* /netty-codec-http-4-1-51-final-sources-
jar/io/netty/handler/codec/http/websocketx/WebSocketServerHandshaker13.java
* /netty-codec-http-4-1-51-final-sources-
jar/io/netty/handler/codec/http/websocketx/WebSocketServerProtocolHandshakeHandler.java
* /netty-codec-http-4-1-51-final-sources-
jar/io/netty/handler/codec/http/websocketx/CorruptedWebSocketFrameException.java
*
/netty-codec-http-4-1-51-final-sources-
jar/io/netty/handler/codec/http/websocketx/WebSocketServerHandshaker00.java
* /netty-codec-http-4-1-51-final-sources-
jar/io/netty/handler/codec/http/websocketx/WebSocketServerProtocolHandler.java
* /netty-codec-http-4-1-51-final-sources-
jar/io/netty/handler/codec/http/websocketx/extensions/WebSocketExtensionFilterProvider.java
* /netty-codec-http-4-1-51-final-sources-
jar/io/netty/handler/codec/http/websocketx/WebSocketServerHandshaker.java
* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/websocketx/WebSocketDecoderConfig.java
* /netty-codec-http-4-1-51-final-sources-
jar/io/netty/handler/codec/http/websocketx/WebSocketServerHandshaker08.java
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* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/cookie/ServerCookieEncoder.java
* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/cookie/CookieDecoder.java
*
* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/cookie/CookieEncoder.java
* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/cookie/Cookie.java
* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/cookie/CookieHeaderNames.java
* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/CombinedHttpHeaders.java
* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/cookie/ClientCookieDecoder.java
* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/HttpExpectationFailedEvent.java
* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/rtsp/RtspEncoder.java
* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/cookie/ServerCookieDecoder.java
* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/HttpScheme.java
* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/cookie/package-info.java
*
* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/CookieUtil.java
* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/EmptyHttpHeaders.java
* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/HttpUtil.java
* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/cookie/ClientCookieEncoder.java
* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/cookie/CookieUtil.java
* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/rtsp/RtspDecoder.java
```

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```

* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/cors/CorsConfigBuilder.java
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Found in path(s):

```

* /netty-codec-http-4-1-51-final-sources-
jar/io/netty/handler/codec/http/websocketx/WebSocket13FrameEncoder.java
* /netty-codec-http-4-1-51-final-sources-
jar/io/netty/handler/codec/http/websocketx/WebSocket08FrameEncoder.java
* /netty-codec-http-4-1-51-final-sources-
jar/io/netty/handler/codec/http/websocketx/WebSocket07FrameEncoder.java

```

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 */
```

Found in path(s):

```
* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/multipart/FileUploadUtil.java
* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/HttpServerKeepAliveHandler.java
* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/websocketx/WebSocketChunkedInput.java
```

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 */
```

Found in path(s):

```
* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/multipart/AbstractMemoryHttpData.java
* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/HttpContentDecompressor.java
* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/package-info.java
*
/netty-codec-http-4-1-51-final-sources-
jar/io/netty/handler/codec/http/multipart/InterfaceHttpPostRequestDecoder.java
* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/multipart/HttpPostRequestDecoder.java
```

```

* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/spdy/SpdyHttpResponseStreamIdHandler.java
* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/HttpResponseDecoder.java
* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/spdy/DefaultSpdySettingsFrame.java
* /netty-codec-http-4-1-51-final-sources-
jar/io/netty/handler/codec/http/websocketx/WebSocketClientHandshaker.java
* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/HttpContentEncoder.java
* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/DefaultCookie.java
* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/rtsp/package-info.java
* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/multipart/DiskAttribute.java
*
/netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/HttpMethod.java
* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/DefaultHttpObject.java
* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/HttpResponseEncoder.java
* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/HttpContentDecoder.java
* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/HttpObjectAggregator.java
* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/HttpObjectDecoder.java
* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/HttpContent.java
* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/multipart/InterfaceHttpData.java
* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/QueryStringEncoder.java
* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/Cookie.java
*
/netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/multipart/HttpPostBodyUtil.java
* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/HttpHeaders.java
* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/websocketx/package-info.java
* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/multipart/Attribute.java
* /netty-codec-http-4-1-51-final-sources-
jar/io/netty/handler/codec/http/websocketx/WebSocketHandshakeException.java
* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/multipart/HttpPostRequestEncoder.java
* /netty-codec-http-4-1-51-final-sources-
jar/io/netty/handler/codec/http/websocketx/WebSocketClientHandshakerFactory.java
* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/multipart/DefaultHttpDataFactory.java
* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/multipart/HttpDataFactory.java
* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/DefaultHttpHeaders.java
*
/netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/HttpServerCodec.java
* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/spdy/SpdyHttpHeaders.java
* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/DefaultHttpResponse.java
* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/multipart/AbstractDiskHttpData.java
* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/HttpObject.java
* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/rtsp/RtspVersions.java
* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/HttpClientCodec.java
* /netty-codec-http-4-1-51-final-sources-
jar/io/netty/handler/codec/http/websocketx/WebSocket00FrameEncoder.java
* /netty-codec-http-4-1-51-final-sources-
jar/io/netty/handler/codec/http/websocketx/WebSocketClientHandshaker00.java
* /netty-codec-http-4-1-51-final-sources-
jar/io/netty/handler/codec/http/websocketx/WebSocketClientHandshaker07.java
*

```

```

/netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/multipart/MemoryAttribute.java
* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/HttpMessage.java
* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/LastHttpContent.java
* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/HttpVersion.java
* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/rtsp/RtspObjectDecoder.java
* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/multipart/DiskFileUpload.java
* /netty-codec-http-4-1-51-final-sources-
jar/io/netty/handler/codec/http/websocketx/ContinuationWebSocketFrame.java
* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/multipart/MixedFileUpload.java
* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/HttpRequestDecoder.java
* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/rtsp/RtspHeaders.java
*
/netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/multipart/FileUpload.java
* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/rtsp/RtspResponseStatuses.java
* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/DefaultHttpRequest.java
* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/HttpRequest.java
* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/rtsp/RtspRequestDecoder.java
* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/DefaultLastHttpContent.java
* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/websocketx/WebSocketUtil.java
* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/spdy/package-info.java
* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/websocketx/BinaryWebSocketFrame.java
* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/rtsp/RtspMethods.java
*
/netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/multipart/AbstractHttpData.java
* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/multipart/CaseIgnoringComparator.java
* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/HttpRequestEncoder.java
* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/rtsp/RtspResponseDecoder.java
* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/HttpResponseStatus.java
* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/HttpResponse.java
* /netty-codec-http-4-1-51-final-sources-
jar/io/netty/handler/codec/http/websocketx/WebSocketClientHandshaker08.java
* /netty-codec-http-4-1-51-final-sources-
jar/io/netty/handler/codec/http/multipart/HttpPostMultipartRequestDecoder.java
* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/rtsp/RtspResponseEncoder.java
* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/DefaultHttpContent.java
*
/netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/spdy/SpdyHttpEncoder.java
* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/websocketx/TextWebSocketFrame.java
* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/HttpObjectEncoder.java
* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/multipart/package-info.java
* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/multipart/MemoryFileUpload.java
* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/spdy/SpdySession.java
* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/HttpConstants.java
* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/websocketx/PongWebSocketFrame.java
* /netty-codec-http-4-1-51-final-sources-
jar/io/netty/handler/codec/http/multipart/HttpPostStandardRequestDecoder.java
*

```

```

/netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/rtsp/RtspRequestEncoder.java
* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/multipart/MixedAttribute.java
* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/multipart/InternalAttribute.java
* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/HttpContentCompressor.java
* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/QueryStringDecoder.java
* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/DefaultHttpMessage.java
* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/websocketx/PingWebSocketFrame.java
* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/multipart/HttpData.java
* /netty-codec-http-4-1-51-final-sources-
jar/io/netty/handler/codec/http/websocketx/WebSocketClientHandshaker13.java
* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/rtsp/RtspObjectEncoder.java
*
/netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/websocketx/WebSocketFrame.java
* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/HTTPHeaderDateFormat.java
* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/CookieDecoder.java
* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/websocketx/WebSocketVersion.java
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```

* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/spdy/SpdyHeaderBlockDecoder.java
* /netty-codec-http-4-1-51-final-sources-
jar/io/netty/handler/codec/http/websocketx/extensions/compression/DeflateDecoder.java
* /netty-codec-http-4-1-51-final-sources-
jar/io/netty/handler/codec/http/websocketx/extensions/WebSocketExtensionEncoder.java
*
/netty-codec-http-4-1-51-final-sources-
jar/io/netty/handler/codec/http/websocketx/extensions/compression/PerMessageDeflateEncoder.java
* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/ServerCookieEncoder.java
* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/HttpChunkedInput.java
* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/HttpStatusClass.java
* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/HttpHeadersEncoder.java
* /netty-codec-http-4-1-51-final-sources-

```

```

jar/io/netty/handler/codec/http/websocketx/extensions/compression/PerFrameDeflateDecoder.java
* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/spdy/SpdyHeaderBlockZlibDecoder.java
* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/spdy/SpdyFrameDecoderDelegate.java
* /netty-codec-http-4-1-51-final-sources-
jar/io/netty/handler/codec/http/websocketx/extensions/WebSocketClientExtension.java
*
/netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/HttpHeaderValues.java
* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/HttpHeaderNames.java
* /netty-codec-http-4-1-51-final-sources-
jar/io/netty/handler/codec/http/websocketx/extensions/WebSocketServerExtensionHandshaker.java
* /netty-codec-http-4-1-51-final-sources-
jar/io/netty/handler/codec/http/websocketx/extensions/WebSocketServerExtension.java
* /netty-codec-http-4-1-51-final-sources-
jar/io/netty/handler/codec/http/websocketx/extensions/compression/DeflateEncoder.java
* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/spdy/SpdyHeaderBlockRawDecoder.java
* /netty-codec-http-4-1-51-final-sources-
jar/io/netty/handler/codec/http/websocketx/extensions/compression/PerMessageDeflateClientExtensionHandshaker.java
ava
* /netty-codec-http-4-1-51-final-sources-
jar/io/netty/handler/codec/http/websocketx/extensions/WebSocketClientExtensionHandshaker.java
*
/netty-codec-http-4-1-51-final-sources-
jar/io/netty/handler/codec/http/websocketx/extensions/compression/WebSocketServerCompressionHandler.java
* /netty-codec-http-4-1-51-final-sources-
jar/io/netty/handler/codec/http/websocketx/extensions/compression/PerMessageDeflateServerExtensionHandshaker.java
java
* /netty-codec-http-4-1-51-final-sources-
jar/io/netty/handler/codec/http/websocketx/extensions/WebSocketExtension.java
* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/spdy/SpdyProtocolException.java
* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/rtp/RtpHeaderNames.java
* /netty-codec-http-4-1-51-final-sources-
jar/io/netty/handler/codec/http/websocketx/extensions/compression/package-info.java
* /netty-codec-http-4-1-51-final-sources-
jar/io/netty/handler/codec/http/websocketx/extensions/compression/DeflateFrameServerExtensionHandshaker.java
* /netty-codec-http-4-1-51-final-sources-
jar/io/netty/handler/codec/http/websocketx/extensions/WebSocketServerExtensionHandler.java
*
/netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/spdy/SpdyFrameEncoder.java
* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/websocketx/Utf8FrameValidator.java
* /netty-codec-http-4-1-51-final-sources-
jar/io/netty/handler/codec/http/websocketx/extensions/compression/PerFrameDeflateEncoder.java
* /netty-codec-http-4-1-51-final-sources-
jar/io/netty/handler/codec/http/websocketx/extensions/compression/DeflateFrameClientExtensionHandshaker.java
* /netty-codec-http-4-1-51-final-sources-
jar/io/netty/handler/codec/http/websocketx/extensions/WebSocketExtensionDecoder.java
* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/rtp/RtpHeaderValues.java
* /netty-codec-http-4-1-51-final-sources-
jar/io/netty/handler/codec/http/websocketx/extensions/compression/WebSocketClientCompressionHandler.java

```

```

* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/spdy/SpdyFrameDecoder.java
*
/netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/HttpMessageUtil.java
* /netty-codec-http-4-1-51-final-sources-
jar/io/netty/handler/codec/http/websocketx/extensions/WebSocketExtensionData.java
* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/ClientCookieEncoder.java
* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/websocketx/extensions/package-info.java
* /netty-codec-http-4-1-51-final-sources-
jar/io/netty/handler/codec/http/websocketx/extensions/WebSocketClientExtensionHandler.java
* /netty-codec-http-4-1-51-final-sources-
jar/io/netty/handler/codec/http/websocketx/extensions/WebSocketExtensionUtil.java
* /netty-codec-http-4-1-51-final-sources-
jar/io/netty/handler/codec/http/websocketx/extensions/compression/PerMessageDeflateDecoder.java
* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/spdy/SpdyFrameCodec.java
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```

Found in path(s):

```

* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/ReadOnlyHttpHeaders.java
* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/websocketx/WebSocketScheme.java
* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/HttpServerExpectContinueHandler.java
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* /netty-codec-http-4-1-51-final-sources-
jar/io/netty/handler/codec/http/websocketx/WebSocket08FrameDecoder.java
* /netty-codec-http-4-1-51-final-sources-
jar/io/netty/handler/codec/http/websocketx/WebSocket13FrameDecoder.java
* /netty-codec-http-4-1-51-final-sources-
jar/io/netty/handler/codec/http/websocketx/WebSocket07FrameDecoder.java
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* /netty-codec-http-4-1-51-final-sources-jar/META-INF/native-image/io.netty/codec-http/native-image.properties
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* /netty-codec-http-4-1-51-final-sources-jar/META-INF/maven/io.netty/netty-codec-http/pom.xml

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* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/websocketx/WebSocketFrameEncoder.java

* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/spdy/SpdyWindowUpdateFrame.java

* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/spdy/SpdySessionStatus.java

*

/netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/spdy/DefaultSpdyWindowUpdateFrame.java

* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/spdy/SpdyDataFrame.java

* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/spdy/SpdySynReplyFrame.java

* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/spdy/SpdyStreamFrame.java

* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/spdy/SpdyRstStreamFrame.java

* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/FullHttpResponse.java

* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/spdy/SpdySynStreamFrame.java

* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/spdy/SpdyPingFrame.java

* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/FullHttpRequest.java

* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/spdy/DefaultSpdyDataFrame.java

* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/spdy/SpdyVersion.java

*

/netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/DefaultFullHttpResponse.java

* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/spdy/SpdySettingsFrame.java

* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/spdy/SpdyGoAwayFrame.java

* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/cors/package-info.java

* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/spdy/SpdyHeaderBlockRawEncoder.java

* /netty-codec-http-4-1-51-final-sources-

jar/io/netty/handler/codec/http/websocketx/WebSocketClientProtocolHandler.java

* /netty-codec-http-4-1-51-final-sources-

jar/io/netty/handler/codec/http/websocketx/WebSocketFrameAggregator.java

```

* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/spdy/SpdyHttpDecoder.java
* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/spdy/SpdyHttpCodec.java
* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/spdy/SpdyHeaders.java
*
/netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/DefaultFullHttpRequest.java
* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/spdy/DefaultSpdyStreamFrame.java
* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/spdy/DefaultSpdyPingFrame.java
* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/spdy/DefaultSpdySynStreamFrame.java
* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/spdy/DefaultSpdySynReplyFrame.java
* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/spdy/DefaultSpdyRstStreamFrame.java
* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/spdy/SpdyFrame.java
* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/ComposedLastHttpContent.java
* /netty-codec-http-4-1-51-final-sources-
jar/io/netty/handler/codec/http/websocketx/WebSocketClientProtocolHandshakeHandler.java
*
/netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/spdy/DefaultSpdyGoAwayFrame.java
* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/spdy/SpdySessionHandler.java
* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/spdy/DefaultSpdyHeaders.java
* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/FullHttpRequest.java
* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/websocketx/WebSocketFrameDecoder.java
* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/spdy/SpdyCodecUtil.java
* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/spdy/SpdyHeaderBlockEncoder.java
* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/spdy/DefaultSpdyHeadersFrame.java
* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/spdy/SpdyHeaderBlockZlibEncoder.java
* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/spdy/SpdyHeaderBlockJZlibEncoder.java
*
/netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/spdy/SpdyStreamStatus.java
* /netty-codec-http-4-1-51-final-sources-
jar/io/netty/handler/codec/http/websocketx/WebSocketProtocolHandler.java
* /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/spdy/SpdyHeadersFrame.java
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- * /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/cors/CorsConfig.java
- * /netty-codec-http-4-1-51-final-sources-jar/io/netty/handler/codec/http/cors/CorsHandler.java

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- * /netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/PemPrivateKey.java
 - * /netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/ReferenceCountedOpenSslServerContext.java
 - * /netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/PemX509Certificate.java
 - *
 - * /netty-handler-4-1-51-final-sources-jar/io/netty/handler/flow/package-info.java
 - * /netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/ReferenceCountedOpenSslClientContext.java
 - * /netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/ReferenceCountedOpenSslEngine.java
 - * /netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/PemEncoded.java
 - * /netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/PemValue.java
 - * /netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/util/X509TrustManagerWrapper.java
 - * /netty-handler-4-1-51-final-sources-jar/io/netty/handler/flush/package-info.java
 - * /netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/Java8SslUtils.java
 - * /netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/OpenSslCertificateException.java
 - * /netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/ReferenceCountedOpenSslContext.java
 - * /netty-handler-4-1-51-final-sources-jar/io/netty/handler/flush/FlushConsolidationHandler.java
 - * /netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/DelegatingSslContext.java
 - *
 - * /netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/OpenSslKeyMaterialManager.java
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* /netty-handler-4-1-51-final-sources-jar/io/netty/handler/stream/ChunkedStream.java

* /netty-handler-4-1-51-final-sources-jar/io/netty/handler/timeout/package-info.java

* /netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/package-info.java

* /netty-handler-4-1-51-final-sources-jar/io/netty/handler/timeout/IdleStateHandler.java

*

/netty-handler-4-1-51-final-sources-jar/io/netty/handler/logging/LoggingHandler.java

* /netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/NotSslRecordException.java

* /netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/SslHandler.java

* /netty-handler-4-1-51-final-sources-jar/io/netty/handler/stream/ChunkedFile.java

* /netty-handler-4-1-51-final-sources-jar/io/netty/handler/stream/ChunkedNioStream.java

* /netty-handler-4-1-51-final-sources-jar/io/netty/handler/logging/LogLevel.java

* /netty-handler-4-1-51-final-sources-jar/io/netty/handler/stream/ChunkedWriteHandler.java

* /netty-handler-4-1-51-final-sources-jar/io/netty/handler/stream/ChunkedInput.java

* /netty-handler-4-1-51-final-sources-jar/io/netty/handler/timeout/ReadTimeoutException.java

* /netty-handler-4-1-51-final-sources-jar/io/netty/handler/timeout/TimeoutException.java

* /netty-handler-4-1-51-final-sources-jar/io/netty/handler/timeout/IdleStateEvent.java

*

/netty-handler-4-1-51-final-sources-jar/io/netty/handler/timeout/WriteTimeoutException.java

* /netty-handler-4-1-51-final-sources-jar/io/netty/handler/stream/package-info.java

* /netty-handler-4-1-51-final-sources-jar/io/netty/handler/timeout/IdleState.java

* /netty-handler-4-1-51-final-sources-jar/io/netty/handler/timeout/WriteTimeoutHandler.java

* /netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/util/package-info.java

* /netty-handler-4-1-51-final-sources-jar/io/netty/handler/logging/package-info.java

* /netty-handler-4-1-51-final-sources-jar/io/netty/handler/timeout/ReadTimeoutHandler.java

* /netty-handler-4-1-51-final-sources-jar/io/netty/handler/stream/ChunkedNioFile.java

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Found in path(s):

* /netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/OpenSslSession.java
 * /netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/OpenSslTlsv13X509ExtendedTrustManager.java
 * /netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/ExtendedOpenSslSession.java
 *
 * /netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/DefaultOpenSslKeyMaterial.java
 * /netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/OpenSslCachingKeyMaterialProvider.java
 * /netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/OpenSslX509KeyManagerFactory.java
 * /netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/OpenSslX509TrustManagerWrapper.java
 * /netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/OpenSslPrivateKey.java
 * /netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/OpenSslKeyMaterial.java
 * /netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/OpenSslCachingX509KeyManagerFactory.java
 * /netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/OpenSslKeyMaterialProvider.java
 * /netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/SignatureAlgorithmConverter.java
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* /netty-handler-4-1-51-final-sources-jar/io/netty/handler/traffic/AbstractTrafficShapingHandler.java
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* /netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/util/InsecureTrustManagerFactory.java
* /netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/PemReader.java
* /netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/JdkBaseApplicationProtocolNegotiator.java
*
* /netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/SniHandler.java
* /netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/OpenSslX509Certificate.java
* /netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/Java7SslParametersUtils.java
* /netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/OpenSslSessionStats.java
* /netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/JdkApplicationProtocolNegotiator.java
* /netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/OpenSslServerContext.java
* /netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/SupportedCipherSuiteFilter.java
* /netty-handler-4-1-51-final-sources-jar/io/netty/handler/ipfilter/package-info.java

```

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* /netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/JettyNpnSslEngine.java
* /netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/OpenSslEngineMap.java
* /netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/OpenSslContext.java
* /netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/util/SimpleTrustManagerFactory.java
*
/netty-handler-4-1-51-final-sources-jar/io/netty/handler/traffic/GlobalChannelTrafficCounter.java
* /netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/util/BouncyCastleSelfSignedCertGenerator.java
* /netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/OpenSslClientContext.java
* /netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/CipherSuiteConverter.java
* /netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/OpenSslSessionContext.java
* /netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/CipherSuiteFilter.java
* /netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/OpenSslEngine.java
* /netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/SslContext.java
* /netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/OpenSslDefaultApplicationProtocolNegotiator.java
* /netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/ApplicationProtocolNegotiator.java
*
/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/JdkSslEngine.java
* /netty-handler-4-1-51-final-sources-jar/io/netty/handler/ipfilter/RuleBasedIpFilter.java
* /netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/JdkAlpnApplicationProtocolNegotiator.java
* /netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/JdkSslServerContext.java
* /netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/JdkDefaultApplicationProtocolNegotiator.java
* /netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/SslProvider.java
* /netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/IdentityCipherSuiteFilter.java
* /netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/util/OpenJdkSelfSignedCertGenerator.java
* /netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/JdkSslContext.java
* /netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/util/ThreadLocalInsecureRandom.java
* /netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/ApplicationProtocolConfig.java
*
/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ipfilter/UniqueIpFilter.java
* /netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/OpenSslApplicationProtocolNegotiator.java
* /netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/OpenSslServerSessionContext.java
* /netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/JdkNpnApplicationProtocolNegotiator.java
* /netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/ApplicationProtocolUtil.java
* /netty-handler-4-1-51-final-sources-jar/io/netty/handler/ipfilter/IpSubnetFilterRule.java
* /netty-handler-4-1-51-final-sources-jar/io/netty/handler/ipfilter/IpFilterRule.java
* /netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/OpenSslNpnApplicationProtocolNegotiator.java
* /netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/SslUtils.java
* /netty-handler-4-1-51-final-sources-jar/io/netty/handler/ipfilter/IpFilterRuleType.java
* /netty-handler-4-1-51-final-sources-jar/io/netty/handler/ipfilter/AbstractRemoteAddressFilter.java
*
/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/JdkSslClientContext.java
* /netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/util/FingerprintTrustManagerFactory.java
* /netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/OpenSsl.java
* /netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/JettyAlpnSslEngine.java
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// Try the OpenJDK's proprietary implementation.

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* /netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/util/SelfSignedCertificate.java
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* /netty-handler-4-1-51-final-sources-jar/io/netty/handler/traffic/GlobalChannelTrafficShapingHandler.java
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* /netty-handler-4-1-51-final-sources-jar/io/netty/handler/traffic/ChannelTrafficShapingHandler.java
* /netty-handler-4-1-51-final-sources-jar/io/netty/handler/traffic/TrafficCounter.java
*

/netty-handler-4-1-51-final-sources-jar/io/netty/handler/traffic/package-info.java

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* /netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/util/X509KeyManagerWrapper.java
* /netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/TrustManagerFactoryWrapper.java
* /netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/util/SimpleKeyManagerFactory.java
*

/netty-handler-4-1-51-final-sources-jar/io/netty/handler/address/DynamicAddressConnectHandler.java

* /netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/KeyManagerFactoryWrapper.java

* /netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/OpenSslPrivateKeyMethod.java

* /netty-handler-4-1-51-final-sources-jar/io/netty/handler/address/package-info.java

* /netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/PseudoRandomFunction.java

* /netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/SslMasterKeyHandler.java

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* /netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/ocsp/package-info.java

* /netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/AbstractSniHandler.java

* /netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/SslCompletionEvent.java

*

/netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/SslCloseCompletionEvent.java

* /netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/Conscrypt.java

* /netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/SniCompletionEvent.java

* /netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/OptionalSslHandler.java

* /netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/JdkAlpnSslUtils.java

* /netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/JdkAlpnSslEngine.java

* /netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/SslClientHelloHandler.java

* /netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/ConscryptAlpnSslEngine.java

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* /netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/ApplicationProtocolAccessor.java
* /netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/OpenSslSessionTicketKey.java
* /netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/ApplicationProtocolNames.java
*
* /netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/OpenSslJavaxX509Certificate.java
* /netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/SslContextBuilder.java
* /netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/ClientAuth.java
* /netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/ApplicationProtocolNegotiationHandler.java
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* /netty-handler-4-1-51-final-sources-jar/io/netty/handler/address/ResolveAddressHandler.java

* /netty-handler-4-1-51-final-sources-jar/io/netty/handler/logging/ByteBufFormat.java

* /netty-handler-4-1-51-final-sources-jar/io/netty/handler/ssl/SslHandshakeTimeoutException.java

1.149 netty-resolver 4.1.51.Final

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* /netty-resolver-4-1-51-final-sources-jar/io/netty/resolver/AbstractAddressResolver.java

* /netty-resolver-4-1-51-final-sources-jar/io/netty/resolver/HostsFileEntriesResolver.java

*

/netty-resolver-4-1-51-final-sources-jar/io/netty/resolver/InetNameResolver.java
* /netty-resolver-4-1-51-final-sources-jar/io/netty/resolver/DefaultHostsFileEntriesResolver.java
* /netty-resolver-4-1-51-final-sources-jar/io/netty/resolver/HostsFileParser.java
* /netty-resolver-4-1-51-final-sources-jar/io/netty/resolver/InetSocketAddressResolver.java
* /netty-resolver-4-1-51-final-sources-jar/io/netty/resolver/CompositeNameResolver.java
* /netty-resolver-4-1-51-final-sources-jar/io/netty/resolver/AddressResolver.java

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* /netty-resolver-4-1-51-final-sources-jar/io/netty/resolver/SimpleNameResolver.java
* /netty-resolver-4-1-51-final-sources-jar/io/netty/resolver/NoopAddressResolver.java
* /netty-resolver-4-1-51-final-sources-jar/io/netty/resolver/NameResolver.java
*
/netty-resolver-4-1-51-final-sources-jar/io/netty/resolver/AddressResolverGroup.java
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1.150 netty-transport 4.1.51.Final

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- * /netty-transport-4-1-51-final-sources-jar/io/netty/channel/ChannelOutboundInvoker.java
- * /netty-transport-4-1-51-final-sources-jar/io/netty/channel/WriteBufferWaterMark.java
- *
- * /netty-transport-4-1-51-final-sources-jar/io/netty/channel/DefaultSelectStrategyFactory.java
- * /netty-transport-4-1-51-final-sources-jar/io/netty/channel/group/VoidChannelGroupFuture.java
- * /netty-transport-4-1-51-final-sources-jar/io/netty/channel/SelectStrategyFactory.java
- * /netty-transport-4-1-51-final-sources-jar/io/netty/channel/ChannelInboundInvoker.java
- * /netty-transport-4-1-51-final-sources-jar/io/netty/bootstrap/BootstrapConfig.java
- * /netty-transport-4-1-51-final-sources-jar/io/netty/bootstrap/ServerBootstrapConfig.java
- * /netty-transport-4-1-51-final-sources-jar/io/netty/bootstrap/AbstractBootstrapConfig.java
- * /netty-transport-4-1-51-final-sources-jar/io/netty/channel/DefaultSelectStrategy.java
- * /netty-transport-4-1-51-final-sources-jar/io/netty/channel/SelectStrategy.java

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 * /netty-transport-4-1-51-final-sources-jar/io/netty/bootstrap/Bootstrap.java
 * /netty-transport-4-1-51-final-sources-jar/io/netty/channel/MultithreadEventLoopGroup.java
 * /netty-transport-4-1-51-final-sources-jar/io/netty/channel/ChannelInboundHandlerAdapter.java
 *
 * /netty-transport-4-1-51-final-sources-jar/io/netty/channel/local/LocalAddress.java
 * /netty-transport-4-1-51-final-sources-jar/io/netty/channel/ChannelConfig.java
 * /netty-transport-4-1-51-final-sources-jar/io/netty/channel/socket/DefaultSocketChannelConfig.java
 * /netty-transport-4-1-51-final-sources-jar/io/netty/channel/nio/AbstractNioMessageChannel.java
 * /netty-transport-4-1-51-final-sources-jar/io/netty/channel/socket/oio/package-info.java
 * /netty-transport-4-1-51-final-sources-jar/io/netty/channel/ChannelDuplexHandler.java
 * /netty-transport-4-1-51-final-sources-jar/io/netty/channel/socket/DefaultServerSocketChannelConfig.java
 * /netty-transport-4-1-51-final-sources-jar/io/netty/channel/socket/nio/NioDatagramChannelConfig.java

- * /netty-transport-4-1-51-final-sources-jar/io/netty/channel/socket/DatagramPacket.java
- * /netty-transport-4-1-51-final-sources-jar/io/netty/channel/DefaultEventLoopGroup.java
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- /netty-transport-4-1-51-final-sources-jar/io/netty/channel/Channel.java
- * /netty-transport-4-1-51-final-sources-jar/io/netty/channel/oio/AbstractOioChannel.java
- * /netty-transport-4-1-51-final-sources-jar/io/netty/bootstrap/AbstractBootstrap.java
- * /netty-transport-4-1-51-final-sources-jar/io/netty/channel/SingleThreadEventLoop.java
- * /netty-transport-4-1-51-final-sources-jar/io/netty/channel/EventLoopGroup.java
- * /netty-transport-4-1-51-final-sources-jar/io/netty/channel/nio/NioEventLoop.java
- * /netty-transport-4-1-51-final-sources-jar/io/netty/channel/ChannelFuture.java
- * /netty-transport-4-1-51-final-sources-jar/io/netty/channel/local/LocalChannelRegistry.java
- * /netty-transport-4-1-51-final-sources-jar/io/netty/channel/socket/nio/package-info.java
- * /netty-transport-4-1-51-final-sources-jar/io/netty/channel/AdaptiveRecvByteBufAllocator.java
- * /netty-transport-4-1-51-final-sources-jar/io/netty/channel/oio/package-info.java
- * /netty-transport-4-1-51-final-sources-jar/io/netty/channel/RecvByteBufAllocator.java
- *
- /netty-transport-4-1-51-final-sources-jar/io/netty/channel/ChannelFlushPromiseNotifier.java
- * /netty-transport-4-1-51-final-sources-jar/io/netty/channel/ChannelPromiseAggregator.java
- * /netty-transport-4-1-51-final-sources-jar/io/netty/channel/socket/DatagramChannel.java
- * /netty-transport-4-1-51-final-sources-jar/io/netty/channel/socket/oio/OioServerSocketChannel.java
- * /netty-transport-4-1-51-final-sources-jar/io/netty/channel/ChannelPromiseNotifier.java
- * /netty-transport-4-1-51-final-sources-jar/io/netty/channel/oio/AbstractOioByteChannel.java
- * /netty-transport-4-1-51-final-sources-jar/io/netty/channel/socket/oio/OioSocketChannel.java
- * /netty-transport-4-1-51-final-sources-jar/io/netty/channel/local/package-info.java
- * /netty-transport-4-1-51-final-sources-jar/io/netty/channel/ChannelPipelineException.java
- * /netty-transport-4-1-51-final-sources-jar/io/netty/channel/local/LocalChannel.java
- * /netty-transport-4-1-51-final-sources-jar/io/netty/channel/socket/InternetProtocolFamily.java
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- /netty-transport-4-1-51-final-sources-jar/io/netty/channel/local/LocalServerChannel.java
- * /netty-transport-4-1-51-final-sources-jar/io/netty/channel/VoidChannelPromise.java
- * /netty-transport-4-1-51-final-sources-jar/io/netty/channel/AbstractChannel.java
- * /netty-transport-4-1-51-final-sources-jar/io/netty/bootstrap/ServerBootstrap.java
- * /netty-transport-4-1-51-final-sources-jar/io/netty/channel/FailedChannelFuture.java
- * /netty-transport-4-1-51-final-sources-jar/io/netty/channel/embedded/EmbeddedEventLoop.java
- * /netty-transport-4-1-51-final-sources-jar/io/netty/channel/AbstractServerChannel.java
- * /netty-transport-4-1-51-final-sources-jar/io/netty/channel/ChannelOutboundHandler.java
- * /netty-transport-4-1-51-final-sources-jar/io/netty/channel/ChannelException.java
- * /netty-transport-4-1-51-final-sources-jar/io/netty/channel/socket/nio/NioDatagramChannel.java
- * /netty-transport-4-1-51-final-sources-jar/io/netty/channel/DefaultChannelPipeline.java
- *
- /netty-transport-4-1-51-final-sources-jar/io/netty/channel/package-info.java
- * /netty-transport-4-1-51-final-sources-jar/io/netty/channel/AbstractChannelHandlerContext.java
- * /netty-transport-4-1-51-final-sources-jar/io/netty/channel/CompleteChannelFuture.java
- * /netty-transport-4-1-51-final-sources-jar/io/netty/channel/ThreadPerChannelEventLoopGroup.java
- * /netty-transport-4-1-51-final-sources-jar/io/netty/channel/ThreadPerChannelEventLoop.java
- * /netty-transport-4-1-51-final-sources-jar/io/netty/channel/socket/DefaultDatagramChannelConfig.java
- * /netty-transport-4-1-51-final-sources-jar/io/netty/channel/ChannelInboundHandler.java
- * /netty-transport-4-1-51-final-sources-jar/io/netty/channel/socket/SocketChannelConfig.java

- * /netty-transport-4-1-51-final-sources-jar/io/netty/channel/ChannelOption.java
- * /netty-transport-4-1-51-final-sources-jar/io/netty/channel/nio/package-info.java
- * /netty-transport-4-1-51-final-sources-jar/io/netty/channel/socket/nio/NioServerSocketChannel.java
- *
- /netty-transport-4-1-51-final-sources-jar/io/netty/channel/ServerChannel.java
- * /netty-transport-4-1-51-final-sources-jar/io/netty/channel/ChannelMetadata.java
- * /netty-transport-4-1-51-final-sources-jar/io/netty/channel/socket/ServerSocketChannel.java
- * /netty-transport-4-1-51-final-sources-jar/io/netty/channel/CombinedChannelDuplexHandler.java
- * /netty-transport-4-1-51-final-sources-jar/io/netty/channel/socket/nio/NioSocketChannel.java
- * /netty-transport-4-1-51-final-sources-jar/io/netty/channel/ChannelPipeline.java
- * /netty-transport-4-1-51-final-sources-jar/io/netty/channel/socket/nio/ProtocolFamilyConverter.java
- * /netty-transport-4-1-51-final-sources-jar/io/netty/channel/nio/AbstractNioChannel.java
- * /netty-transport-4-1-51-final-sources-jar/io/netty/channel/group/CombinedIterator.java
- * /netty-transport-4-1-51-final-sources-jar/io/netty/channel/oio/OioEventLoopGroup.java
- * /netty-transport-4-1-51-final-sources-jar/io/netty/channel/nio/AbstractNioByteChannel.java
- * /netty-transport-4-1-51-final-sources-jar/io/netty/channel/socket/ChannelInputShutdownEvent.java
- *
- /netty-transport-4-1-51-final-sources-jar/io/netty/channel/nio/NioTask.java
- * /netty-transport-4-1-51-final-sources-jar/io/netty/channel/group/DefaultChannelGroupFuture.java
- * /netty-transport-4-1-51-final-sources-jar/io/netty/channel/ChannelHandlerContext.java
- * /netty-transport-4-1-51-final-sources-jar/io/netty/channel/ChannelInitializer.java
- * /netty-transport-4-1-51-final-sources-jar/io/netty/channel/EventLoopException.java
- * /netty-transport-4-1-51-final-sources-jar/io/netty/channel/group/package-info.java
- * /netty-transport-4-1-51-final-sources-jar/io/netty/channel/embedded/EmbeddedSocketAddress.java
- * /netty-transport-4-1-51-final-sources-jar/io/netty/channel/DefaultEventLoop.java
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- * /netty-transport-4-1-51-final-sources-jar/io/netty/channel/socket/SocketChannel.java
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- * /netty-transport-4-1-51-final-sources-jar/io/netty/channel/nio/NioEventLoopGroup.java
- * /netty-transport-4-1-51-final-sources-jar/io/netty/channel/group/ChannelGroupFutureListener.java
- * /netty-transport-4-1-51-final-sources-jar/io/netty/channel/EventLoop.java
- * /netty-transport-4-1-51-final-sources-jar/io/netty/channel/group/ChannelGroupFuture.java
- * /netty-transport-4-1-51-final-sources-jar/io/netty/channel/SucceededChannelFuture.java
- * /netty-transport-4-1-51-final-sources-jar/io/netty/channel/ChannelFutureListener.java
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- * /netty-transport-4-1-51-final-sources-jar/io/netty/channel/ChannelOutboundHandlerAdapter.java
- * /netty-transport-4-1-51-final-sources-jar/io/netty/bootstrap/package-info.java
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- * /netty-transport-4-1-51-final-sources-jar/io/netty/channel/DefaultChannelPromise.java
- * /netty-transport-4-1-51-final-sources-jar/io/netty/channel/socket/ServerSocketChannelConfig.java
- * /netty-transport-4-1-51-final-sources-jar/io/netty/channel/local/LocalEventLoopGroup.java

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/**

* Handles an I/O event or intercepts an I/O operation, and forwards it to its next handler in

* its { @link ChannelPipeline }.

*

* <h3>Sub-types</h3>

* <p>

* { @link ChannelHandler } itself does not provide many methods, but you usually have to implement one of its subtypes:

*

* { @link

ChannelInboundHandler } to handle inbound I/O events, and

* { @link ChannelOutboundHandler } to handle outbound I/O operations.

*

* </p>

* <p>

* Alternatively, the following adapter classes are provided for your convenience:

*

* { @link ChannelInboundHandlerAdapter } to handle inbound I/O events,

* { @link ChannelOutboundHandlerAdapter } to handle outbound I/O operations, and

* { @link ChannelDuplexHandler } to handle both inbound and outbound events

*

* </p>

* <p>

* For more information, please refer to the documentation of each subtype.

* </p>

*

* <h3>The context object</h3>

* <p>

* A { @link ChannelHandler } is provided with a { @link ChannelHandlerContext }

* object. A { @link ChannelHandler } is supposed to interact with the

* { @link ChannelPipeline } it belongs to via a context object. Using the

* context object, the { @link ChannelHandler } can pass events upstream or

* downstream, modify the pipeline dynamically,

or store the information

* (using { @link AttributeKey }s) which is specific to the handler.

*

* <h3>State management</h3>

*

* A { @link ChannelHandler } often needs to store some stateful information.

* The simplest and recommended approach is to use member variables:

* <pre>

* public interface Message {

* // your methods here

* }

*

* public class DataServerHandler extends { @link SimpleChannelInboundHandler }<Message> {

*

* private boolean loggedIn;

*

* { @code @Override }

* public void channelRead0({ @link ChannelHandlerContext } ctx, Message message) {

* if (message instanceof LoginMessage) {

* authenticate((LoginMessage) message);

* loggedIn = true;

```
*     } else (message instanceof GetDataMessage) {
*         if (<b>loggedIn</b>) {
*             ctx.writeAndFlush(fetchSecret((GetDataMessage) message));
*         } else {
*             fail();
*         }
*     }
* }
* }
* ...
* }
```

* </pre>

* Because the handler instance has a state variable which is dedicated to one connection, you have to create a new handler instance for each new channel to avoid a race condition where a unauthenticated client can get the confidential information:

```
* <pre>
* // Create a new handler instance per channel.
* // See { @link ChannelInitializer#initChannel(Channel)}.
* public class DataServerInitializer extends { @link ChannelInitializer} &lt; { @link Channel} &gt; {
*     { @code @Override}
*     public void initChannel({ @link Channel} channel) {
*         channel.pipeline().addLast("handler", <b>new DataServerHandler()</b>);
*     }
* }
* }
```

* </pre>

* <h4>Using { @link AttributeKey}s</h4>

* Although it's recommended to use member variables to store the state of a handler, for some reason you might not want to create many handler instances. In such a case, you can use { @link AttributeKey}s which is provided by { @link ChannelHandlerContext}:

```
* <pre>
* public interface Message {
*     // your methods here
* }
*
* { @code @Sharable}
* public class DataServerHandler extends { @link SimpleChannelInboundHandler} &lt; Message &gt; {
*     private final { @link AttributeKey} &lt; { @link Boolean} &gt; auth =
*         { @link AttributeKey#valueOf(String) AttributeKey.valueOf("auth")};
*
*     { @code @Override}
*     public void channelRead({ @link ChannelHandlerContext} ctx, Message message) {
*         { @link Attribute} &lt; { @link Boolean} &gt; attr = ctx.attr(auth);
*         if (message instanceof LoginMessage) {
*             authenticate((LoginMessage) o);
*         }
*     }
* }
```

```

*      <b>attr.set(true)</b>;
*    } else (message instanceof GetDataMessage) {
*      if (<b>Boolean.TRUE.equals(attr.get())</b>) {
*        ctx.writeAndFlush(fetchSecret((GetDataMessage) o));
*      } else {
*        fail();
*      }
*    }
*  }
* }
* ...
* }
* </pre>

```

Now that the state of the handler is attached to the { @link ChannelHandlerContext }, you can add the same handler instance to different pipelines:

```

* <pre>
* public class DataServerInitializer extends { @link ChannelInitializer } &lt; { @link Channel } &gt; {
*
*   private static final DataServerHandler <b>SHARED</b> = new DataServerHandler();
*
*   { @code @Override }
*   public void initChannel({ @link Channel } channel) {
*     channel.pipeline().addLast("handler", <b>SHARED</b>);
*   }
* }
* </pre>

```

The { @code @Sharable } annotation</h4>

In the example above which used an { @link AttributeKey }, you might have noticed the { @code @Sharable } annotation.

If a { @link ChannelHandler } is annotated with the { @code @Sharable } annotation, it means you can create an instance of the handler just once and add it to one or more { @link ChannelPipeline }s multiple times without a race condition.

If this annotation is not specified, you have to create a new handler instance every time you add it to a pipeline because it has unshared state such as member variables.

This annotation is provided for documentation purpose, just like [the JCIP annotations](http://www.javaconcurrencyinpractice.com/annotations/doc/).

Additional resources worth reading</h3>

- * Please refer to the { @link ChannelHandler}, and
- * { @link ChannelPipeline} to find out more about inbound and outbound operations,
- * what fundamental differences they have, how they flow in a pipeline, and how to handle
- * the operation in your application.

*/

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* /netty-transport-4-1-51-final-sources-jar/io/netty/channel/AbstractEventLoop.java

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* /netty-transport-4-1-51-final-sources-jar/io/netty/channel/pool/AbstractChannelPoolHandler.java

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/netty-transport-4-1-51-final-sources-jar/io/netty/channel/DefaultMaxBytesRecvByteBufAllocator.java

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* /netty-transport-4-1-51-final-sources-jar/io/netty/channel/MaxBytesRecvByteBufAllocator.java

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* /netty-transport-4-1-51-final-sources-jar/io/netty/channel/ChannelProgressivePromise.java

* /netty-transport-4-1-51-final-sources-jar/io/netty/channel/group/ChannelGroupException.java

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* /netty-transport-4-1-51-final-sources-jar/io/netty/channel/ChannelId.java

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* /netty-transport-4-1-51-final-sources-jar/io/netty/channel/AbstractEventLoopGroup.java

```

* /netty-transport-4-1-51-final-sources-jar/io/netty/channel/group/ChannelGroup.java
* /netty-transport-4-1-51-final-sources-jar/io/netty/channel/DefaultChannelId.java
* /netty-transport-4-1-51-final-sources-jar/io/netty/channel/group/ChannelMatcher.java
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* /netty-transport-4-1-51-final-sources-jar/io/netty/channel/group/ChannelMatchers.java
*
/netty-transport-4-1-51-final-sources-jar/io/netty/channel/ConnectTimeoutException.java
* /netty-transport-4-1-51-final-sources-jar/io/netty/bootstrap/ChannelFactory.java
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* /netty-transport-4-1-51-final-sources-jar/io/netty/channel/DefaultChannelProgressivePromise.java
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* /netty-transport-4-1-51-final-sources-jar/io/netty/channel/DelegatingChannelPromiseNotifier.java
*
/netty-transport-4-1-51-final-sources-jar/io/netty/bootstrap/FailedChannel.java
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* /netty-transport-4-1-51-final-sources-jar/io/netty/channel/internal/package-info.java
* /netty-transport-4-1-51-final-sources-jar/io/netty/channel/nio/SelectedSelectionKeySetSelector.java
* /netty-transport-4-1-51-final-sources-jar/io/netty/channel/socket/oio/OioDatagramChannelConfig.java
* /netty-transport-4-1-51-final-sources-jar/io/netty/channel/socket/ChannelInputShutdownReadComplete.java
* /netty-transport-4-1-51-final-sources-jar/io/netty/channel/internal/ChannelUtils.java
* /netty-transport-4-1-51-final-sources-jar/io/netty/channel/socket/ChannelOutputShutdownException.java

```

1.151 netty-codec 4.1.51.Final

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/**
* A decoder that splits the received { @link ByteBuf}s dynamically by the
* value of the length field in the message. It is particularly useful when you
* decode a binary message which has an integer header field that represents the
* length of the message body or the whole message.
*
* <p>
* { @link LengthFieldBasedFrameDecoder} has many configuration parameters so
* that it can decode any message with a length field, which is often seen in
* proprietary client-server protocols. Here are some example that will give
* you the basic idea on which option does what.
*
* <h3>2 bytes length field at offset 0, do not strip header</h3>
*

```

* The value of the length field in this example is `<tt>12 (0x0C)</tt>` which
 * represents the length of "HELLO, WORLD". By default, the decoder assumes
 * that the length field represents the number of the bytes that follows the
 * length field. Therefore, it can be decoded with the simplistic parameter
 * combination.

* `<pre>`

* `lengthFieldOffset = 0`

* `lengthFieldLength = 2`

* `lengthAdjustment = 0`

* `initialBytesToStrip = 0` (= do not strip header)

*

* BEFORE DECODE (14 bytes) AFTER DECODE (14 bytes)

* +-----+-----+ +-----+-----+

* | Length | Actual Content

|---->| Length | Actual Content |

* | 0x000C | "HELLO, WORLD" | | 0x000C | "HELLO, WORLD" |

* +-----+-----+ +-----+-----+

* `</pre>`

*

* `<h3>2 bytes length field at offset 0, strip header</h3>`

*

* Because we can get the length of the content by calling

* `{ @link ByteBuf#readableBytes() }`, you might want to strip the length

* field by specifying `<tt>initialBytesToStrip</tt>`. In this example, we

* specified `<tt>2</tt>`, that is same with the length of the length field, to

* strip the first two bytes.

* `<pre>`

* `lengthFieldOffset = 0`

* `lengthFieldLength = 2`

* `lengthAdjustment = 0`

* `initialBytesToStrip = 2` (= the length of the Length field)

*

* BEFORE DECODE (14 bytes) AFTER DECODE (12 bytes)

* +-----+-----+ +-----+-----+

* | Length | Actual Content |---->| Actual Content |

* | 0x000C | "HELLO, WORLD" | | "HELLO, WORLD" |

* +-----+-----+ +-----+-----+

* `</pre>`

*

* `<h3>2 bytes length field at offset 0, do not strip header, the length field`

* `represents the length of the whole message</h3>`

*

* In most cases, the length field represents the length of the message body

* only, as shown in the previous examples. However, in some protocols, the

* length field represents the length of the whole message, including the

* message header. In such a case, we specify a non-zero

* `<tt>lengthAdjustment</tt>`. Because the length value in this example message

* is always greater than the body length by `<tt>2</tt>`, we specify `<tt>-2</tt>`

```

* as <tt>lengthAdjustment</tt> for compensation.
* <pre>
* lengthFieldOffset = 0
* lengthFieldLength = 2
* <b>lengthAdjustment</b> = <b>-2</b> (= the length of the Length field)
* initialBytesToStrip = 0
*
* BEFORE DECODE (14 bytes)      AFTER DECODE (14 bytes)
* +-----+-----+-----+-----+
* | Length | Actual Content |---->| Length | Actual
  Content |
* | 0x000E | "HELLO, WORLD" |    | 0x000E | "HELLO, WORLD" |
* +-----+-----+-----+-----+
* </pre>
*
* <h3>3 bytes length field at the end of 5 bytes header, do not strip header</h3>
*
* The following message is a simple variation of the first example. An extra
* header value is prepended to the message. <tt>lengthAdjustment</tt> is zero
* again because the decoder always takes the length of the prepended data into
* account during frame length calculation.
* <pre>
* <b>lengthFieldOffset</b> = <b>2</b> (= the length of Header 1)
* <b>lengthFieldLength</b> = <b>3</b>
* lengthAdjustment = 0
* initialBytesToStrip = 0
*
* BEFORE DECODE (17 bytes)      AFTER DECODE (17 bytes)
* +-----+-----+-----+-----+
* | Header 1 | Length | Actual Content |---->| Header 1 | Length | Actual Content |
* | 0xCAFE | 0x00000C | "HELLO, WORLD" |    | 0xCAFE | 0x00000C | "HELLO, WORLD" |
* +-----+-----+-----+-----+
* </pre>
*
* <h3>3 bytes length field at the beginning of 5 bytes header, do not strip header</h3>
*
* This is an advanced example that shows the case where there is an extra
* header between the length field and the message body. You have to specify a
* positive <tt>lengthAdjustment</tt> so that the decoder counts the extra
* header into the frame length calculation.
* <pre>
* lengthFieldOffset = 0
* lengthFieldLength = 3
* <b>lengthAdjustment</b> = <b>2</b> (= the length of Header 1)
* initialBytesToStrip = 0
*
* BEFORE DECODE (17 bytes)      AFTER DECODE (17 bytes)

```

```
* +-----+-----+-----+-----+ +-----+-----+-----+
* | Length | Header 1 | Actual Content |---->| Length | Header 1 | Actual Content |
* | 0x00000C | 0xCAFE | "HELLO, WORLD" |    | 0x00000C | 0xCAFE | "HELLO,
WORLD" |
```

```
* +-----+-----+-----+-----+ +-----+-----+-----+
* </pre>
```

*
* <h3>2 bytes length field at offset 1 in the middle of 4 bytes header,
* strip the first header field and the length field</h3>
*

* This is a combination of all the examples above. There are the prepended
* header before the length field and the extra header after the length field.
* The prepended header affects the <tt>lengthFieldOffset</tt> and the extra
* header affects the <tt>lengthAdjustment</tt>. We also specified a non-zero
* <tt>initialBytesToStrip</tt> to strip the length field and the prepended
* header from the frame. If you don't want to strip the prepended header, you
* could specify <tt>0</tt> for <tt>initialBytesToSkip</tt>.

```
* <pre>
* lengthFieldOffset = 1 (= the length of HDR1)
* lengthFieldLength = 2
* <b>lengthAdjustment</b> = <b>1</b> (= the length of HDR2)
* <b>initialBytesToStrip</b> = <b>3</b> (= the length of HDR1 + LEN)
```

```
*
* BEFORE DECODE (16 bytes)          AFTER DECODE (13 bytes)
* +-----+-----+-----+-----+ +-----+-----+-----+
* | HDR1 | Length | HDR2 | Actual Content |---->| HDR2 | Actual Content |
* | 0xCA | 0x000C | 0xFE | "HELLO, WORLD" |    | 0xFE | "HELLO, WORLD" |
```

```
* +-----+-----+-----+-----+ +-----+-----+-----+
* </pre>
```

*
* <h3>2 bytes length field at offset 1 in the middle of 4 bytes header,
* strip the first header field and the length field, the length field
* represents the length of the whole message</h3>
*

* Let's give another twist to the previous example. The only difference from
* the previous example is that the length field represents the length of the
* whole message instead of the message body, just like the third example.
* We have to count the length of HDR1 and Length into <tt>lengthAdjustment</tt>.
* Please note that we don't need to take the length of HDR2 into account
* because
the length field already includes the whole header length.

```
* <pre>
* lengthFieldOffset = 1
* lengthFieldLength = 2
* <b>lengthAdjustment</b> = <b>-3</b> (= the length of HDR1 + LEN, negative)
* <b>initialBytesToStrip</b> = <b>3</b>
```

```
*
* BEFORE DECODE (16 bytes)          AFTER DECODE (13 bytes)
```



```

* +-----+-----+-----+-----+-----+-----+
* | HDR1 | Length | HDR2 | Actual Content |----->| HDR2 | Actual Content |
* | 0xCA | 0x0010 | 0xFE | "HELLO, WORLD" |      | 0xFE | "HELLO, WORLD" |
* +-----+-----+-----+-----+-----+-----+
* </pre>
* @see LengthFieldPrepender
*/

```

Found in path(s):

`/netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/LengthFieldBasedFrameDecoder.java`

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`/netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/DefaultHeaders.java`

`/netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/EmptyHeaders.java`

`/netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/Headers.java`

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- * /netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/string/LineSeparator.java
- * /netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/compression/ByteBufChecksum.java
- * /netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/DatagramPacketDecoder.java
- *
- /netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/string/LineEncoder.java
- * /netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/CodecOutputList.java
- * /netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/compression/CompressionUtil.java
- * /netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/DateFormatter.java
- * /netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/DatagramPacketEncoder.java

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- * /netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/compression/Lz4XXHash32.java

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- * /netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/DefaultHeadersImpl.java
- * /netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/CharSequenceValueConverter.java
- * /netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/ValueConverter.java

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- * /netty-codec-4-1-51-final-sources-jar/META-INF/maven/io.netty/netty-codec/pom.xml

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- * /netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/compression/Crc32c.java
- * /netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/compression/JdkZlibDecoder.java
- * /netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/xml/XmlFrameDecoder.java

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```
* /netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/protobuf/ProtobufVarint32FrameDecoder.java
* /netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/ProtocolDetectionResult.java
* /netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/protobuf/ProtobufDecoder.java
*
* /netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/protobuf/ProtobufVarint32LengthFieldPrepender.java
* /netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/protobuf/ProtobufEncoderNano.java
* /netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/protobuf/ProtobufDecoderNano.java
* /netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/UnsupportedValueConverter.java
* /netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/ProtocolDetectionState.java
* /netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/HeadersUtils.java
* /netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/protobuf/ProtobufEncoder.java
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- * /netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/DelimiterBasedFrameDecoder.java
- * /netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/serialization/ObjectDecoder.java
- * /netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/serialization/ReferenceMap.java
- *
- /netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/marshalling/UnmarshallerProvider.java
- * /netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/marshalling/CompatibleMarshallingDecoder.java
- * /netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/base64/package-info.java
- * /netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/serialization/CompactObjectInputStream.java
- * /netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/TooLongFrameException.java
- * /netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/marshalling/MarshallingDecoder.java
- * /netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/PrematureChannelClosureException.java
- * /netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/compression/JdkZlibEncoder.java
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- * /netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/serialization/ObjectEncoderOutputStream.java
- * /netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/serialization/ObjectEncoder.java
- * /netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/marshalling/ChannelBufferByteOutput.java
- * /netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/CodecException.java
- * /netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/ReplayingDecoder.java
- * /netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/MessageToMessageEncoder.java
- * /netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/EncoderException.java
- * /netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/bytes/ByteArrayDecoder.java
- * /netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/serialization/ClassLoaderClassResolver.java
- *
- /netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/marshalling/UnmarshallerProvider.java
- * /netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/serialization/ClassResolver.java
- * /netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/MessageToMessageDecoder.java
- * /netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/LineBasedFrameDecoder.java
- * /netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/compression/ZlibEncoder.java
- * /netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/UnsupportedMessageTypeException.java
- * /netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/marshalling/ContextBoundUnmarshallerProvider.java
- * /netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/compression/ZlibUtil.java
- * /netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/compression/ZlibWrapper.java
- * /netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/compression/ZlibCodecFactory.java
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- /netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/serialization/ObjectDecoderInputStream.java
- * /netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/ByteToMessageCodec.java
- * /netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/CorruptedFrameException.java
- * /netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/string/StringEncoder.java
- * /netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/serialization/ClassResolvers.java
- * /netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/marshalling/package-info.java
- * /netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/compression/JZlibDecoder.java
- * /netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/MessageAggregator.java
- * /netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/serialization/package-info.java

```

* /netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/base64/Base64Decoder.java
* /netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/bytes/ByteArrayEncoder.java
*
/netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/protobuf/package-info.java
* /netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/marshalling/DefaultUnmarshallerProvider.java
* /netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/xml/package-info.java
* /netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/compression/ZlibDecoder.java
* /netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/compression/CompressionException.java
* /netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/base64/Base64Encoder.java
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* /netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/ByteToMessageDecoder.java
* /netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/DecoderException.java
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* /netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/serialization/SoftReferenceMap.java
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* /netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/MessageToMessageCodec.java
* /netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/bytes/package-info.java
* /netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/MessageToByteEncoder.java
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* /netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/serialization/CompactObjectOutputStream.java
* /netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/ReplayingDecoderByteBuf.java
* /netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/DecoderResult.java
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* /netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/compression/JZlibEncoder.java
*
/netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/compression/package-info.java
* /netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/FixedLengthFrameDecoder.java
* /netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/string/package-info.java
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* /netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/compression/SnappyFrameDecoder.java
* /netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/compression/Snappy.java
* /netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/marshalling/CompatibleMarshallingEncoder.java
* /netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/marshalling/ThreadLocalMarshallerProvider.java
* /netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/marshalling/ChannelBufferByteInput.java
* /netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/serialization/CompatibleObjectEncoder.java
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* /netty-codec-4-1-51-final-sources-jar/io/netty/handler/codec/DecoderResultProvider.java
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*/
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* <p>
* The internal lookup tables in this class has been derived from
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*/
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 * Utility class for { @link ByteBuf} that encodes and decodes to and from
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1.155 acl 2.2.53-6

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*/netty-transport-native-epoll-4-1-51-final-sources-jar/netty_epoll_linuxsocket.c
*/netty-transport-native-epoll-4-1-51-final-sources-jar/netty_epoll_linuxsocket.h
*/netty-transport-native-epoll-4-1-51-final-sources-jar/io/netty/channel/epoll/LinuxSocket.java
*/netty-transport-native-epoll-4-1-51-final-sources-
jar/io/netty/channel/epoll/NativeStaticallyReferencedJniMethods.java
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 * /netty-transport-native-epoll-4-1-51-final-sources-
 jar/io/netty/channel/epoll/EpollDomainSocketChannelConfig.java
 * /netty-transport-native-epoll-4-1-51-final-sources-jar/io/netty/channel/epoll/EpollChannelConfig.java
 *
 /netty-transport-native-epoll-4-1-51-final-sources-jar/io/netty/channel/epoll/EpollEventArray.java
 * /netty-transport-native-epoll-4-1-51-final-sources-
 jar/io/netty/channel/epoll/EpollServerDomainSocketChannel.java
 * /netty-transport-native-epoll-4-1-51-final-sources-jar/io/netty/channel/epoll/EpollMode.java
 * /netty-transport-native-epoll-4-1-51-final-sources-jar/io/netty/channel/epoll/TcpMd5Util.java
 * /netty-transport-native-epoll-4-1-51-final-sources-
 jar/io/netty/channel/epoll/EpollRecvByteAllocatorStreamingHandle.java
 * /netty-transport-native-epoll-4-1-51-final-sources-jar/io/netty/channel/epoll/AbstractEpollServerChannel.java
 * /netty-transport-native-epoll-4-1-51-final-sources-jar/io/netty/channel/epoll/EpollServerChannelConfig.java
 * /netty-transport-native-epoll-4-1-51-final-sources-jar/io/netty/channel/epoll/EpollRecvByteAllocatorHandle.java
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* /netty-transport-native-epoll-4-1-51-final-sources-jar/io/netty/channel/epoll/EpollDatagramChannel.java
* /netty-transport-native-epoll-4-1-51-final-sources-jar/io/netty/channel/epoll/Epoll.java
*
/netty-transport-native-epoll-4-1-51-final-sources-jar/io/netty/channel/epoll/package-info.java
* /netty-transport-native-epoll-4-1-51-final-sources-jar/io/netty/channel/epoll/EpollServerSocketChannel.java
* /netty-transport-native-epoll-4-1-51-final-sources-jar/io/netty/channel/epoll/EpollEventLoop.java
* /netty-transport-native-epoll-4-1-51-final-sources-jar/io/netty/channel/epoll/EpollEventLoopGroup.java
* /netty-transport-native-epoll-4-1-51-final-sources-jar/io/netty/channel/epoll/EpollChannelOption.java
* /netty-transport-native-epoll-4-1-51-final-sources-jar/io/netty/channel/epoll/AbstractEpollChannel.java
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```

Found in path(s):

```

* /netty-transport-native-epoll-4-1-51-final-sources-jar/io/netty/channel/epoll/Native.java
* /netty-transport-native-epoll-4-1-51-final-sources-jar/netty_epoll_native.c

```

1.158 netty-transport-native-unix-common

4.1.51.Final

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```

Found in path(s):

```

* /netty-transport-native-unix-common-4-1-51-final-sources-jar/io/netty/channel/unix/PeerCredentials.java
* /netty-transport-native-unix-common-4-1-51-final-sources-
jar/io/netty/channel/unix/SocketWritableByteChannel.java
* /netty-transport-native-unix-common-4-1-51-final-sources-jar/netty_unix_util.c
*
* /netty-transport-native-unix-common-4-1-51-final-sources-jar/netty_unix_limits.h
* /netty-transport-native-unix-common-4-1-51-final-sources-jar/netty_unix_util.h
* /netty-transport-native-unix-common-4-1-51-final-sources-
jar/io/netty/channel/unix/ErrorsStaticallyReferencedJniMethods.java
* /netty-transport-native-unix-common-4-1-51-final-sources-jar/netty_unix_limits.c
* /netty-transport-native-unix-common-4-1-51-final-sources-jar/io/netty/channel/unix/Limits.java
* /netty-transport-native-unix-common-4-1-51-final-sources-
jar/io/netty/channel/unix/LimitsStaticallyReferencedJniMethods.java
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```

Found in path(s):

```

* /netty-transport-native-unix-common-4-1-51-final-sources-
jar/io/netty/channel/unix/PreferredDirectByteBufAllocator.java
* /netty-transport-native-unix-common-4-1-51-final-sources-jar/io/netty/channel/unix/Buffer.java
* /netty-transport-native-unix-common-4-1-51-final-sources-jar/netty_unix_buffer.c
*

```

/netty-transport-native-unix-common-4-1-51-final-sources-jar/netty_unix_buffer.h

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* /netty-transport-native-unix-common-4-1-51-final-sources-jar/io/netty/channel/unix/DomainSocketChannel.java

* /netty-transport-native-unix-common-4-1-51-final-sources-

jar/io/netty/channel/unix/ServerDomainSocketChannel.java

* /netty-transport-native-unix-common-4-1-51-final-sources-jar/netty_unix_socket.c

*

/netty-transport-native-unix-common-4-1-51-final-sources-jar/io/netty/channel/unix/DomainSocketAddress.java

* /netty-transport-native-unix-common-4-1-51-final-sources-jar/io/netty/channel/unix/DatagramSocketAddress.java

* /netty-transport-native-unix-common-4-1-51-final-sources-jar/netty_unix_filedescriptor.h

* /netty-transport-native-unix-common-4-1-51-final-sources-jar/netty_unix_filedescriptor.c

* /netty-transport-native-unix-common-4-1-51-final-sources-jar/io/netty/channel/unix/NativeInetAddress.java

* /netty-transport-native-unix-common-4-1-51-final-sources-

jar/io/netty/channel/unix/DomainSocketChannelConfig.java

* /netty-transport-native-unix-common-4-1-51-final-sources-jar/netty_unix_socket.h

* /netty-transport-native-unix-common-4-1-51-final-sources-jar/netty_unix_errors.h

* /netty-transport-native-unix-common-4-1-51-final-sources-jar/io/netty/channel/unix/Socket.java

* /netty-transport-native-unix-common-4-1-51-final-sources-jar/netty_unix_errors.c

*

/netty-transport-native-unix-common-4-1-51-final-sources-jar/io/netty/channel/unix/FileDescriptor.java

* /netty-transport-native-unix-common-4-1-51-final-sources-

jar/io/netty/channel/unix/DomainSocketReadMode.java

* /netty-transport-native-unix-common-4-1-51-final-sources-jar/io/netty/channel/unix/Errors.java

* /netty-transport-native-unix-common-4-1-51-final-sources-jar/io/netty/channel/unix/UnixChannel.java

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- * /netty-transport-native-unix-common-4-1-51-final-sources-jar/io/netty/channel/unix/IovArray.java
- * /netty-transport-native-unix-common-4-1-51-final-sources-jar/io/netty/channel/unix/UnixChannelOption.java
- * /netty-transport-native-unix-common-4-1-51-final-sources-jar/io/netty/channel/unix/package-info.java

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- * /netty-transport-native-unix-common-4-1-51-final-sources-jar/META-INF/maven/io.netty/netty-transport-native-unix-common/pom.xml

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- * /netty-transport-native-unix-common-4-1-51-final-sources-jar/netty_unix_jni.h
- * /netty-transport-native-unix-common-4-1-51-final-sources-jar/io/netty/channel/unix/UnixChannelUtil.java

1.159 jackson-annotations 2.11.2

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1.160 ffmpeg 4.3.1

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- libpostproc
- optional x86 optimization in the files
 - `libavcodec/x86/flac_dsp_gpl.asm`
 - `libavcodec/x86/idct_mmx.c`
 - `libavfilter/x86/vf_removegrain.asm`
- the following building and testing tools
 - `compat/solaris/make_sunver.pl`

- `doc/t2h.pm`
- `doc/txi2pod.pl`
- `libswresample/tests/swresample.c`
- `tests/checkasm/*`
- `tests/tiny_ssim.c`

the following filters in libavfilter:

- `signature_lookup.c`
- `vf_blackframe.c`
- `vf_boxblur.c`
- `vf_colormatrix.c`
- `vf_cover_rect.c`
- `vf_cropdetect.c`
- `vf_delogo.c`
- `vf_eq.c`
- `vf_find_rect.c`
- `vf_fspp.c`
- `vf_histeq.c`
- `vf_hqdn3d.c`
- `vf_kerndeint.c`
- `vf_lensfun.c` (GPL version 3 or later)
- `vf_mcdeint.c`
- `vf_mpdecimate.c`
- `vf_nnedi.c`
- `vf_owdenoise.c`
- `vf_perspective.c`
- `vf_phase.c`
- `vf_pp.c`
- `vf_pp7.c`
- `vf_pullup.c`
- `vf_repeatfields.c`
- `vf_sab.c`
- `vf_signature.c`
- `vf_smartblur.c`
- `vf_spp.c`
- `vf_stereo3d.c`
- `vf_super2xsai.c`
- `vf_tinterlace.c`
- `vf_uspp.c`
- `vf_vaguedenoiser.c`
- `vsrc_mptestsrc.c`

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There are a handful of files under other licensing terms, namely:

- * The files `libavcodec/jfdctfst.c`, `libavcodec/jfdctint_template.c` and `libavcodec/jrevdct.c` are taken from libjpeg, see the top of the files for licensing details. Specifically note that you must credit the IJG in the documentation accompanying your program if you only distribute executables. You must also indicate any changes including additions and deletions to those three files in the documentation.
- * `tests/reference.pnm` is under the expat license.

External libraries

FFmpeg can be combined with a number of external libraries, which sometimes affect the licensing of binaries resulting from the combination.

Compatible libraries

The following libraries are under GPL version 2:

- avisynth
- frei0r
- libcdio
- libdavs2
- librubberband
- libvidstab
- libx264
- libx265
- libxavs
- libxavs2
- libxvid

When combining them with FFmpeg, FFmpeg needs to be licensed as GPL as well by passing `--enable-gpl` to configure.

The following libraries are under LGPL version 3:

- gmp
- libaribb24
- liblensfun

When combining them with FFmpeg, use the configure option `--enable-version3` to upgrade FFmpeg to the LGPL v3.

The VMAF, mbedTLS, RK MPI, OpenCORE and VisualOn libraries are under the Apache License 2.0. That license is incompatible with the LGPL v2.1 and the GPL v2, but not with version 3 of those licenses. So to combine these libraries with FFmpeg, the license version needs to be upgraded by passing `--enable-version3` to configure.

The smbclient library is under the GPL v3, to combine it with FFmpeg, the options `--enable-gpl` and `--enable-version3` have to be passed to configure to upgrade FFmpeg to the GPL v3.

Incompatible libraries

There are certain libraries you can combine with FFmpeg whose licenses are not compatible with the GPL and/or the LGPL. If you wish to enable these libraries, even in circumstances that their license may be incompatible, pass `--enable-nonfree` to configure. This will cause the resulting binary to be unredistributable.

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Version 3, 29 June 2007

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1.161 netty-handler-proxy 4.1.51.Final

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* /netty-handler-proxy-4-1-51-final-sources-jar/io/netty/handler/proxy/ProxyHandler.java

- * /netty-handler-proxy-4-1-51-final-sources-jar/io/netty/handler/proxy/package-info.java
- * /netty-handler-proxy-4-1-51-final-sources-jar/io/netty/handler/proxy/Socks4ProxyHandler.java
- *
- /netty-handler-proxy-4-1-51-final-sources-jar/io/netty/handler/proxy/ProxyConnectionEvent.java
- * /netty-handler-proxy-4-1-51-final-sources-jar/io/netty/handler/proxy/Socks5ProxyHandler.java
- * /netty-handler-proxy-4-1-51-final-sources-jar/io/netty/handler/proxy/ProxyConnectException.java

1.162 netty-codec-socks 4.1.51.Final

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- * /netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socksx/v5/DefaultSocks5PasswordAuthResponse.java
- *
- /netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socks/UnknownSocksRequest.java
- * /netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socksx/v5/DefaultSocks5InitialResponse.java
- * /netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socksx/v4/Socks4CommandRequest.java
- * /netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socksx/v5/DefaultSocks5CommandResponse.java
- * /netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socksx/v4/Socks4CommandResponse.java
- * /netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socks/SocksMessage.java
- * /netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socksx/v5/DefaultSocks5PasswordAuthRequest.java
- * /netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socks/SocksInitResponseDecoder.java
- * /netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socks/SocksCmdRequestDecoder.java
- *

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/netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socksx/v5/Socks5InitialRequest.java
* /netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socksx/v5/Socks5PasswordAuthResponse.java
* /netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socksx/v4/Socks4ClientDecoder.java
* /netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socks/SocksAuthRequest.java
* /netty-codec-socks-4-1-51-final-sources-
jar/io/netty/handler/codec/socksx/v4/DefaultSocks4CommandResponse.java
* /netty-codec-socks-4-1-51-final-sources-
jar/io/netty/handler/codec/socksx/v5/DefaultSocks5CommandRequest.java
* /netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socks/SocksResponse.java
* /netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socks/UnknownSocksResponse.java
* /netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socks/SocksCommonUtils.java
* /netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socksx/v5/Socks5CommandRequest.java
*
/netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socksx/v4/Socks4CommandType.java
* /netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socks/SocksCmdResponse.java
* /netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socks/SocksAuthResponse.java
* /netty-codec-socks-4-1-51-final-sources-
jar/io/netty/handler/codec/socksx/v4/DefaultSocks4CommandRequest.java
* /netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socks/SocksInitResponse.java
* /netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socks/SocksInitRequest.java
* /netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socks/SocksCmdResponseDecoder.java
* /netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socksx/v5/Socks5PasswordAuthRequest.java
* /netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socksx/v5/Socks5CommandResponse.java
* /netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socksx/v5/Socks5InitialResponse.java
*
/netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socksx/v5/package-info.java
* /netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socks/SocksRequest.java
* /netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socks/SocksAuthRequestDecoder.java
* /netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socks/SocksCmdRequest.java
* /netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socks/SocksAuthResponseDecoder.java
* /netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socksx/SocksMessage.java
* /netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socksx/v5/DefaultSocks5InitialRequest.java
* /netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socks/SocksMessageEncoder.java
* /netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socksx/v4/Socks4CommandStatus.java
* /netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socks/package-info.java
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* /netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socksx/v5/Socks5CommandResponseDecoder.java
*
* /netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socksx/v4/Socks4Message.java
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* /netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socksx/AbstractSocksMessage.java
* /netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socksx/v5/AbstractSocks5Message.java
* /netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socksx/v5/Socks5PasswordAuthRequestDecoder.java
* /netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socksx/package-info.java
* /netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socksx/v5/Socks5InitialResponseDecoder.java
* /netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socksx/v4/AbstractSocks4Message.java
* /netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socksx/v5/Socks5PasswordAuthResponseDecoder.java
*
* /netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socksx/v4/Socks4ServerEncoder.java
* /netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socksx/v5/Socks5ClientEncoder.java

* /netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socksx/v5/Socks5CommandRequestDecoder.java
* /netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socksx/v5/Socks5ServerEncoder.java
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* /netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socks/SocksAuthScheme.java
* /netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socks/SocksCmdStatus.java
*
/netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socks/SocksRequestType.java
* /netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socks/SocksCmdType.java

- * /netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socks/SocksResponseType.java
- * /netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socks/SocksMessageType.java
- * /netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socks/SocksAddressType.java
- * /netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socks/SocksAuthStatus.java
- * /netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socksx/v5/Socks5AuthMethod.java
- * /netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socksx/v5/Socks5CommandStatus.java
- * /netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socks/SocksProtocolVersion.java
- * /netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socksx/v5/Socks5CommandType.java
- *
- /netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socksx/v5/Socks5AddressType.java
- * /netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socksx/SocksVersion.java
- * /netty-codec-socks-4-1-51-final-sources-jar/io/netty/handler/codec/socksx/v5/Socks5PasswordAuthStatus.java

1.163 jackson-datatype-jdk8 2.11.2

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1.164 jackson-datatype-jsr310 2.11.2

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1.165 jackson-module-parameter-names

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- * /spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/server/authorization/AuthorizationWebFilter.java
- * /spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/server/util/matcher/AndServerWebExchangeMatcher.java
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- * /spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/server/csrf/WebSessionServerCsrfTokenRepository.java
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- * /spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/server/DelegatingServerAuthenticationEntryPoint.java
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* /spring-security-web-5-3-4-release-sources-

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* /spring-security-web-5-3-4-release-sources-
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* /spring-security-web-5-3-4-release-sources-
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/spring-security-web-5-3-4-release-sources-
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a
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jar/org/springframework/security/web/server/ServerAuthenticationEntryPoint.java
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*
/spring-security-web-5-3-4-release-sources-
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* /spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/csrf/DefaultCsrfToken.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/authentication/session/AbstractSessionFixationProtectionStrategy.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/authentication/session/ChangeSessionIdAuthenticationStrategy.java
* /spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/csrf/CsrfException.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/csrf/MissingCsrfTokenException.java
*
/spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/bind/support/AuthenticationPrincipalArgumentResolver.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/servlet/support/csrf/CsrfRequestDataValueProcessor.java
* /spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/csrf/CsrfFilter.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/context/AbstractSecurityWebApplicationInitializer.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/authentication/session/SessionFixationProtectionStrategy.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/authentication/session/CompositeSessionAuthenticationStrategy.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/header/writers/XContentTypeOptionsHeaderWriter.java
*
/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/csrf/CsrfTokenRepository.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/method/annotation/AuthenticationPrincipalArgumentResolver.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/bind/annotation/AuthenticationPrincipal.java
```

* /spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/csrf/CsrfToken.java
* /spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/header/HeaderWriter.java
* /spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/authentication/session/SessionFixationProtectionEvent.java
* /spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/method/annotation/CsrfTokenArgumentResolver.java
* /spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/header/writers/DelegatingRequestMatcherHeaderWriter.java
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* /spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/jaasapi/JaasApiIntegrationFilter.java
* /spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/authentication/DelegatingAuthenticationEntryPoint.java
* /spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/util/matcher/ELRequestMatcher.java
*
* /spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/util/matcher/RequestMatcherEditor.java
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jar/org/springframework/security/web/util/matcher/RequestHeaderRequestMatcher.java
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jar/org/springframework/security/web/util/matcher/RequestVariablesExtractor.java
* /spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/firewall/StrictHttpFirewall.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/servlet/util/matcher/MvcRequestMatcher.java
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jar/org/springframework/security/web/util/matcher/ELRequestMatcherContext.java

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* /spring-security-web-5-3-4-release-sources-

jar/org/springframework/security/web/server/header/ReferrerPolicyServerHttpHeadersWriter.java

* /spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/http/SecurityHeaders.java

* /spring-security-web-5-3-4-release-sources-

jar/org/springframework/security/web/server/authentication/logout/HttpStatusReturningServerLogoutSuccessHandle
r.java

*

/spring-security-web-5-3-4-release-sources-

jar/org/springframework/security/web/server/authentication/ServerAuthenticationConverter.java

* /spring-security-web-5-3-4-release-sources-

jar/org/springframework/security/web/server/DefaultServerRedirectStrategy.java

* /spring-security-web-5-3-4-release-sources-

jar/org/springframework/security/web/server/util/matcher/PathPatternParserServerWebExchangeMatcher.java

* /spring-security-web-5-3-4-release-sources-

jar/org/springframework/security/web/server/authentication/HttpStatusServerEntryPoint.java

* /spring-security-web-5-3-4-release-sources-

jar/org/springframework/security/web/reactive/result/method/annotation/AuthenticationPrincipalArgumentResolver.
java

* /spring-security-web-5-3-4-release-sources-

jar/org/springframework/security/web/server/authorization/ServerWebExchangeDelegatingServerAccessDeniedHan
dler.java

* /spring-security-web-5-3-4-release-sources-

jar/org/springframework/security/web/server/ServerHttpBasicAuthenticationConverter.java

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*
/spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/authentication/logout/ForwardLogoutSuccessHandler.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/context/request/async/SecurityContextCallableProcessingInterceptor.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/server/authentication/ServerFormLoginAuthenticationConverter.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/server/authentication/DelegatingServerAuthenticationSuccessHandler.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/server/context/WebSessionServerSecurityContextRepository.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/authentication/ui/DefaultLogoutPageGeneratingFilter.java
*
/spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/authentication/SimpleUrlAuthenticationFailureHandler.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/server/header/ContentSecurityPolicyServerHttpHeadersWriter.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/reactive/result/view/CsrfRequestDataValueProcessor.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/authentication/ForwardAuthenticationFailureHandler.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/server/csrf/CsrfServerLogoutHandler.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/server/header/FeaturePolicyServerHttpHeadersWriter.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/server/header/XXssProtectionServerHttpHeadersWriter.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/firewall/FirewalledResponse.java
*
/spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/authentication/ui/DefaultLoginPageGeneratingFilter.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/authentication/ExceptionMappingAuthenticationFailureHandler.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/authentication/ForwardAuthenticationSuccessHandler.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/server/authentication/ServerX509AuthenticationConverter.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/server/util/matcher/NegatedServerWebExchangeMatcher.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/header/writers/CacheControlHeadersWriter.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/authentication/preauth/AbstractPreAuthenticatedProcessingFilter.java
*
/spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/server/header/StaticServerHttpHeadersWriter.java

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* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/access/RequestMatcherDelegatingAccessDeniedHandler.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/server/authentication/AnonymousAuthenticationWebFilter.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/server/MatcherSecurityWebFilterChain.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/server/authentication/logout/DelegatingServerLogoutHandler.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/server/authentication/ServerHttpBasicAuthenticationConverter.java
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jar/org/springframework/security/web/header/writers/ContentSecurityPolicyHeaderWriter.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/server/transport/HttpsRedirectWebFilter.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/authentication/AbstractAuthenticationTargetUrlRequestHandler.java
*
/spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/session/ConcurrentSessionFilter.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/authentication/AuthenticationFilter.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/server/authentication/ReactivePreAuthenticatedAuthenticationManager.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/access/intercept/RequestKey.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/header/writers/ReferrerPolicyHeaderWriter.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/server/header/ClearSiteDataServerHttpHeadersWriter.java

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* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/reactive/result/method/annotation/CurrentSecurityContextArgumentResolver.
java
*
/spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/util/matcher/IpAddressMatcher.java
* /spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/header/HeaderWriterFilter.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/util/matcher/MediaTypeRequestMatcher.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/authentication/AuthenticationEntryPointFailureHandler.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/authentication/session/ConcurrentSessionControlAuthenticationStrategy.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/method/annotation/CurrentSecurityContextArgumentResolver.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/authentication/logout/LogoutSuccessEventPublishingLogoutHandler.java
*
/spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/header/writers/frameoptions/XFrameOptionsHeaderWriter.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/header/writers/FeaturePolicyHeaderWriter.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/server/authentication/logout/HeaderWriterServerLogoutHandler.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/header/writers/HstsHeaderWriter.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/authentication/www/BasicAuthenticationConverter.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/server/csrf/CookieServerCsrfTokenRepository.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/authentication/AuthenticationConverter.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/util/matcher/AntPathRequestMatcher.java
*
/spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/header/writers/StaticHeadersWriter.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/authentication/logout/CookieClearingLogoutHandler.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/header/writers/HpkpHeaderWriter.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/header/writers/XXssProtectionHeaderWriter.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/header/writers/ClearSiteDataHeaderWriter.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/header/writers/CompositeHeaderWriter.java
* /spring-security-web-5-3-4-release-sources-

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```
jar/org/springframework/security/web/authentication/logout/HeaderWriterLogoutHandler.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/access/expression/ExpressionBasedFilterInvocationSecurityMetadataSource.j
ava
*
/spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/util/matcher/RequestMatcher.java
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jar/org/springframework/security/web/authentication/logout/LogoutHandler.java
* /spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/savedrequest/Enumerator.java
* /spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/util/UrlUtils.java
*
/spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/access/DefaultWebInvocationPrivilegeEvaluator.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/savedrequest/FastDateFormat.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/authentication/rememberme/TokenBasedRememberMeServices.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/session/HttpSessionEventPublisher.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/access/AccessDeniedHandlerImpl.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/savedrequest/SavedRequestAwareWrapper.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/access/channel/ChannelProcessingFilter.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/access/channel/RetryWithHttpEntryPoint.java
*
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/spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/authentication/WebAuthenticationDetails.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/authentication/switchuser/SwitchUserFilter.java
* /spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/PortMapperImpl.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/authentication/www/DigestAuthenticationEntryPoint.java
* /spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/PortResolver.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/authentication/RememberMeServices.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/savedrequest/SimpleSavedRequest.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/authentication/switchuser/AuthenticationSwitchUserEvent.java
*
/spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/authentication/UsernamePasswordAuthenticationFilter.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/authentication/WebAuthenticationDetailsSource.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/authentication/LoginUrlAuthenticationEntryPoint.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/authentication/logout/SecurityContextLogoutHandler.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/access/channel/ChannelDecisionManagerImpl.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/access/intercept/FilterSecurityInterceptor.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/access/channel/ChannelEntryPoint.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/access/AccessDeniedHandler.java
*
/spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/authentication/www/BasicAuthenticationFilter.java
* /spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/AuthenticationEntryPoint.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/access/WebInvocationPrivilegeEvaluator.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/access/intercept/FilterInvocationSecurityMetadataSource.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/access/channel/SecureChannelProcessor.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/authentication/NullRememberMeServices.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/access/intercept/DefaultFilterInvocationSecurityMetadataSource.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/authentication/AnonymousAuthenticationFilter.java
*

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/spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/authentication/www/NonceExpiredException.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/access/channel/ChannelDecisionManager.java
* /spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/PortResolverImpl.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/authentication/www/BasicAuthenticationEntryPoint.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/authentication/AbstractAuthenticationProcessingFilter.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/access/channel/RetryWithHttpsEntryPoint.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/savedrequest/DefaultSavedRequest.java
*
/spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/session/HttpSessionCreatedEvent.java
* /spring-security-web-5-3-4-release-sources-
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* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/session/HttpSessionDestroyedEvent.java
* /spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/PortMapper.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/servletapi/SecurityContextHolderAwareRequestWrapper.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/access/channel/InsecureChannelProcessor.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/authentication/switchuser/SwitchUserGrantedAuthority.java
* /spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/FilterChainProxy.java
* /spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/FilterInvocation.java
*
/spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/access/channel/ChannelProcessor.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/authentication/logout/LogoutFilter.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/authentication/rememberme/RememberMeAuthenticationFilter.java

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*/

Found in path(s):

* /spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/server/jackson2/DefaultCsrfServerTokenMixin.java

* /spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/jackson2/PreAuthenticatedAuthenticationTokenDeserializer.java

* /spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/server/jackson2/WebServerJackson2Module.java

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*/

Found in path(s):

* /spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/access/ExceptionTranslationFilter.java

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Found in path(s):

* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/server/authentication/AuthenticationWebFilter.java
* /spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/server/csrf/CsrfWebFilter.java
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* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/authentication/www/DigestAuthenticationFilter.java
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Found in path(s):

```

* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/jackson2/DefaultCsrfTokenMixin.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/jackson2/DefaultSavedRequestMixin.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/session/SessionInformationExpiredStrategy.java
*
/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/jackson2/CookieDeserializer.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/jackson2/WebAuthenticationDetailsMixin.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/jackson2/SavedCookieMixin.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/jackson2/WebServletJackson2Module.java
* /spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/jackson2/CookieMixin.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/jackson2/PreAuthenticatedAuthenticationTokenMixin.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/jackson2/WebJackson2Module.java
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```

Found in path(s):

```

* /spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/savedrequest/package-info.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/access/expression/WebExpressionConfigAttribute.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/authentication/logout/SimpleUrlLogoutSuccessHandler.java
*
/spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/authentication/rememberme/CookieTheftException.java
* /spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/authentication/package-
info.java

```

```

* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/authentication/SimpleUrlAuthenticationSuccessHandler.java
* /spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/package-info.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/authentication/session/SessionAuthenticationException.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/savedrequest/SavedRequest.java
* /spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/savedrequest/SavedCookie.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/authentication/preauth/websphere/package-info.java
*
/spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/authentication/AuthenticationSuccessHandler.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/context/SecurityContextPersistenceFilter.java
* /spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/util/TextEscapeUtils.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/savedrequest/HttpSessionRequestCache.java
* /spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/access/intercept/package-
info.java
* /spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/debug/DebugFilter.java
* /spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/RedirectStrategy.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/context/HttpRequestResponseHolder.java
*
/spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/authentication/SavedRequestAwareAuthenticationSuccessHandler.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/access/expression/WebSecurityExpressionRoot.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/servletapi/HttpServletRequestFactory.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/context/SecurityContextRepository.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/util/matcher/AndRequestMatcher.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/util/matcher/OrRequestMatcher.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/authentication/switchuser/package-info.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/authentication/session/SessionAuthenticationStrategy.java
*
/spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/authentication/Http403ForbiddenEntryPoint.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/authentication/preauth/j2ee/J2eeBasedPreAuthenticatedWebAuthenticationD
etailsSource.java
* /spring-security-web-5-3-4-release-sources-

```

```

jar/org/springframework/security/web/session/SessionManagementFilter.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/authentication/rememberme/PersistentTokenRepository.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/authentication/HttpStatusEntryPoint.java
* /spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/servletapi/package-info.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/authentication/preauth/PreAuthenticatedAuthenticationToken.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/authentication/rememberme/InMemoryTokenRepositoryImpl.java
*
/spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/authentication/preauth/PreAuthenticatedGrantedAuthoritiesUserDetailsService.java
* /spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/jackson2/package-info.java
* /spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/WebAttributes.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/authentication/preauth/websphere/WASUsernameAndGroupsExtractor.java
* /spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/DefaultRedirectStrategy.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/header/writers/frameoptions/AbstractRequestParameterAllowFromStrategy.java
va
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/util/matcher/NegatedRequestMatcher.java
*
/spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/authentication/preauth/j2ee/WebXmlMappableAttributesRetriever.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/authentication/session/NullAuthenticatedSessionStrategy.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/authentication/preauth/PreAuthenticatedAuthenticationProvider.java
* /spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/authentication/logout/package-
info.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/authentication/www/DigestAuthUtils.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/firewall/RequestRejectedException.java
* /spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/util/package-info.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/authentication/logout/LogoutSuccessHandler.java
*
/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/firewall/FirewalledRequest.java
* /spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/authentication/ui/package-
info.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/context/HttpSessionSecurityContextRepository.java
* /spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/authentication/session/package-
info.java

```

```

* /spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/access/package-info.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/authentication/preauth/j2ee/J2eePreAuthenticatedProcessingFilter.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/authentication/rememberme/package-info.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/access/expression/DefaultWebSecurityExpressionHandler.java
*
/spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/authentication/preauth/x509/SubjectDnX509PrincipalExtractor.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/util/OnCommittedResponseWrapper.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/authentication/session/RegisterSessionAuthenticationStrategy.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/authentication/switchuser/SwitchUserAuthorityChanger.java
* /spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/SecurityFilterChain.java
* /spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/util/RedirectUrlBuilder.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/authentication/preauth/websphere/DefaultWASUsernameAndGroupsExtractor.java
*
/spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/authentication/logout/CompositeLogoutHandler.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/savedrequest/RequestCacheAwareFilter.java
* /spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/util/ThrowableAnalyzer.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/authentication/preauth/PreAuthenticatedCredentialsNotFoundException.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/authentication/preauth/x509/X509AuthenticationFilter.java
* /spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/header/Header.java
* /spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/session/package-info.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/header/writers/frameoptions/WhiteListedAllowFromStrategy.java
*
/spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/authentication/AuthenticationFailureHandler.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/context/SaveContextOnUpdateOrErrorResponseWrapper.java
* /spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/DefaultSecurityFilterChain.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/session/SimpleRedirectSessionInformationExpiredStrategy.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/authentication/rememberme/PersistentRememberMeToken.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/util/matcher/RegexRequestMatcher.java
* /spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/firewall/HttpFirewall.java

```

```

* /spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/access/channel/package-
info.java
*
/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/firewall/DefaultHttpFirewall.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/authentication/preauth/j2ee/package-info.java
* /spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/firewall/RequestWrapper.java
* /spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/authentication/preauth/package-
info.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/savedrequest/RequestCache.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/authentication/preauth/websphere/WebSpherePreAuthenticatedWebAuthentic
ationDetailsSource.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/servletapi/HttpServletRequest3RequestFactory.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/util/ThrowableCauseExtractor.java
*
/spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/authentication/preauth/RequestHeaderAuthenticationFilter.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/authentication/preauth/x509/X509PrincipalExtractor.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/context/NullSecurityContextRepository.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/authentication/rememberme/InvalidCookieException.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/savedrequest/NullRequestCache.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/session/SimpleRedirectInvalidSessionStrategy.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/header/writers/frameoptions/StaticAllowFromStrategy.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/context/request/async/WebAsyncManagerIntegrationFilter.java
*
/spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/authentication/logout/HttpStatusReturningLogoutSuccessHandler.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/authentication/preauth/PreAuthenticatedGrantedAuthoritiesWebAuthenticatio
nDetails.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/authentication/preauth/RequestAttributeAuthenticationFilter.java
* /spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/debug/Logger.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/header/writers/frameoptions/RegExpAllowFromStrategy.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/authentication/logout/DelegatingLogoutSuccessHandler.java

```

```

* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/authentication/preauth/websphere/WebSpherePreAuthenticatedProcessingFilter.java
*
/spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/header/writers/frameoptions/AllowFromStrategy.java
* /spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/access/expression/package-info.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/authentication/preauth/x509/package-info.java
* /spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/jaasapi/package-info.java
* /spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/authentication/www/package-info.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/session/InvalidSessionStrategy.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/access/channel/AbstractRetryEntryPoint.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/authentication/rememberme/RememberMeAuthenticationException.java
*
/spring-security-web-5-3-4-release-sources-jar/org/springframework/security/web/context/package-info.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/access/expression/WebExpressionVoter.java
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```

Found in path(s):

```

* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/access/expression/DelegatingEvaluationContext.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/session/SessionInformationExpiredEvent.java
* /spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/csrf/CookieCsrfTokenRepository.java

```


*
/spring-security-web-5-3-4-release-sources-
jar/org/springframework/security/web/csrf/LazyCsrfTokenRepository.java

1.168 spring-security-core 5.3.4.RELEASE

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 * limitations under the License.
 */
/**
 * Base64 encoder which is a reduced version of Robert Harder's public domain
 * implementation (version 2.3.7). See <a
 * href="http://iharder.sourceforge.net/current/java/base64/">http://iharder.sourceforge.net/current/java/base64/</a>
 * for more information.
 * <p>
 * For internal use only.
 *
 * @author
 * Luke Taylor
 * @since 3.0
 * @deprecated Use java.util.Base64
 */
```

Found in path(s):

* /spring-security-core-5-3-4-release-sources-jar/org/springframework/security/crypto/codec/Base64.java
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Found in path(s):

- * /spring-security-core-5-3-4-release-sources-
- jar/org/springframework/security/core/parameters/AnnotationParameterNameDiscoverer.java
- * /spring-security-core-5-3-4-release-sources-
- jar/org/springframework/security/core/annotation/AuthenticationPrincipal.java

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Found in path(s):

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 * limitations under the License.
 */

/**
 * Reviews the <code>Object</code> returned from a secure object invocation, being able to
 * modify the <code>Object</code> or throw an { @link AccessDeniedException }.
 *
 * <p>
 * Typically used to ensure the principal is permitted to access the domain object
 * instance returned by a service layer bean.
 */
```

Can also be used to mutate the domain object

- * instance so the principal is only able to access authorised bean properties or
- * `Collection` elements.
- *
- * Special consideration should be given to using an `AfterInvocationManager`
- * on bean methods that modify a database. Typically an
- * `AfterInvocationManager` is used with read-only methods, such as
- * `public DomainObject getById(id)`. If used with methods that modify a
- * database, a transaction manager should be used to ensure any
- * `AccessDeniedException` will cause a rollback of the changes made by the
- * transaction.
- *
- *
- * @author Ben Alex
- */

Found in path(s):

- * /spring-security-core-5-3-4-release-sources-
- jar/org/springframework/security/access/intercept/AfterInvocationManager.java
- No license file was found, but licenses were detected in source scan.

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Found in path(s):

- * /spring-security-core-5-3-4-release-sources-
- jar/org/springframework/security/crypto/scrypt/SCryptPasswordEncoder.java
- * /spring-security-core-5-3-4-release-sources-jar/org/springframework/security/converter/RsaKeyConverters.java
- * /spring-security-core-5-3-4-release-sources-
- jar/org/springframework/security/core/userdetails/UserDetailsPasswordService.java
- *
- /spring-security-core-5-3-4-release-sources-
- jar/org/springframework/security/crypto/argon2/Argon2PasswordEncoder.java
- * /spring-security-core-5-3-4-release-sources-
- jar/org/springframework/security/authentication/ReactiveAuthenticationManagerResolver.java

```

* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/authentication/AbstractUserDetailsReactiveAuthenticationManager.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/crypto/argon2/Argon2EncodingUtils.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/core/token/SecureRandomFactoryBean.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/access/expression/method/ExpressionBasedPreInvocationAdvice.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/authentication/event/LogoutSuccessEvent.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/authentication/UserDetailsRepositoryReactiveAuthenticationManager.java
*
/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/core/annotation/CurrentSecurityContext.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/access/hierarchicalroles/RoleHierarchyImpl.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/authentication/ReactiveAuthenticationManagerAdapter.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/authentication/AuthenticationManagerResolver.java
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Found in path(s):

```

* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/crypto/password/PasswordEncoder.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/crypto/keygen/SecureRandomBytesKeyGenerator.java
* /spring-security-core-5-3-4-release-sources-jar/org/springframework/security/crypto/util/EncodingUtils.java
*
/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/crypto/encrypt/HexEncodingTextEncryptor.java

```

```

* /spring-security-core-5-3-4-release-sources-jar/org/springframework/security/crypto/encrypt/TextEncryptor.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/crypto/keygen/HexEncodingStringKeyGenerator.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/crypto/password/StandardPasswordEncoder.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/crypto/password/NoOpPasswordEncoder.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/crypto/encrypt/BouncyCastleAesCbcBytesEncryptor.java
* /spring-security-core-5-3-4-release-sources-jar/org/springframework/security/crypto/encrypt/CipherUtils.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/crypto/keygen/SharedKeyGenerator.java
*
/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/crypto/encrypt/BouncyCastleAesBytesEncryptor.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/crypto/keygen/StringKeyGenerator.java
* /spring-security-core-5-3-4-release-sources-jar/org/springframework/security/crypto/keygen/KeyGenerators.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/crypto/encrypt/AesBytesEncryptor.java
* /spring-security-core-5-3-4-release-sources-jar/org/springframework/security/crypto/encrypt/BytesEncryptor.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/crypto/encrypt/BouncyCastleAesGcmBytesEncryptor.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/crypto/keygen/BytesKeyGenerator.java
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Found in path(s):
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/jackson2/SecurityJackson2Modules.java
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Found in path(s):

```

* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/access/expression/method/PreInvocationExpressionAttribute.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/access/method/AbstractFallbackMethodSecurityMetadataSource.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/core/authority/SimpleGrantedAuthority.java
*
/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/authentication/jaas/event/package-
info.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/access/expression/method/MethodSecurityExpressionRoot.java
* /spring-security-core-5-3-4-release-sources-jar/org/springframework/security/access/method/P.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/access/expression/SecurityExpressionRoot.java
* /spring-security-core-5-3-4-release-sources-jar/org/springframework/security/access/package-info.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/authentication/InternalAuthenticationServiceException.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/access/prepost/PostInvocationAttribute.java
* /spring-security-core-5-3-4-release-sources-jar/org/springframework/security/access/prepost/PostFilter.java
*
/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/access/intercept/package-info.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/access/prepost/PreInvocationAuthorizationAdviceVoter.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/core/authority/mapping/GrantedAuthoritiesMapper.java
* /spring-security-core-5-3-4-release-sources-jar/org/springframework/security/authentication/jaas/package-
info.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/access/intercept/aspectj/AspectJMethodSecurityInterceptor.java
* /spring-security-core-5-3-4-release-sources-

```

jar/org/springframework/security/access/annotation/AnnotationMetadataExtractor.java
 * /spring-security-core-5-3-4-release-sources-
 jar/org/springframework/security/authentication/AccountStatusException.java
 * /spring-security-core-5-3-4-release-sources-jar/org/springframework/security/provisioning/MutableUser.java
 *
 /spring-security-core-5-3-4-release-sources-
 jar/org/springframework/security/core/session/SessionDestroyedEvent.java
 * /spring-security-core-5-3-4-release-sources-
 jar/org/springframework/security/concurrent/DelegatingSecurityContextScheduledExecutorService.java
 * /spring-security-core-5-3-4-release-sources-
 jar/org/springframework/security/access/intercept/aspectj/MethodInvocationAdapter.java
 * /spring-security-core-5-3-4-release-sources-jar/org/springframework/security/jackson2/package-info.java
 * /spring-security-core-5-3-4-release-sources-
 jar/org/springframework/security/core/authority/mapping/MappableAttributesRetriever.java
 * /spring-security-core-5-3-4-release-sources-
 jar/org/springframework/security/access/expression/method/MethodSecurityExpressionOperations.java
 * /spring-security-core-5-3-4-release-sources-
 jar/org/springframework/security/access/expression/method/AbstractExpressionBasedMethodConfigAttribute.java
 *
 /spring-security-core-5-3-4-release-sources-
 jar/org/springframework/security/core/authority/mapping/MapBasedAttributes2GrantedAuthoritiesMapper.java
 * /spring-security-core-5-3-4-release-sources-jar/org/springframework/security/core/context/package-info.java
 * /spring-security-core-5-3-4-release-sources-
 jar/org/springframework/security/provisioning/UserDetailsManager.java
 * /spring-security-core-5-3-4-release-sources-jar/org/springframework/security/access/prepost/PostAuthorize.java
 * /spring-security-core-5-3-4-release-sources-
 jar/org/springframework/security/core/authority/GrantedAuthoritiesContainer.java
 * /spring-security-core-5-3-4-release-sources-jar/org/springframework/security/core/authority/package-info.java
 * /spring-security-core-5-3-4-release-sources-
 jar/org/springframework/security/core/authority/mapping/SimpleMappableAttributesRetriever.java
 * /spring-security-core-5-3-4-release-sources-
 jar/org/springframework/security/core/authority/mapping/NullAuthoritiesMapper.java
 *
 /spring-security-core-5-3-4-release-sources-
 jar/org/springframework/security/context/DelegatingApplicationListener.java
 * /spring-security-core-5-3-4-release-sources-jar/org/springframework/security/core/authority/AuthorityUtils.java
 * /spring-security-core-5-3-4-release-sources-jar/org/springframework/security/core/session/package-info.java
 * /spring-security-core-5-3-4-release-sources-
 jar/org/springframework/security/access/expression/ExpressionUtils.java
 * /spring-security-core-5-3-4-release-sources-
 jar/org/springframework/security/access/vote/RoleHierarchyVoter.java
 * /spring-security-core-5-3-4-release-sources-jar/org/springframework/security/access/prepost/PreFilter.java
 * /spring-security-core-5-3-4-release-sources-
 jar/org/springframework/security/core/userdetails/UserDetailsByNameServiceWrapper.java
 * /spring-security-core-5-3-4-release-sources-
 jar/org/springframework/security/access/prepost/PrePostInvocationAttributeFactory.java
 * /spring-security-core-5-3-4-release-sources-
 jar/org/springframework/security/concurrent/DelegatingSecurityContextExecutor.java

```

*
/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/core/authority/mapping/SimpleAttributes2GrantedAuthoritiesMapper.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/core/userdetails/UserDetailsChecker.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/task/DelegatingSecurityContextAsyncTaskExecutor.java
* /spring-security-core-5-3-4-release-sources-jar/org/springframework/security/crypto/codec/Utf8.java
* /spring-security-core-5-3-4-release-sources-jar/org/springframework/security/access/event/package-info.java
* /spring-security-core-5-3-4-release-sources-jar/org/springframework/security/core/userdetails/jdbc/package-
info.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/access/prepost/PrePostAnnotationSecurityMetadataSource.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/access/PermissionCacheOptimizer.java
*
/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/concurrent/AbstractDelegatingSecurityContextSupport.java
* /spring-security-core-5-3-4-release-sources-jar/org/springframework/security/access/vote/package-info.java
* /spring-security-core-5-3-4-release-sources-jar/org/springframework/security/core/package-info.java
* /spring-security-core-5-3-4-release-sources-jar/org/springframework/security/provisioning/package-info.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/crypto/password/AbstractPasswordEncoder.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/access/prepost/PostInvocationAdviceProvider.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/access/prepost/PreInvocationAuthorizationAdvice.java
* /spring-security-core-5-3-4-release-sources-jar/org/springframework/security/provisioning/GroupManager.java
*
/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/util/package-info.java
* /spring-security-core-5-3-4-release-sources-jar/org/springframework/security/core/userdetails/cache/package-
info.java
* /spring-security-core-5-3-4-release-sources-jar/org/springframework/security/core/userdetails/package-info.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/access/expression/SecurityExpressionHandler.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/core/userdetails/cache/SpringCacheBasedUserCache.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/task/DelegatingSecurityContextTaskExecutor.java
* /spring-security-core-5-3-4-release-sources-jar/org/springframework/security/access/expression/method/package-
info.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/access/expression/DenyAllPermissionEvaluator.java
*
/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/access/method/DelegatingMethodSecurityMetadataSource.java
* /spring-security-core-5-3-4-release-sources-jar/org/springframework/security/core/token/Sha512DigestUtils.java
* /spring-security-core-5-3-4-release-sources-

```


jar/org/springframework/security/core/session/SessionCreationEvent.java
 * /spring-security-core-5-3-4-release-sources-jar/org/springframework/security/access/annotation/package-info.java
 * /spring-security-core-5-3-4-release-sources-jar/org/springframework/security/authentication/rcp/package-info.java
 * /spring-security-core-5-3-4-release-sources-jar/org/springframework/security/access/hierarchicalroles/package-info.java
 * /spring-security-core-5-3-4-release-sources-jar/org/springframework/security/provisioning/InMemoryUserDetailsManager.java
 * /spring-security-core-5-3-4-release-sources-jar/org/springframework/security/core/userdetails/AuthenticationUserDetailsService.java
 * /spring-security-core-5-3-4-release-sources-jar/org/springframework/security/core/userdetails/memory/package-info.java
 *
 /spring-security-core-5-3-4-release-sources-jar/org/springframework/security/access/hierarchicalroles/RoleHierarchyAuthoritiesMapper.java
 * /spring-security-core-5-3-4-release-sources-jar/org/springframework/security/core/authority/mapping/Attributes2GrantedAuthoritiesMapper.java
 * /spring-security-core-5-3-4-release-sources-jar/org/springframework/security/scheduling/DelegatingSecurityContextSchedulingTaskExecutor.java
 * /spring-security-core-5-3-4-release-sources-jar/org/springframework/security/access/annotation/method/ExpressionBasedAnnotationAttributeFactory.java
 * /spring-security-core-5-3-4-release-sources-jar/org/springframework/security/crypto/codec/Hex.java
 * /spring-security-core-5-3-4-release-sources-jar/org/springframework/security/access/hierarchicalroles/CycleInRoleHierarchyException.java
 * /spring-security-core-5-3-4-release-sources-jar/org/springframework/security/core/CredentialsContainer.java
 *
 /spring-security-core-5-3-4-release-sources-jar/org/springframework/security/authentication/AccountStatusUserDetailsChecker.java
 * /spring-security-core-5-3-4-release-sources-jar/org/springframework/security/core/token/DefaultToken.java
 * /spring-security-core-5-3-4-release-sources-jar/org/springframework/security/access/intercept/aspectj/package-info.java
 * /spring-security-core-5-3-4-release-sources-jar/org/springframework/security/access/method/package-info.java
 * /spring-security-core-5-3-4-release-sources-jar/org/springframework/security/authentication/package-info.java
 * /spring-security-core-5-3-4-release-sources-jar/org/springframework/security/access/prepost/PreAuthorize.java
 * /spring-security-core-5-3-4-release-sources-jar/org/springframework/security/authentication/jaas/memory/package-info.java
 * /spring-security-core-5-3-4-release-sources-jar/org/springframework/security/core/parameters/DefaultSecurityParameterNameDiscoverer.java
 *
 /spring-security-core-5-3-4-release-sources-jar/org/springframework/security/access/annotation/AbstractSecurityExpressionHandler.java
 * /spring-security-core-5-3-4-release-sources-jar/org/springframework/security/authentication/dao/package-info.java
 * /spring-security-core-5-3-4-release-sources-jar/org/springframework/security/access/prepost/PostInvocationAuthorizationAdvice.java
 * /spring-security-core-5-3-4-release-sources-jar/org/springframework/security/authentication/AuthenticationEventPublisher.java
 * /spring-security-core-5-3-4-release-sources-jar/org/springframework/security/crypto/codec/package-info.java
 * /spring-security-core-5-3-4-release-sources-jar/org/springframework/security/core/authority/mapping/SimpleAuthorityMapper.java

```

* /spring-security-core-5-3-4-release-sources-jar/org/springframework/security/access/annotation/package-info.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/access/annotation/method/PostInvocationExpressionAttribute.java
*
/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/access/annotation/Js250Voter.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/concurrent/DelegatingSecurityContextExecutorService.java
* /spring-security-core-5-3-4-release-sources-jar/org/springframework/security/core/token/package-info.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/provisioning/MutableUserDetails.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/access/annotation/Js250SecurityConfig.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/access/annotation/aopalliance/package-info.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/access/hierarchicalroles/RoleHierarchy.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/access/hierarchicalroles/NullRoleHierarchy.java
* /spring-security-core-5-3-4-release-sources-jar/org/springframework/security/core/authority/mapping/package-
info.java
*
/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/access/annotation/method/MethodSecurityExpressionHandler.java
* /spring-security-core-5-3-4-release-sources-jar/org/springframework/security/authentication/event/package-
info.java
* /spring-security-core-5-3-4-release-sources-jar/org/springframework/security/access/prepost/package-info.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/access/prepost/PreInvocationAttribute.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/access/annotation/method/ExpressionBasedPostInvocationAdvice.java
* /spring-security-core-5-3-4-release-sources-jar/org/springframework/security/core/token/TokenService.java
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```

```

/**
 * A token issued by { @link TokenService}.
 *
 * <p>
 * It is important that the keys assigned to tokens are sufficiently randomised and
 * secured that they can serve as identifying a unique user session. Implementations of
 * { @link TokenService} are free to use encryption or encoding strategies of their
 * choice.
 * It is strongly recommended that keys are of sufficient length to balance safety against
 * persistence cost. In relation to persistence cost, it is strongly recommended that
 * returned keys are small enough for encoding in a cookie.
 * </p>
 *
 * @author Ben Alex
 * @since 2.0.1
 */

```

Found in path(s):

* /spring-security-core-5-3-4-release-sources-jar/org/springframework/security/core/token/Token.java

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 */

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Found in path(s):

- * /spring-security-core-5-3-4-release-sources-jar/org/springframework/security/access/AccessDecisionVoter.java

- * /spring-security-core-5-3-4-release-sources-

- jar/org/springframework/security/access/intercept/MethodInvocationPrivilegeEvaluator.java

- * /spring-security-core-5-3-4-release-sources-jar/org/springframework/security/util/FieldUtils.java

*

- /spring-security-core-5-3-4-release-sources-jar/org/springframework/security/core/session/SessionRegistry.java

- * /spring-security-core-5-3-4-release-sources-

- jar/org/springframework/security/authentication/AnonymousAuthenticationProvider.java

- * /spring-security-core-5-3-4-release-sources-

- jar/org/springframework/security/authentication/event/AuthenticationFailureServiceExceptionEvent.java

- * /spring-security-core-5-3-4-release-sources-jar/org/springframework/security/access/annotation/Secured.java

- * /spring-security-core-5-3-4-release-sources-

- jar/org/springframework/security/authentication/event/AbstractAuthenticationFailureEvent.java

- * /spring-security-core-5-3-4-release-sources-

- jar/org/springframework/security/authentication/rcp/RemoteAuthenticationManager.java

- * /spring-security-core-5-3-4-release-sources-

- jar/org/springframework/security/authentication/AuthenticationTrustResolver.java

- * /spring-security-core-5-3-4-release-sources-

- jar/org/springframework/security/access/intercept/AfterInvocationProviderManager.java

```

*
/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/authentication/jaas/JaasGrantedAuthority.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/access/event/PublicInvocationEvent.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/access/event/AbstractAuthorizationEvent.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/authentication/AuthenticationServiceException.java
* /spring-security-core-5-3-4-release-sources-jar/org/springframework/security/access/vote/AuthenticatedVoter.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/access/intercept/aopalliance/MethodSecurityInterceptor.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/authentication/LockedException.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/core/userdetails/UserDetailsService.java
*
/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/authentication/event/AuthenticationFailureCredentialsExpiredEvent.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/authentication/event/AuthenticationFailureProviderNotFoundEvent.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/authentication/TestingAuthenticationToken.java
* /spring-security-core-5-3-4-release-sources-jar/org/springframework/security/access/vote/UnanimousBased.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/authentication/RememberMeAuthenticationProvider.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/core/SpringSecurityMessageSource.java
* /spring-security-core-5-3-4-release-sources-jar/org/springframework/security/access/SecurityConfig.java
* /spring-security-core-5-3-4-release-sources-jar/org/springframework/security/access/vote/ConsensusBased.java
*
/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/access/AfterInvocationProvider.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/authentication/rcp/RemoteAuthenticationManagerImpl.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/authentication/event/AbstractAuthenticationEvent.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/access/intercept/NullRunAsManager.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/access/vote/AbstractAccessDecisionManager.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/access/intercept/InterceptorStatusToken.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/authentication/event/LoggerListener.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/core/context/InheritableThreadLocalSecurityContextHolderStrategy.java
*

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/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/core/session/SessionRegistryImpl.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/authentication/event/InteractiveAuthenticationSuccessEvent.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/access/intercept/AbstractSecurityInterceptor.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/access/event/AuthenticationCredentialsNotFoundEvent.java
* /spring-security-core-5-3-4-release-sources-jar/org/springframework/security/access/event/AuthorizedEvent.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/authentication/TestingAuthenticationProvider.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/authentication/jaas/AuthorityGranter.java
* /spring-security-core-5-3-4-release-sources-jar/org/springframework/security/access/ConfigAttribute.java
*
/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/core/userdetails/UsernameNotFoundException.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/authentication/event/AuthenticationFailureProxyUntrustedEvent.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/access/intercept/RunAsManagerImpl.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/authentication/event/AuthenticationFailureExpiredEvent.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/authentication/jaas/DefaultLoginExceptionResolver.java
* /spring-security-core-5-3-4-release-sources-jar/org/springframework/security/core/context/SecurityContext.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/authentication/rcp/RemoteAuthenticationException.java
*
/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/authentication/jaas/JaasNameCallbackHandler.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/access/AuthorizationServiceException.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/core/userdetails/memory/UserAttributeEditor.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/access/annotation/SecuredAnnotationSecurityMetadataSource.java
* /spring-security-core-5-3-4-release-sources-jar/org/springframework/security/core/GrantedAuthority.java
* /spring-security-core-5-3-4-release-sources-jar/org/springframework/security/core/Authentication.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/authentication/event/AuthenticationFailureBadCredentialsEvent.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/authentication/jaas/event/JaasAuthenticationFailedEvent.java
*
/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/core/context/SecurityContextImpl.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/access/method/MethodSecurityMetadataSource.java

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* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/access/intercept/RunAsUserToken.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/authentication/dao/DaoAuthenticationProvider.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/core/userdetails/jdbc/JdbcDaoImpl.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/core/context/SecurityContextHolderStrategy.java
* /spring-security-core-5-3-4-release-sources-jar/org/springframework/security/core/userdetails/UserCache.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/authentication/AuthenticationProvider.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/authentication/event/AuthenticationFailureLockedEvent.java
*
/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/authentication/AuthenticationCredentialsNotFoundException.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/authentication/jaas/JaasAuthenticationProvider.java
* /spring-security-core-5-3-4-release-sources-jar/org/springframework/security/access/vote/AbstractAclVoter.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/core/userdetails/cache/EhCacheBasedUserCache.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/access/annotation/JsR250MethodSecurityMetadataSource.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/authentication/jaas/event/JaasAuthenticationEvent.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/authentication/rcp/RemoteAuthenticationProvider.java
*
/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/util/MethodInvocationUtils.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/access/intercept/RunAsImplAuthenticationProvider.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/core/context/GlobalSecurityContextHolderStrategy.java
* /spring-security-core-5-3-4-release-sources-jar/org/springframework/security/util/InMemoryResource.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/core/context/SecurityContextHolder.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/authentication/event/AuthenticationSuccessEvent.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/authentication/jaas/SecurityContextLoginModule.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/authentication/CredentialsExpiredException.java
*
/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/authentication/AccountExpiredException.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/core/session/SessionInformation.java
* /spring-security-core-5-3-4-release-sources-jar/org/springframework/security/access/event/LoggerListener.java

```

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* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/access/intercept/aopalliance/MethodSecurityMetadataSourceAdvisor.java
* /spring-security-core-5-3-4-release-sources-jar/org/springframework/security/access/AccessDeniedException.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/core/userdetails/memory/UserAttribute.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/authentication/event/AuthenticationFailureDisabledEvent.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/access/method/MapBasedMethodSecurityMetadataSource.java
*
/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/authentication/DisabledException.java
* /spring-security-core-5-3-4-release-sources-jar/org/springframework/security/core/userdetails/UserDetails.java
* /spring-security-core-5-3-4-release-sources-jar/org/springframework/security/util/SimpleMethodInvocation.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/authentication/InsufficientAuthenticationException.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/authentication/AuthenticationManager.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/authentication/jaas/event/JaasAuthenticationSuccessEvent.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/authentication/jaas/JaasAuthenticationCallbackHandler.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/authentication/jaas/JaasAuthenticationToken.java
*
/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/authentication/ProviderNotFoundException.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/authentication/UsernamePasswordAuthenticationToken.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/authentication/AuthenticationTrustResolverImpl.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/authentication/AnonymousAuthenticationToken.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/access/intercept/aspectj/AspectJCallback.java
* /spring-security-core-5-3-4-release-sources-jar/org/springframework/security/core/userdetails/User.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/authentication/BadCredentialsException.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/access/event/AuthorizationFailureEvent.java
*
/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/core/AuthenticationException.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/core/context/ThreadLocalSecurityContextHolderStrategy.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/authentication/AuthenticationDetailsSource.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/core/userdetails/cache/NullUserCache.java

```



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* /spring-security-core-5-3-4-release-sources-jar/org/springframework/security/access/vote/AffirmativeBased.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/access/method/AbstractMethodSecurityMetadataSource.java
* /spring-security-core-5-3-4-release-sources-jar/org/springframework/security/access/AccessDecisionManager.java
* /spring-security-core-5-3-4-release-sources-jar/org/springframework/security/access/SecurityMetadataSource.java
*
/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/authentication/AbstractAuthenticationToken.java
* /spring-security-core-5-3-4-release-sources-jar/org/springframework/security/access/vote/RoleVoter.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/authentication/dao/AbstractUserDetailsAuthenticationProvider.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/authentication/RememberMeAuthenticationToken.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/authentication/jaas/JaasPasswordCallbackHandler.java
* /spring-security-core-5-3-4-release-sources-jar/org/springframework/security/access/intercept/RunAsManager.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/authentication/jaas/LoginExceptionResolver.java
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* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/authentication/DefaultAuthenticationEventPublisher.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/access/evaluation/method/MethodSecurityEvaluationContext.java
* /spring-security-core-5-3-4-release-sources-jar/org/springframework/security/authentication/ProviderManager.java
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- * /spring-security-core-5-3-4-release-sources-jar/org/springframework/security/crypto/password/Digester.java

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- * /spring-security-core-5-3-4-release-sources-jar/org/springframework/security/core/context/ReactiveSecurityContextHolder.java
- * /spring-security-core-5-3-4-release-sources-jar/org/springframework/security/authorization/AuthorizationDecision.java
- * /spring-security-core-5-3-4-release-sources-jar/org/springframework/security/crypto/password/PasswordEncoderUtils.java
- *
- /* /spring-security-core-5-3-4-release-sources-jar/org/springframework/security/authentication/ReactiveAuthenticationManager.java
- * /spring-security-core-5-3-4-release-sources-jar/org/springframework/security/core/userdetails/ReactiveUserDetailsService.java
- * /spring-security-core-5-3-4-release-sources-jar/org/springframework/security/authorization/AuthenticatedReactiveAuthorizationManager.java
- * /spring-security-core-5-3-4-release-sources-jar/org/springframework/security/crypto/password/Md4.java
- * /spring-security-core-5-3-4-release-sources-

```

jar/org/springframework/security/crypto/factory/PasswordEncoderFactories.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/core/SpringSecurityCoreVersion.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/authorization/ReactiveAuthorizationManager.java
* /spring-security-core-5-3-4-release-sources-jar/org/springframework/security/core/AuthenticatedPrincipal.java
*
/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/core/parameters/P.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/core/userdetails/MapReactiveUserDetailsService.java
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* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/authentication/jaas/DefaultJaasAuthenticationProvider.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/authentication/jaas/AbstractJaasAuthenticationProvider.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/authentication/jaas/memory/InMemoryConfiguration.java
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* /spring-security-core-5-3-4-release-sources-jar/org/springframework/security/jackson2/UsernamePasswordAuthenticationTokenDeserializer.java
* /spring-security-core-5-3-4-release-sources-jar/org/springframework/security/jackson2/UserDeserializer.java
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* /spring-security-core-5-3-4-release-sources-jar/org/springframework/security/crypto/keygen/Base64StringKeyGenerator.java
* /spring-security-core-5-3-4-release-sources-jar/org/springframework/security/authentication/DelegatingReactiveAuthenticationManager.java
* /spring-security-core-5-3-4-release-sources-jar/org/springframework/security/core/Transient.java
*
* /spring-security-core-5-3-4-release-sources-jar/org/springframework/security/core/userdetails/ReactiveUserDetailsPasswordService.java
* /spring-security-core-5-3-4-release-sources-jar/org/springframework/security/crypto/password/MessageDigestPasswordEncoder.java
* /spring-security-core-5-3-4-release-sources-jar/org/springframework/security/scheduling/DelegatingSecurityContextTaskScheduler.java
* /spring-security-core-5-3-4-release-sources-jar/org/springframework/security/authorization/AuthorityReactiveAuthorizationManager.java
* /spring-security-core-5-3-4-release-sources-jar/org/springframework/security/jackson2/UnmodifiableListDeserializer.java
* /spring-security-core-5-3-4-release-sources-jar/org/springframework/security/provisioning/JdbcUserDetailsManager.java
* /spring-security-core-5-3-4-release-sources-jar/org/springframework/security/access/expression/method/DefaultMethodSecurityExpressionHandler.java

```

* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/core/token/KeyBasedPersistenceTokenService.java
*
/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/crypto/password/LdapShaPasswordEncoder.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/jackson2/UnmodifiableListMixin.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/concurrent/DelegatingSecurityContextCallable.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/concurrent/DelegatingSecurityContextRunnable.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/access/prepost/PrePostAdviceReactiveMethodInterceptor.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/authentication/CachingUserDetailsService.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/crypto/password/Md4PasswordEncoder.java
*
/spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/crypto/password/DelegatingPasswordEncoder.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/jackson2/BadCredentialsExceptionMixin.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/crypto/password/Pbkdf2PasswordEncoder.java
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*/
/**
 * Determines if the { @link #getAuthentication() } has permission to access the target
 * given the permission
 * @param target the target domain object to check permission on
 * @param permission the permission to check on the domain object (i.e. "read",
 * "write", etc).
 * @return true if permission
is granted to the { @link #getAuthentication() }, else
 * false
 */

```

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```

* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/access/expressions/SecurityExpressionOperations.java
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 */

```

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* /spring-security-core-5-3-4-release-sources-
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```
* /spring-security-core-5-3-4-release-sources-jar/org/springframework/security/jackson2/CoreJackson2Module.java
* /spring-security-core-5-3-4-release-sources-jar/org/springframework/security/jackson2/UserMixin.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/jackson2/UnmodifiableSetDeserializer.java
*
/spring-security-core-5-3-4-release-sources-jar/org/springframework/security/jackson2/UnmodifiableSetMixin.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/jackson2/RememberMeAuthenticationTokenMixin.java
```

```
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/jackson2/SimpleGrantedAuthorityMixin.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/jackson2/UsernamePasswordAuthenticationTokenMixin.java
* /spring-security-core-5-3-4-release-sources-
jar/org/springframework/security/jackson2/AnonymousAuthenticationTokenMixin.java
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 */
/**
 *
 * @param authentication represents the user in question. Should not be null.
 * @param targetDomainObject the domain object for which permissions should be
 * checked. May be null in which case implementations should return false, as the null
 * condition can be checked explicitly in the expression.
 *
 * @param permission a representation of the permission object as supplied by the
 * expression system. Not null.
 * @return true if the permission is granted, false otherwise
 */
```

Found in path(s):

```
* /spring-security-core-5-3-4-release-sources-jar/org/springframework/security/access/PermissionEvaluator.java
```

1.169 classgraph 4.8.69

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1.170 ical4j 3.0.19

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1.171 oniguruma 6.9.4-1

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* /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/logging/LoggingRegistryConfig.java
* /micrometer-core-1-5-4-sources-jar/io/micrometer/core/ipc/http/ReactorNettySender.java
* /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/logging/LoggingMeterRegistry.java
*
* /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/push/PushRegistryConfig.java
* /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/StrongReferenceGaugeFunction.java
* /micrometer-core-1-5-4-sources-jar/io/micrometer/core/ipc/http/HttpSender.java
* /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/binder/kafka/KafkaConsumerMetrics.java
* /micrometer-core-1-5-4-sources-jar/io/micrometer/core/ipc/http/HttpStatusClass.java
* /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/util/NamedThreadFactory.java
* /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/util/JsonUtils.java
* /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/push/PushMeterRegistry.java
* /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/MultiGauge.java
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* /micrometer-core-1-5-4-sources-jar/io/micrometer/core/util/internal/logging/Slf4JLogger.java

* /micrometer-core-1-5-4-sources-jar/io/micrometer/core/util/internal/logging/AbstractInternalLogger.java

* /micrometer-core-1-5-4-sources-jar/io/micrometer/core/util/internal/logging/InternalLoggerFactory.java

* /micrometer-core-1-5-4-sources-jar/io/micrometer/core/util/internal/logging/JdkLoggerFactory.java

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* /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/config/validate/Validated.java
*
* /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/binder/http/package-info.java
* /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/binder/httpcomponents/HttpContextUtils.java
* /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/binder/httpcomponents/MicrometerHttpClientInterceptor.java
* /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/config/validate/InvalidReason.java
* /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/config/validate/DurationValidator.java
* /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/binder/http/HttpServletRequestTagsProvider.java
* /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/config/validate/PropertyValidator.java
* /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/step/StepTuple2.java
* /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/binder/db/JooqExecuteListener.java
* /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/distribution/FixedBoundaryVictoriaMetricsHistogram.java
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* /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/binder/jetty/JettyClientTagsProvider.java
* /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/binder/jvm/JvmHeapPressureMetrics.java
* /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/config/validate/ValidationException.java
* /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/binder/db/MetricsDSLContext.java

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* /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/step/StepValue.java
* /micrometer-core-1-5-4-sources-
jar/io/micrometer/core/instrument/binder/http/DefaultHttpRequestTagsProvider.java
* /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/distribution/TimeWindowSum.java
* /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/binder/kafka/KafkaMetrics.java
* /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/binder/http/HttpRequestTags.java
*
/micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/binder/cache/HazelcastIMapAdapter.java
* /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/binder/jetty/JettySslHandshakeMetrics.java
* /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/binder/httpcomponents/DefaultUriMapper.java
* /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/binder/http/Outcome.java
* /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/binder/jpa/HibernateQueryMetrics.java
* /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/config/MeterRegistryConfigValidator.java
* /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/binder/jetty/JettyClientMetrics.java
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Found in path(s):

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* /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/binder/kafka/KafkaClientMetrics.java
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- * /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/binder/jetty/OnCompletionAsyncListener.java
 - * /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/Timer.java
 - * /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/internal/TimedScheduledExecutorService.java
 - * /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/binder/jetty/InstrumentedQueuedThreadPool.java
 - *
 - /micrometer-core-1-5-4-sources-jar/io/micrometer/core/util/internal/logging/WarnThenDebugLogger.java
 - * /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/binder/jetty/TimedHandler.java
 - * /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/internal/TimedCallable.java
 - * /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/binder/mongodb/MongoMetricsCommandListener.java
 - * /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/binder/jvm/JvmMemory.java
 - * /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/internal/TimedRunnable.java
 - * /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/binder/mongodb/MongoMetricsConnectionPoolListener.java
 - * /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/binder/jetty/JettyServerThreadPoolMetrics.java
 - * /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/binder/jetty/JettyConnectionMetrics.java
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- * /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/distribution/NoopHistogram.java
- * /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/MockClock.java
- * /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/binder/cache/CacheMeterBinder.java
- * /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/binder/hystrix/HystrixMetricsBinder.java
- *
- /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/step/StepMeterRegistry.java
- * /micrometer-core-1-5-4-sources-jar/io/micrometer/core/lang/NonNullApi.java

- * /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/distribution/TimeWindowMax.java
- * /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/binder/cache/CaffeineCacheMetrics.java
- * /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/binder/cache/package-info.java
- * /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/simple/SimpleMeterRegistry.java
- * /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/TimeGauge.java
- * /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/util/MeterEquivalence.java
- * /micrometer-core-1-5-4-sources-
- jar/io/micrometer/core/instrument/config/MissingRequiredConfigurationException.java
- * /micrometer-core-1-5-4-sources-jar/io/micrometer/core/annotation/Timed.java
- *
- /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/Measurement.java
- * /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/distribution/pause/NoPauseDetector.java
- * /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/binder/db/DatabaseTableMetrics.java
- * /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/binder/logging/Log4j2Metrics.java
- * /micrometer-core-1-5-4-sources-jar/io/micrometer/core/aop/CountedAspect.java
- * /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/util/StringEscapeUtils.java
- * /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/search/RequiredSearch.java
- * /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/dropwizard/package-info.java
- * /micrometer-core-1-5-4-sources-
- jar/io/micrometer/core/instrument/binder/okhttp3/OkHttpMetricsEventListener.java
- * /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/ImmutableTag.java
- * /micrometer-core-1-5-4-sources-jar/io/micrometer/core/annotation/TimedSet.java
- *
- /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/step/StepLong.java
- * /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/LongTaskTimer.java
- * /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/noop/NoopCounter.java
- * /micrometer-core-1-5-4-sources-
- jar/io/micrometer/core/instrument/dropwizard/DropwizardDistributionSummary.java
- * /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/dropwizard/DropwizardFunctionCounter.java
- * /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/binder/BaseUnits.java
- * /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/util/MeterPartition.java
- * /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/step/StepFunctionCounter.java
- * /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/noop/NoopLongTaskTimer.java
- * /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/composite/CompositeLongTaskTimer.java
- *
- /micrometer-core-1-5-4-sources-
- jar/io/micrometer/core/instrument/binder/hystrix/MicrometerMetricsPublisherCommand.java
- * /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/DistributionSummary.java
- * /micrometer-core-1-5-4-sources-jar/io/micrometer/core/aop/TimedAspect.java
- * /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/distribution/pause/PauseDetector.java
- * /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/binder/cache/EhCache2Metrics.java
- * /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/step/package-info.java
- * /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/internal/Mergeable.java
- * /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/binder/system/FileDescriptorMetrics.java
- * /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/package-info.java
- * /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/Tags.java
- * /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/Statistic.java
- *

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/micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/dropwizard/DropwizardMeterRegistry.java
* /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/MeterRegistry.java
* /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/Metrics.java
* /micrometer-core-1-5-4-sources-
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* /micrometer-core-1-5-4-sources-jar/io/micrometer/core/lang/Nullable.java
* /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/binder/jvm/DiskSpaceMetrics.java
* /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/composite/CompositeGauge.java
* /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/push/package-info.java
* /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/step/StepTimer.java
* /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/logging/package-info.java
* /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/dropwizard/DropwizardFunctionTimer.java
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/micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/util/TimeUtils.java
* /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/noop/NoopTimeGauge.java
* /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/simple/CountingMode.java
* /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/composite/CompositeMeterRegistry.java
* /micrometer-core-1-5-4-sources-
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* /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/step/StepRegistryConfig.java
* /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/Meter.java
* /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/config/package-info.java
* /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/composite/CompositeCustomMeter.java
* /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/composite/CompositeTimeGauge.java
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/micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/binder/jvm/JvmCompilationMetrics.java
* /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/cumulative/CumulativeFunctionCounter.java
* /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/config/MeterRegistryConfig.java
* /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/simple/SimpleConfig.java
* /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/config/InvalidConfigurationException.java
* /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/binder/jvm/JvmThreadMetrics.java
* /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/Clock.java
* /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/AbstractTimer.java
* /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/distribution/package-info.java
* /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/util/HierarchicalNameMapper.java
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* /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/internal/DefaultMeter.java
* /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/step/StepDouble.java
* /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/AbstractMeter.java
* /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/composite/AbstractCompositeMeter.java
* /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/search/MeterNotFoundException.java
* /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/binder/system/UptimeMetrics.java
* /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/distribution/HistogramGauges.java
* /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/cumulative/CumulativeCounter.java
* /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/binder/MeterBinder.java
* /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/util/IOUtils.java
*

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/micrometer-core-1-5-4-sources-
jar/io/micrometer/core/instrument/binder/hystrix/MicrometerMetricsPublisherThreadPool.java
* /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/binder/db/PostgreSQLDatabaseMetrics.java
* /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/noop/NoopDistributionSummary.java
* /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/config/MeterFilter.java
* /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/distribution/PercentileHistogramBuckets.java
* /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/step/StepMeasurement.java
* /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/binder/system/ProcessorMetrics.java
* /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/distribution/ValueAtPercentile.java
* /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/distribution/DistributionStatisticConfig.java
*
/micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/FunctionCounter.java
* /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/Gauge.java
* /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/distribution/Histogram.java
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* /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/distribution/CountAtBucket.java
* /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/util/DoubleFormat.java
* /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/internal/TimedExecutor.java
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* /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/util/StringUtils.java
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* /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/dropwizard/DropwizardTimer.java
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* /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/binder/tomcat/TomcatMetrics.java
* /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/composite/CompositeTimer.java
* /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/noop/NoopFunctionCounter.java
* /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/dropwizard/DropwizardConfig.java
* /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/distribution/HistogramSnapshot.java
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* /micrometer-core-1-5-4-sources-
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* /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/noop/NoopMeter.java
* /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/composite/CompositeFunctionCounter.java
* /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/cumulative/package-info.java
* /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/composite/CompositeCounter.java
* /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/dropwizard/DropwizardRate.java
* /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/search/Search.java
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/micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/FunctionTimer.java
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* /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/dropwizard/DropwizardGauge.java
* /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/binder/jvm/JvmGcMetrics.java
* /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/composite/package-info.java
* /micrometer-core-1-5-4-sources-jar/io/micrometer/core/lang/NonNullFields.java
* /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/Tag.java
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* /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/noop/package-info.java
* /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/util/AbstractPartition.java
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/micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/dropwizard/DropwizardClock.java
* /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/internal/package-info.java
* /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/AbstractDistributionSummary.java
* /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/internal/DefaultLongTaskTimer.java
* /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/search/package-info.java
* /micrometer-core-1-5-4-sources-
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* /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/binder/cache/HazelcastCacheMetrics.java
* /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/cumulative/CumulativeFunctionTimer.java
* /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/config/NamingConvention.java
* /micrometer-core-1-5-4-sources-jar/io/micrometer/core/lang/NonNull.java
*
/micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/binder/logging/LogbackMetrics.java
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* /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/binder/jvm/ClassLoaderMetrics.java
* /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/noop/NoopTimer.java
* /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/dropwizard/DropwizardCounter.java
* /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/binder/cache/GuavaCacheMetrics.java
* /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/step/StepFunctionTimer.java
* /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/binder/jvm/ExecutorServiceMetrics.java
* /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/internal/DefaultGauge.java
* /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/binder/jpa/HibernateMetrics.java
* /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/step/StepDistributionSummary.java
*
/micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/noop/NoopGauge.java
* /micrometer-core-1-5-4-sources-
jar/io/micrometer/core/instrument/distribution/TimeWindowFixedBoundaryHistogram.java
* /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/util/package-info.java
* /micrometer-core-1-5-4-sources-jar/io/micrometer/core/instrument/simple/package-info.java

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1.174 jaxb-core 2.3.3

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1.178 boost 1.71.0-6ubuntu6

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Aleksey Gurtovoy (agurtovoy@meta-comm.com)

Andrei Alexandrescu (andrewalex - at - hotmail.com) (See Boost list message of August 12, 2004 11:06:58 AM
EST)

Andrew Lumsdaine ()
Anthony Williams (anthony -at- justsoftwaresolutions.co.uk)
Beman Dawes (bdawes@acm.org)
Brad King (brad.king -at- kitware.com) (See Boost list message of Wed, 21 Jul 2004 11:15:46 -0400)
Brian Osman (osman -at- vvisions.com) (See CVS log)
Bruce Barr (schmoost -at- yahoo.com) (See Boost list of Mon, 16 Aug 2004 15:06:43 -0500)
Bruno da Silva de Oliveira (bruno - at - esss.com.br)
Christain Engstrom (christian.engstrom -at- glindra.org) (See Boost list message of Mon, 30 Aug 2004 14:31:49 +0200)
Cromwell D Enage (sponage -at- yahoo.com) (See Boost list message of August 12, 2004 11:49:13 AM EST)
Dan Gohman (djg
-at- cray.com) (See Boost list message of Sat, 21 Aug 2004 10:54:59 +0100)
Dan Nuffer (dan -at- nuffer.name)
Daniel Frey (d.frey -at- gmx.de, daniel.frey -at- aixigo.de)
Daniel Nuffer (dan -at- nuffer.name)
Darin Adler (darin -at- bentspoon.com) (Email to Andreas Huber, see change log)
Daryle Walker (darylew - at - hotmail.com)
Dave Abrahams (dave@boost-consulting.com)
Dave Moore (dmoore -at- viefinacial.com) (See Boost list message of 18 Dec 2003 15:35:50 -0500)
David Abrahams (dave@boost-consulting.com)
Dietmar Kuehl (dietmar_kuehl -at- yahoo.com) (Email to Andreas Huber, see change log)
Douglas Gregor (gregod -at- cs.rpi.edu, dgregor -at- cs.indiana.edu, doug.gregor -at- gmail.com)
Dr John Maddock (john - at - johnmaddock.co.uk)
Edward D. Brey (brey -at- ductape.net) (Email to Andreas Huber, see change log)
Eric Ford (un5o6n902 -at- sneakemail.com) (See Boost list message of Sun, 15 Aug 2004 10:29:13 +0100)
Eric Friedman (ebf@users.sourceforge.net)
Eric Niebler (eric@boost-consulting.com)
Fernando
Cacciola (fernando_cacciola@ciudad.com.ar)
Fernando Luis Cacciola Carballal (fernando_cacciola@ciudad.com.ar)
Francois Faure (Francois.Faure -at- imag.fr) (See CVS log)
Gary Powell (powellg - at - amazon.com) (See Boost list message of 10 Feb 2004 14:22:46 -0800)
Gennadiy Rozental (rogeeff -at- mail.com) (Email to Andreas Huber, see change log)
Gottfried Ganssauge (Gottfried.Ganssauge -at- HAUF.DE) (See Boost List message of Mon, 16 Aug 2004 10:09:19 +0200)
Gottfried Ganaue (Gottfried.Ganssauge -at- HAUF.DE) (Alternative spelling of Gottfried Ganssauge)
Greg Colvin (gregory.colvin -at- oracle.com) (See Boost list message of Sat, 14 Aug 2004 10:57:00 +0100)
Gregory Colvin (gregory.colvin -at- oracle.com) (See Boost list message of Sat, 14 Aug 2004 10:57:00 +0100)
Gunter Winkler (gunter.winkler -at- unbw-muenchen.de) (See Boost List message of Mon, 16 Aug 2004 10:24:17 +0200)
Hartmut Kaiser (hartmut.kaiser -at- gmail.com)
Herve Bronnimann (hbr -at- poly.edu)
Herv
Brnnimann (hbr -at- poly.edu)
Housemarque Oy (Ilari Kuittinen ilari.kuittinen -at- housemarque.fi)
Howard Hinnant (hinnant -at- twcnv.rr.com) (See Boost list message of July 25, 2004 3:44:49 PM EST)
Hubert Holin (hubert_holin -at- users.sourceforge.net)
Indiana University ()

Itay Maman (imaman -at- users.sourceforge.net)
Jaakko Jrv (jajarvi -at- osl.iu.edu)
Jaap Suter (j.suter -at- student.utwente.nl) (See Boost list message of Thu, 16 Sep 2004 09:32:43 -0700)
Jeff Garland (jeff - at - crystalclearsoftware.com) (see Boost list post of July 25, 2004 19:31:09 -0700)
Jens Maurer (Jens.Maurer@gmx.net)
Jeremy G Siek (jsiek@osl.iu.edu)
Jeremy Siek (jsiek@osl.iu.edu)
Joel de Guzman (joel -at- boost-consulting.com) (See Boost list message of July 25, 2004 8:32:00 PM EST)
John Bandela (jbandela-at-ufl.edu)
John Maddock (john - at - johnmaddock.co.uk)
John R Bandela (jbandela-at-ufl.edu)
Jonathan Turkanis (turkanis -at- coderage dot com)
Juergen Hunold (hunold -at- ive.uni-hannover.de) (See Boost
List Message of Fri, 13 Aug 2004 19:39:55 +0200)
Kevlin Henney (kevin -at- curbralan.com) (See Boost list message of Wed, 15 Sep 2004 18:15:17 +0200)
Kresimir Fresl (fresl -at- master.grad.hr) (See Boost List message of August 16, 2004 8:23:35 AM EST)
Lars Gullik Bjnnes (larsbj -at- lyx.org) (See Boost list message of Tue, 17 Aug 2004 15:49:02 +0100)
Lie-Quan Lee (liequan - at - slac.stanford.edu, llee - at - cs.indiana.edu)
Maarten Keijzer (mkeijzer -at- cs.vu.nl) (See Boost list message of Wed, 18 Aug 2004 21:43:18 +0100)
Mac Murrett (mmurrett -at- mac.com)
Marc Wintermantel (wintermantel -at- imes.mavt.ethz.ch, wintermantel -at- even-ag.ch) (See CVS log)
Michael Glassford (glassfordm - at - hotmail.com)
Michael Stevens (Michael.Stevens - at - epost.de)
Multi Media Ltd. (pdimov@mmltd.net)
Nicolai M Josuttis (solutions -at- josuttis.com) (See Boost list message of Mon, 30 Aug 2004 10:52:00 +0100)
Nikolay Mladenov (nickm -at- sitius.com) (See Boost list message of Tue, 17 Aug 2004
15:45:33 +0100)
Paul Mensonides (pmenso57 -at- comcast.net) (See Boost list message of July 21, 2004 1:12:21 AM EST)
Pavol Droba (droba -at- topmail.sk)
Peter Dimov (pdimov@mmltd.net)
R W Grosse-Kunstleve (RWGrosse-Kunstleve@lbl.gov)
Ralf W. Grosse-Kunstleve (RWGrosse-Kunstleve@lbl.gov)
Rational Discovery LLC (Greg Landrum Landrum -at- RationalDiscovery.com) (See Boost list post of Tue, 17 Aug
2004 10:35:36 +0100)
Rene Rivera (grafik/redshift-software.com, rrivera/acm.org)
Robert Ramey (ramey@www.rrsd.com)
Roland Richter (roland -at- flil.jku.at) (See Boost list post of Mon, 16 Aug 2004 22:16:55 +0200)
Roland Schwarz (roland.schwarz -at- chello.at)
Ronald Garcia (garcia -at- cs.indiana.edu) (Email to Andreas Huber, see change log)
Samuel Krempp (krempp -at- crans.ens-cachan.fr) (See Boost list message of Mon, 27 Sep 2004 13:18:36 +0200)
Stefan Seefeld (seefeld -at- sympatico.ca)
Stephen Cleary (scleary -at- jerviswebb.com) (See Boost list message of Tue, 28 Sep 2004 13:11:46 +0100)
Steve
Cleary (Variant of Stephen Cleary)
Sylvain Pion (Sylvain.Pion - at - sophia.inria.fr)
The Trustees of Indiana University ()
Thomas Witt (witt - at - ive.uni-hannover.de, witt - at - acm.org, witt - at - styleadvisor.com)
Thorsten Jrgen Ottosen (nesotto - at - cs.auc.dk)

Thorsten Ottosen (nesotto - at - cs.auc.dk)

Toon Knapen (toon dot knapen - at - fft.be)

Trustees of Indiana University ()

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Vladimir Prus (ghost@cs.msu.su)

William E. Kempf () (email to Beman Dawes, 9/14/2006 4:18 PM)

Joerg Walter (jhr.walter - at - t-online.de : email to ublas mailing list Mon, 17 Sep 2007 10:17:08 +0200)

Mathias Koch (mkoch - at - idesis.de 7 : email to boost-owner@lists.boost.org Sep 2007 13:20:09 +0200)

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1.179 fdisk 1.1.0

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```
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1.180 flyway-core 6.4.4

1.180.1 Available under license :

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```

*/

Found in path(s):

- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/resource/filesystem/package-info.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/oracle/OracleDatabase.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/util/TimeFormat.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/resolver/CompositeMigrationResolver.java
- *
- /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/firebird/FirebirdDatabase.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/mysql/MySQLParser.java
- * /flyway-core-6-4-4-sources-
- jar/org/flywaydb/core/internal/jdbc/CockroachRetryingTransactionalExecutionTemplate.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/sqlite/SQLiteParser.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/oracle/OracleParser.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/base/Database.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/h2/package-info.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/util/FileCopyUtils.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/derby/DerbyDatabase.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/sqlscript/SqlScriptExecutor.java
- *
- /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/clazz/ClassProvider.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/license/package-info.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/package-info.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/jdbc/package-info.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/command/package-info.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/util/ExceptionUtils.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/cockroachdb/package-info.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/hsqldb/HSQLDBDatabase.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/schemahistory/package-info.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/scanner/filesystem/FileSystemScanner.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/derby/DerbySchema.java
- *
- /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/schemahistory/SchemaHistory.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/sqlscript/SqlStatement.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/sybasease/SybaseASEConnection.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/scanner/android/AndroidScanner.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/resource/android/package-info.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/hsqldb/package-info.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/scanner/classpath/UrlResolver.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/api/migration/BaseJavaMigration.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/redshift/RedshiftDatabase.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/logging/package-info.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/db2/DB2Table.java
- *
- /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/saphana/SAPHANASchema.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/util/StopWatch.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/api/InfoOutputProvider.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/scanner/classpath/DefaultUrlResolver.java

- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/jdbc/RowMapper.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/license/FlywayEditionUpgradeRequiredException.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/parser/PlaceholderReplacingReader.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/sqlscript/package-info.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/parser/ParsingContext.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/resource/LoadableResource.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/sqlserver/SQLServerTable.java
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- /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/command/DbSchemas.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/license/VersionPrinter.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/util/StringUtils.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/saphana/SAPHANADatabase.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/scanner/classpath/package-info.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/derby/package-info.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/scanner/classpath/ClassPathLocationScanner.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/sqlscript/SqlScript.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/sybasease/SybaseASETTable.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/mysql/MySQLConnection.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/jdbc/WarningImpl.java
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- /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/db2/DB2Connection.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/util/FeatureDetector.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/postgresql/PostgreSQLConnection.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/logging/LogCreatorFactory.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/h2/H2Table.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/parser/Recorder.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/api/migration/package-info.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/util/BomFilter.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/jdbc/TransactionalExecutionTemplate.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/base/SchemaObject.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/schemahistory/JdbcTableSchemaHistory.java
- *
- /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/informix/InformixConnection.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/scanner/classpath/jboss/package-info.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/util/CloseableIterator.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/oracle/package-info.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/jdbc/ExecutionTemplate.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/api/executor/Context.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/api/migration/JavaMigration.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/scanner/Scanner.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/configuration/ConfigUtils.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/resolver/package-info.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/redshift/RedshiftConnection.java
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- /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/logging/android/AndroidLogCreator.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/h2/H2Schema.java
- * /flyway-core-6-4-4-sources-
- jar/org/flywaydb/core/internal/scanner/classpath/JarFileClassPathLocationScanner.java

- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/parser/PeekingReader.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/scanner/ResourceNameCache.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/command/DbClean.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/firebird/package-info.java
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- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/snowflake/SnowflakeSchema.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/snowflake/SnowflakeConnection.java
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- jar/org/flywaydb/core/internal/scanner/classpath/FileSystemClassPathLocationScanner.java
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- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/h2/H2Database.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/parser/Statement.java
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- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/cockroachdb/CockroachDBParser.java
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- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/api/configuration/ClassicConfiguration.java
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- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/info/MigrationInfoContext.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/scanner/LocationScannerCache.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/sqlserver/package-info.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/schemahistory/AppliedMigration.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/oracle/OracleSqlScriptExecutor.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/callback/CallbackExecutor.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/cockroachdb/CockroachDBSchema.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/resource/Resource.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/api/executor/package-info.java
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- /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/postgresql/package-info.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/db2/DB2Parser.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/sqlscript/SqlScriptMetadata.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/redshift/RedshiftSchema.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/parser/StatementType.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/sqlscript/DefaultSqlScriptExecutor.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/resource/ResourceNameValidator.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/sqlite/package-info.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/oracle/OracleTable.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/oracle/OracleConnection.java
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- /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/hsqldb/HSQLDBConnection.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/parser/ParserContext.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/hsqldb/HSQLDBParser.java

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- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/resolver/java/JavaMigrationExecutor.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/resource/package-info.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/license/Edition.java
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- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/api/callback/Statement.java
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- /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/logging/apachecommons/ApacheCommonsLog.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/postgresql/PostgreSQLParser.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/sqlscript/SqlStatementIterator.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/logging/slf4j/Slf4jLog.java
- * /flyway-core-6-4-4-sources-
- jar/org/flywaydb/core/internal/database/cockroachdb/CockroachDBRetryingStrategy.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/api/callback/Error.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/parser/RecordingReader.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/api/migration/Context.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/cockroachdb/CockroachDBConnection.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/api/FlywayException.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/base/package-info.java
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- /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/logging/javautil/JavaUtilLog.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/logging/slf4j/package-info.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/db2/DB2Database.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/package-info.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/command/DbRepair.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/firebird/FirebirdParser.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/parser/Parser.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/jdbc/PlainExecutionTemplate.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/info/MigrationInfoDumper.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/resource/ResourceName.java
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- /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/base/Type.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/base/Table.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/api/configuration/FluentConfiguration.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/util/Locations.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/hsqldb/HSQLDBSchema.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/package-info.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/resolver/MigrationInfoHelper.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/informix/InformixSchema.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/api/logging/Log.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/jdbc/DatabaseType.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/postgresql/PostgreSQLType.java
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- /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/sqlscript/ParsedSqlStatement.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/logging/android/AndroidLog.java

- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/sqlscript/SqlScriptFactory.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/license/FlywayProUpgradeRequiredException.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/scanner/android/package-info.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/snowflake/SnowflakeDatabase.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/api/logging/LogFactory.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/resolver/java/package-info.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/base/Function.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/util/AsciiTable.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/mysql/MySQLNamedLockTemplate.java
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- /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/callback/DefaultCallbackExecutor.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/api/resolver/ResolvedMigration.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/exception/package-info.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/info/MigrationInfoServiceImpl.java
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- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/derby/DerbyConnection.java
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- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/api/MigrationInfo.java
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- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/jdbc/ErrorImpl.java
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- /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/firebird/FirebirdConnection.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/util/DateUtils.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/callback/NoopCallbackExecutor.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/DatabaseExecutionStrategy.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/resolver/sql/SqlMigrationExecutorFactory.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/informix/package-info.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/sqlserver/SQLServerParser.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/output/InfoOutputFactory.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/jdbc/Results.java
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- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/info/AppliedMigrationAttributes.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/resolver/sql/DefaultSqlMigrationExecutorFactory.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/mysql/MySQLTable.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/informix/InformixTable.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/api/MigrationState.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/api/MigrationType.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/snowflake/SnowflakeTable.java
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- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/Flyway.java

- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/sqlserver/SQLServerSchema.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/logging/javautil/package-info.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/resolver/ChecksumCalculator.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/resolver/sql/SqlMigrationExecutor.java
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- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/callback/package-info.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/resolver/java/ResolvedJavaMigration.java
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- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/clazz/NoopClassProvider.java
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- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/oracle/OracleSchema.java
- * /flyway-core-6-4-4-sources-
- jar/org/flywaydb/core/internal/database/postgresql/PostgreSQLAdvisoryLockTemplate.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/configuration/ConfigurationValidator.java
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- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/resolver/ResolvedMigrationImpl.java
- * /flyway-core-6-4-4-sources-
- jar/org/flywaydb/core/internal/logging/apachecommons/ApacheCommonsLogCreator.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/db2/DB2Type.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/util/UrlUtils.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/api/logging/LogCreator.java
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- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/jdbc/DriverDataSource.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/sqlite/SQLiteSchema.java
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- /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/resolver/ResolvedMigrationComparator.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/postgresql/PostgreSQLDatabase.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/jdbc/JdbcUtils.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/output/MigrationOutput.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/h2/H2Parser.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/api/logging/package-info.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/api/callback/Callback.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/resource/android/AndroidResource.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/scanner/package-info.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/api/MigrationVersion.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/derby/DerbyTable.java
- * /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/scanner/classpath/JarUtils.java
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/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/resolver/java/ScanningJavaMigrationResolver.java
* /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/snowflake/package-info.java
* /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/redshift/package-info.java
* /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/jdbc/Result.java
* /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/sqlite/SQLiteConnection.java
* /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/info/MigrationInfoImpl.java
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* /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/mysql/MySQLSchema.java
* /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/firebird/FirebirdSchema.java
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* /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/sqlserver/SQLServerDatabase.java
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* /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/derby/DerbyParser.java
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* /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/sqlscript/FlywaySqlScriptException.java
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* /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/resource/classpath/ClassPathResource.java
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* /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/clazz/package-info.java
* /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/scanner/classpath/OsgiClassPathLocationScanner.java
* /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/firebird/FirebirdTable.java
* /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/scanner/classpath/ResourceAndClassScanner.java
* /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/sybasease/SybaseASEDatabase.java
* /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/parser/Token.java
* /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/jdbc/JdbcTemplate.java
* /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/postgresql/PostgreSQLTable.java
* /flyway-core-6-4-4-sources-jar/org/flywaydb/core/api/android/package-info.java
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* /flyway-core-6-4-4-sources-jar/org/flywaydb/core/api/resolver/MigrationResolver.java
* /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/configuration/package-info.java
* /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/resolver/java/FixedJavaMigrationResolver.java
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* /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/sqlscript/Delimiter.java
* /flyway-core-6-4-4-sources-jar/org/flywaydb/core/api/Location.java
* /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/jdbc/JdbcConnectionFactory.java
* /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/resource/ResourceType.java
* /flyway-core-6-4-4-sources-jar/org/flywaydb/core/api/callback/Context.java
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/flyway-core-6-4-4-sources-jar/org/flywaydb/core/api/configuration/package-info.java
* /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/sybasease/SybaseASEParser.java
* /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/util/package-info.java
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* /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/resource/classpath/package-info.java
* /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/util/AbbreviationUtils.java
* /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/exception/FlywayDbUpgradeRequiredException.java
* /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/snowflake/SnowflakeParser.java
* /flyway-core-6-4-4-sources-jar/org/flywaydb/core/api/package-info.java
*
/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/sqlite/SQLiteDatabase.java
* /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/scanner/classpath/ClassPathScanner.java
* /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/util/IOUtils.java
* /flyway-core-6-4-4-sources-jar/org/flywaydb/core/api/callback/Event.java
* /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/sybasease/SybaseASESchema.java
* /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/resource/StringResource.java
* /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/resource/ResourceNameParser.java
* /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/output/InfoOutput.java
* /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/util/ClassUtils.java
* /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/hsqldb/HSQLDBTable.java
* /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/parser/PositionTracker.java
*
/flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/logging/apachecommons/package-info.java
* /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/util/Pair.java
* /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/resource/filesystem/FileSystemResource.java
* /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/exception/FlywaySqlException.java
* /flyway-core-6-4-4-sources-
jar/org/flywaydb/core/internal/database/sqlserver/SQLServerApplicationLockTemplate.java
* /flyway-core-6-4-4-sources-jar/org/flywaydb/core/internal/database/sybasease/package-info.java
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Found in path(s):

* /flyway-core-6-4-4-sources-jar/META-INF/maven/org.flywaydb/flyway-core/pom.xml

1.181 brotli 1.0.7-6ubuntu0.1

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1.182 docker-engine 19.03.5

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1.183 nlohmann-json 3.9.1

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amalgamate.py - Amalgamate C source and header files

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Arne Beer <arne@twobeer.de>

Billy

Robert O'Neal III <billy.oneal@gmail.com> <bion@microsoft.com>
Chris Kennelly <ckennelly@google.com> <ckennelly@ckennelly.com>
Christopher Seymour <chris.j.seymour@hotmail.com>
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Matt Clarkson <mattyclarkson@gmail.com>
Maxim Vafin <maxvafin@gmail.com>
Nick Hutchinson
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Oleksandr Sochka <sasha.sochka@gmail.com>
Pascal Leroy <phl@google.com>
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*

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```
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```

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```
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```

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<signature of Ty Coon>, 1 April 1989

Ty Coon, President of Vice

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```
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```
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```

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Glenn Randers-Pehrson
glennrp at users.sourceforge.net
June 26, 2010

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1.186 dav1d 0.6.0

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1.187 inja 3.1.0

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amalgamate.py - Amalgamate C source and header files

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1.188 gnulib 2019-09-23

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Files:

tests/test-update-copyright.sh

Depends-on:

configure.ac:

```
abs_aux_dir=`cd "$ac_aux_dir"; pwd`
```

```
AC_SUBST([abs_aux_dir])
```

Makefile.am:

```
TESTS += test-update-copyright.sh
```

```
TESTS_ENVIRONMENT += abs_aux_dir='${abs_aux_dir}'
```

```
@c The GNU Lesser General Public License.
```

```
@center Version 2.1, February 1999
```

```
@c This file is intended to be included within another document,
```

```
@c hence no sectioning command or @node.
```

```
@display
```

```
Copyright @copyright{ } 1991, 1999 Free Software Foundation, Inc.
```

```
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```

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```
@end display
```

```
@subheading Preamble
```

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Description:

Concatenate two arbitrary file names.

Files:

lib/filenamecat.h

lib/filenamecat-lgpl.c

m4/filenamecat.m4

Depends-on:

dirname-lgpl

configure.ac:

gl_FILE_NAME_CONCAT_LGPL

Makefile.am:

lib_SOURCES += filenamecat-lgpl.c

Include:

"filenamecat.h"

License:

LGPLv2+

Maintainer:

Jim Meyering

\$Id: COPYING,v 1.3 2006-10-26 16:20:28 eggert Exp \$

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@iftex
@heading END OF TERMS AND CONDITIONS
@end iftex
@ifinfo
@center END OF TERMS AND CONDITIONS

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@page
@heading Appendix: How to Apply These Terms to Your New Programs

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```
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and a brief idea of what it does.}
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```

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@end smallexample

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```
@smallexample
Gnomovision version
69, Copyright (C) @var{year} @var{name of author}
Gnomovision comes with ABSOLUTELY NO WARRANTY; for details type `show w'.
This is free software, and you are welcome to redistribute it
under certain conditions; type `show c' for details.
@end smallexample
```

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@example

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`Gnomovision' (which makes passes at compilers) written by James Hacker.

@var{signature of Ty Coon}, 1 April 1989

Ty Coon, President of Vice

@end example

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Version 3, 29 June 2007

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The

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Files:

tests/test-canonicalize-lgpl.c
tests/signature.h
tests/null-ptr.h
tests/macros.h

Depends-on:

ignore-value
same-inode
symlink

configure.ac:

Makefile.am:

TESTS += test-canonicalize-lgpl
check_PROGRAMS += test-canonicalize-lgpl

Description:

Provide the GNU Free Documentation License in Texinfo format.

Files:

doc/fdl.texi

Depends-on:

configure.ac:

Makefile.am:

Include:

License:

unmodifiable license text

Maintainer:

all

Legal Issues about Contributing Code to GNU last updated 14 July 2015

Project GNU has to be careful to obey copyright laws, even though these laws are wrong when they stop people from sharing generally useful published information such as software, because we are in the public eye. We also use copyright to defend users' freedom, by means

of copyleft (though this does not excuse copyright law for helping to make software proprietary).

This means that if you want to contribute software to GNU, you have to do something to give us legal permission to use it. There are three ways this can be done:

- * Assign the copyright to the Free Software Foundation.

This allows the FSF to act to stop violations of the GPL.

- * Keep the copyright and release the program yourself under the GNU GPL. (This alternative is too impractical for contributions to a preexisting FSF-copyrighted GNU program.)

- * Put the code in the public domain. Then there is nothing to stop hoarding of modified versions, but we can still use the program in GNU.

Most of these alternatives require a signed piece of paper, or in some cases a digital signature, to make it happen.

- * Assigning copyright.

Assigning the copyright means signing a contract that makes the Free Software Foundation the "owner" of the program according to the law. As the copyright holder, the Foundation can sue anyone who tries to distribute the program as a proprietary product. We are willing to keep your name on the program as the author for as long as the program remains recognizably distinct. ("Owner" is in quotes to show that we don't really believe in this kind of ownership.)

The assignment contract commits the foundation to setting distribution terms that permit free redistribution.

Often we don't want to do the work of starting to distribute a program right away. There are many things which we will need in order to have a complete system but which aren't really useful until the rest of the system is done. But signing the assignment does not stop you from distributing the program yourself--as long as you do so under the GNU terms. You don't have to wait for us to start distributing. You can start distributing as soon as you attach our standard copyleft to the files. (Ask for our advice on how to do this.)

The assignment contract we normally use has a clause that permits you to use your code in proprietary programs, on 30 days' notice. (The 30 days' notice is there because, through a legal technicality, it would improve our position in a suit against a hoarder.) Although we

believe that proprietary software is wrong, we include this clause because it would serve no purpose to ask you to promise not to do it. You're giving us a gift in the first place.

You don't need to invoke this clause in order to distribute copies as free software under the GNU GPL, since everyone is allowed to do that.

* Releasing it yourself.

You can release a program yourself under copyleft distribution terms such as the

GNU GPL. (In order to accept the program as GNU software, we would have to be happy with your choice of terms.) This does not require a contract between you and the FSF, but we would appreciate having a signed piece of paper to confirm your decision.

If someone violates your terms--for example, if someone gets a copy from us, and uses it as a basis for a proprietary product in violation of the terms--we cannot sue him. You would have to sue, or he gets away with it.

* Public domain.

If you put the program in the public domain, we prefer to have a signed piece of paper--a disclaimer of rights--from you confirming this. If the program is not very important, we can do without one; the worst that could happen is that we might some day be forced to stop using it.

The law says that anyone can copyright a modified version of the public domain work. (This doesn't restrict the original, which remains in the public domain; only the changes are copyrighted.) If we make extensive changes,

we will probably do this and add our usual copyleft. If we make small changes, we will leave the version we distribute in the public domain.

* What about your employer?

If you are employed to do programming, or have made an agreement with your employer that says it owns programs you write, we need a signed piece of paper from your employer disclaiming rights to the program. It should be signed by a vice president or general manager of the company. If you can't get at them, it is almost as good to find someone who signs licenses for software that is purchased. Here is a sample wording:

Digital Simulation Corporation hereby disclaims all copyright interest in the program "sample.el" (a program to direct assemblers to make passes at compilers under GNU Emacs) written by Hugh Hacker.

<signature of Mo Ghoul>, 1 April 1987

Mo Ghoul, President of Vice, Digital Simulation Corp.

The description of what the program does is just to make it clearer what the disclaimer covers.

If

what you did was change an existing program, it should say this:

...in the changes and enhancements made by Hugh Hacker to the program "sample.el".

* Did anyone else contribute?

If someone else contributed more than a few lines here or there to the program, then that person too is an author, and that person too needs to sign papers just as you do. So may that person's employer. However, if his contribution is just a fraction of the whole work, it is satisfactory if he disclaims his own rights, even if you are assigning yours. (If just the minor contributors' work goes in the public domain, that doesn't leave much of a loophole for hoarders.)

If you incorporated packages which you found floating around as "public domain", we might still want to track down their authors, to get disclaimers to reassure us that they really are in the public domain. So keep track of what these packages are and who wrote them.

* A reminder:

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It is not considered a serious problem if you have read Unix sources or other non-free source code in the past for other purposes, provided you don't copy anything in particular from them. However, referring to them while you do the work could cause us legal problems later. Please email the following information to assign@gnu.org, and we will send you the assignment form for your past and future changes.

Please use your full legal name (in ASCII characters) as the subject line of the message.

REQUEST: SEND FORM FOR PAST AND FUTURE CHANGES

[What is the name of the program or package you're contributing to?]

[Did you copy any files or text written by someone else in these changes?
Even if that material is free software, we need to know about it.]

[Do you have an employer who might have a basis to claim to own
your changes? Do you attend a school which might make such a claim?]

[For the copyright registration, what country are you a citizen of?]

[What year were you born?]

[Please write your email address here.]

[Please write your postal address here.]

[Which files have you changed so far, and which new files have you written
so far?]

Description:

Help make libraries relocatable, that is, to allow them to function
properly when copied to an arbitrary directory.

Files:

doc/relocatable.texi

lib/relocatable.h

lib/relocatable.c

lib/relocatable.valgrind

m4/relocatable-lib.m4

Depends-on:

strdup

configure.ac:

gl_RELOCATABLE_LIBRARY

if test \$RELOCATABLE = yes; then

AC_LIBOBJ([relocatable])

fi

Makefile.am:

DEFS += -DNO_XMALLOC

Include:

"relocatable.h"

License:

LGPLv2+

Maintainer:

Ben Pfaff

Description:

Ensure getcwd(NULL, 0) returns a buffer allocated by the malloc() function.

Files:

lib/getcwd-lgpl.c

m4/getcwd.m4

Depends-on:

unistd

strdup [test \$REPLACE_GETCWD = 1]

configure.ac:

gl_FUNC_GETCWD_LGPL

if test \$REPLACE_GETCWD = 1; then

AC_LIBOBJ([getcwd-lgpl])

fi

gl_UNISTD_MODULE_INDICATOR([getcwd])

Makefile.am:

Include:

<unistd.h>

License:

LGPLv2+

Maintainer:

Eric Blake

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Version 2, June 1991

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```
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```

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```
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it  
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```

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```
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```

<signature of Ty Coon>, 1 April 1989

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Version 2.1, February 1999

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the work with the complete corresponding

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<signature of Ty Coon>, 1 April 1990
Ty Coon, President of Vice

That's all there is to it!

Description:

Locating a program in PATH (LGPLed version).

Files:

lib/findprog.h
lib/findprog.c
lib/findprog-lgpl.c
m4/findprog.m4
m4/eaccess.m4

Depends-on:

stdbool
strdup
concat-filename
access
unistd

configure.ac:

gl_FINDPROG
gl_MODULE_INDICATOR([findprog-lgpl])

Makefile.am:

lib_SOURCES += findprog.h findprog.c

Include:

"findprog.h"

License:

LGPLv2+

Maintainer:

all

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postal address here.]

[Which files have you changed so far, and which new files have you written so far?]

Files:

tests/test-getcwd-lgpl.c

tests/signature.h

tests/macros.h

Depends-on:

configure.ac:

Makefile.am:

```
TESTS += test-getcwd-lgpl
```

```
check_PROGRAMS += test-getcwd-lgpl
```

```
test_getcwd_lgpl_LDADD = $(LDADD) $(LIBINTL)
```

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Description:

realpath, canonicalize_file_name: Provide canonical absolute file name

Files:

lib/canonicalize-lgpl.c

m4/canonicalize.m4

m4/double-slash-root.m4

Depends-on:

extensions

stdlib

nocrash

alloca-opt [test \$HAVE_CANONICALIZE_FILE_NAME = 0 || test
\$REPLACE_CANONICALIZE_FILE_NAME = 1]

errno [test \$HAVE_CANONICALIZE_FILE_NAME = 0 || test
\$REPLACE_CANONICALIZE_FILE_NAME = 1]

lstat [test \$HAVE_CANONICALIZE_FILE_NAME = 0 || test \$REPLACE_CANONICALIZE_FILE_NAME
= 1]

malloca [test \$HAVE_CANONICALIZE_FILE_NAME = 0 || test
\$REPLACE_CANONICALIZE_FILE_NAME = 1]

memmove [test \$HAVE_CANONICALIZE_FILE_NAME = 0 || test
\$REPLACE_CANONICALIZE_FILE_NAME = 1]

pathmax [test \$HAVE_CANONICALIZE_FILE_NAME = 0 || test
\$REPLACE_CANONICALIZE_FILE_NAME = 1]

readlink [test \$HAVE_CANONICALIZE_FILE_NAME = 0 || test
\$REPLACE_CANONICALIZE_FILE_NAME = 1]

sys_stat [test \$HAVE_CANONICALIZE_FILE_NAME = 0 || test
\$REPLACE_CANONICALIZE_FILE_NAME = 1]

configure.ac:

gl_CANONICALIZE_LGPL

if

test \$HAVE_CANONICALIZE_FILE_NAME = 0 || test \$REPLACE_CANONICALIZE_FILE_NAME = 1; then
AC_LIBOBJ([canonicalize-lgpl])

fi

gl_MODULE_INDICATOR([canonicalize-lgpl])

gl_STDLIB_MODULE_INDICATOR([canonicalize_file_name])

gl_STDLIB_MODULE_INDICATOR([realpath])

Makefile.am:

Include:

<stdlib.h>

License:

LGPLv2+

Maintainer:

all

Description:

Extract specific portions of filenames.

Files:

lib/dirname.h

lib/dirname-lgpl.c

lib/basename-lgpl.c

lib/strip slash.c

m4/dirname.m4

Depends-on:

dosname

double-slash-root

malloc-posix

stdbool

configure.ac:

gl_DIRNAME_LGPL

Makefile.am:

lib_SOURCES += dirname-lgpl.c basename-lgpl.c strip slash.c

Include:

"dirname.h"

License:

LGPLv2+

Maintainer:

Jim Meyering, Eric Blake

1.189 hd-parm 9.38

1.189.1 Available under license :

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Version 2, June 1991

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Mark Lord (mlord@pobox.com)
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Wed, 21 Nov 2001 15:51:14 -0600.

It was downloaded from <http://www.ibiblio.org/pub/Linux/system/hardware>

Upstream Author: Mark S. Lord <mlord@pobox.com>

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1.190 libjpeg 8d

1.190.1 Available under license :

This is Debian's prepackaged version of the 'jpeg library' by the Independent
JPEG Group.

This package was created by Mark Mickan <mmickan@debian.org> from sources
which can be found at <ftp://ftp.uu.net/graphics/jpeg/jpegsrc.v6b.tar.gz>

It is partly based on the libjpeg6a package originally put together by
Andy Guy <awpguy@acs.ualgary.ca> and later maintained by Mark Mickan.

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1.191 xmltooling 3.0.5-1build1

1.191.1 Available under license :

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1.192 xerces-c 3.2.2+debian-1build3

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1.201 webrtc m44

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modules/audio_coding/codecs/isac/main/source/fft.c
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* Written by Wilco Dijkstra, 1996. The following email exchange establishes the
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*
* From: Wilco Dijkstra <Wilco.Dijkstra@ntlworld.com>
* Date: Fri, Jun 24, 2011 at 3:20 AM
* Subject: Re: sqrt routine

* To: Kevin Ma <kma@google.com>
* Hi Kevin,
* Thanks for asking. Those routines are public domain (originally posted to
* comp.sys.arm a long time ago), so you can use them freely for any purpose.
* Cheers,
* Wilco

*

* ----- Original Message -----

* From: "Kevin Ma" <kma@google.com>

* To: <Wilco.Dijkstra@ntlworld.com>

* Sent: Thursday, June 23, 2011 11:44 PM

* Subject: Fwd: sqrt routine

* Hi Wilco,

* I saw your sqrt routine from several web sites, including

* <http://www.finesse.demon.co.uk/steven/sqrt.html>.

* Just wonder if there's any copyright information with your Successive
* approximation routines, or if I can freely use it for any purpose.

* Thanks.

* Kevin

*/

Files:

modules/audio_coding/codecs/g711/main/source/g711.c

modules/audio_coding/codecs/g711/main/source/g711.h

License:

/*

* SpanDSP - a series of DSP components for telephony

*

* g711.h - In line A-law and u-law conversion routines

*

* Written by Steve Underwood <steveu@coppice.org>

*

* Copyright (C) 2001 Steve Underwood

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Files:

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modules/audio_coding/codecs/g722/main/source/g722_enc_dec.h

modules/audio_coding/codecs/g722/main/source/g722_encode.c

License:

/*

- * SpanDSP - a series of DSP components for telephony
- *
- * g722_decode.c - The ITU G.722 codec, decode part.
- *
- * Written by Steve Underwood <steveu@coppice.org>
- *
- * Copyright (C) 2005 Steve Underwood
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- * Based in part on a single channel G.722 codec which is:
- *
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- * Computer Science, Speech Group
- * Chengxiang Lu and Alex Hauptmann
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 * It is also implicitly understood that bug fixes and improvements
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* that everyone benefits.

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modules/audio_device/mac/portaudio/pa_ringbuffer.c

modules/audio_device/mac/portaudio/pa_ringbuffer.h

License:

/*

* \$Id: pa_memorybarrier.h 1240 2007-07-17 13:05:07Z bjornroche \$

* Portable Audio I/O Library

* Memory barrier utilities

*

* Author: Bjorn Roche, XO Audio, LLC

*

* This program uses the PortAudio Portable Audio Library.

* For more information see: <http://www.portaudio.com>

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/*

- * \$Id: pa_ringbuffer.c 1421 2009-11-18 16:09:05Z bjornroche \$

- * Portable Audio I/O Library

- * Ring Buffer utility.

- *

- * Author: Phil Burk, <http://www.softsynth.com>

- * modified for SMP safety on Mac OS X by Bjorn Roche

- * modified for SMP safety on Linux by Leland Lucius

- * also, allowed for const where possible

- * modified for multiple-byte-sized data elements by Sven Fischer

- *

- * Note that this is safe only for a single-thread reader and a

- * single-thread writer.

- *

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- * For more information see: <http://www.portaudio.com>

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Contributors to bttv:

Michael Chu <mmchu@pobox.com>

AverMedia fix and more flexible card recognition

Alan Cox <alan@lxorguk.ukuu.org.uk>

Video4Linux interface and 2.1.x kernel adaptation

Chris Kleitsch

Hardware I2C

Gerd Knorr <kraxel@cs.tu-berlin.de>

Radio card (ITT sound processor)

bigfoot <bigfoot@net-way.net>

Ragnar Hojland Espinosa <ragnar@macula.net>

ConferenceTV card

+ many more (please mail me if you are missing in this list and would
like to be mentioned)

/* nicstar.c v0.22 Jawaid Bazyar (bazyar@hypermall.com)

* nicstar.c, M. Welsh (matt.welsh@cl.cam.ac.uk)

*

* Hacked October, 1997 by Jawaid Bazyar, Interlink Advertising Services Inc.

* <http://www.hypermall.com/>

* 10/1/97 - commented out CFG_PHYIE bit - we don't care when the PHY

* interrupts us (except possibly for removal/insertion of the cable?)

* 10/4/97 - began heavy inline documentation of the code. Corrected typos

* and spelling mistakes.

* 10/5/97 - added code to handle PHY interrupts, disable PHY on

* loss of link, and correctly re-enable PHY when link is

* re-established. (put back CFG_PHYIE)

*

* Modified to work with the IDT7721 nicstar -- AAL5 (tested) only.

*

* R. D. Rechenmacher <ron@fnal.gov>, Aug. 6, 1997

*

* Linux driver for the IDT77201 NICStAR PCI ATM controller.

* PHY component is expected to be 155 Mbps S/UNI-Lite or IDT 77155;

* see init_nicstar() for PHY initialization to change this. This driver

- * expects the Linux ATM stack to support scatter-gather lists
- * (skb->atm.iovcnt != 0) for Rx skb's passed to vcc->push.
- *
- * Implementing minimal-copy of received data:
- * IDT always receives data into a small buffer, then large buffers
- * as needed. This means that data must always be copied to create
- * the linear buffer needed by most non-ATM protocol stacks (e.g. IP)
- * Fix is simple: make large buffers large enough to hold entire
- * SDU, and leave <small_buffer_data> bytes empty at the start. Then
- * copy small buffer contents to head of large buffer.
- * Trick is to avoid fragmenting Linux, due to need for a lot of large
- * buffers. This is done by 2 things:
- * 1) skb->destructor / skb->atm.recycle_buffer
- * combined, allow nicstar_free_rx_skb to be called to
- * recycle large data buffers
- * 2) skb_clone of received buffers
- * See nicstar_free_rx_skb and linearize_buffer for implementation
- * details.
- *
- *
- *
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- *
- * M. Welsh, 6 July 1996
- *
- *
- */

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- * c)

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procedure and CyberLogin is no longer used.)

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<obi@linuxtv.org>

Dennis Noermann <dennis.noermann@noernet.de>

Felix Domke <tmbinc@elitedvb.net>

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for merging the nxt2002 and nxt2004 modules into a
single nxt200x frontend driver.

(If you think you should be in this list, but you are not, drop
a

line to the DVB mailing list)

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- e) Verify that the user has already received a copy of these materials or that you have already sent this user a copy.

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Version 3, 29 June 2007

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The

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This file contains a list of people who have made large contributions to the public version of Protocol Buffers.

Original Protocol Buffers design and implementation:

Sanjay Ghemawat <sanjay@google.com>

Jeff Dean <jeff@google.com>

Daniel Dulitz <daniel@google.com>

Craig Silverstein

Paul Haahr <haahr@google.com>

Corey Anderson <corin@google.com>

(and many others)

Proto2 C++ and Java primary author:

Kenton Varda <kenton@google.com>

Proto2 Python primary authors:

Will Robinson <robinson@google.com>

Petar Petrov <petar@google.com>

Java Nano primary authors:

Brian Duff <bduff@google.com>

Tom Chao <chaot@google.com>

Max Cai <maxtroy@google.com>

Ulas Kirazci <ulas@google.com>

Large code contributions:

Jason Hsueh <jasonh@google.com>

Joseph Schorr <jschorr@google.com>

Wenbo Zhu <wenboz@google.com>

Large quantity of code reviews:

Scott Bruce <sbruce@google.com>

Frank Yellin

Neal Norwitz <nnorwitz@google.com>

Jeffrey Yasskin <jyasskin@google.com>

Ambrose

Feinstein <ambrose@google.com>

Documentation:

Lisa Carey <lcarey@google.com>

Maven packaging:

Gregory Kick <gak@google.com>

Patch contributors:

Kevin Ko <kevin.s.ko@gmail.com>

- * Small patch to handle trailing slashes in --proto_path flag.

Johan Euphrosine <proppy@aminche.com>

- * Small patch to fix Python CallMethod().

Ulrich Kunitz <kune@deine-taler.de>

- * Small optimizations to Python serialization.

Leandro Lucarella <llucax@gmail.com>

- * VI syntax highlighting tweaks.
- * Fix compiler to not make output executable.

Dilip Joseph <dilip.antony.joseph@gmail.com>

- * Heuristic detection of sub-messages when printing unknown fields in text format.

Brian Atkinson <nairb774@gmail.com>

- * Added @Override annotation to generated Java code where appropriate.

Vincent Choinire <Choiniere.Vincent@hydro.qc.ca>

- * Tru64 support.

Monty Taylor <monty.taylor@gmail.com>

- * Solaris 10 + Sun Studio fixes.

Alek Storm <alek.storm@gmail.com>

- * Slicing support for repeated scalar fields for the Python API.

Oleg Smolsky <oleg.smolsky@gmail.com>

- * MS Visual Studio error format option.
- * Detect unordered_map in stl_hash.m4.

Brian Olson <brianolson@google.com>

- * gzip/zlib I/O support.

Michael Poole <mdpoole@troilus.org>

- * Fixed warnings about generated constructors not explicitly initializing all fields (only present with certain compiler settings).
- * Added generation of field number constants.

Wink Saville <wink@google.com>

- * Fixed initialization ordering problem in logging code.

Will Pierce <willp@nuclei.com>

- * Small patch improving performance of in Python serialization.

Alexandre Vassalotti <alexandre@peadrop.com>

- * Emacs mode for Protocol Buffers (editors/protobuf-mode.el).

Scott Stafford <scott.stafford@gmail.com>

- * Added Swap(), SwapElements(), and RemoveLast() to Reflection interface.

Alexander Melnikov <alm@sibmail.ru>

- * HPUX support.

Oliver Jowett <oliver.jowett@gmail.com>

- * Detect whether zlib is new enough in configure script.
- * Fixes for Solaris 10 32/64-bit confusion.

Evan Jones <evanj@mit.edu>

- * Optimize Java serialization code when writing a small message to a stream.
- * Optimize Java serialization of strings so that UTF-8 encoding happens only once per string per serialization call.
- * Clean up some Java warnings.
- * Fix bug with permanent callbacks that delete themselves when run.

Michael Kucharski <m.kucharski@gmail.com>

- * Added CodedInputStream.getTotalBytesRead().

Kacper Kowalik <xarthisius.kk@gmail.com>

- * Fixed m4/acx_pthread.m4 problem for some Linux distributions.

William Orr <will@worrbase.com>

- * Fixed detection of sched_yield on Solaris.

- * Added atomicops for Solaris

Andrew Paprocki <andrew@ishiboo.com>

- * Fixed minor IBM xLC compiler build issues

- * Added atomicops for AIX (POWER)

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1.215 x264 0.155.2917+git0a84d98-2

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1.216 flyway-test 6.4.0

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- * /flyway-test-6-4-0-sources-jar/org/flywaydb/test/annotation/FlywayTest.java

1.217 flyway-spring5-test 6.4.0

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* /flyway-spring5-test-6-4-0-sources-jar/context/flywayContainerContext.xml
* /flyway-spring5-test-6-4-0-sources-jar/context/flywaySingleContext.xml
* /flyway-spring5-test-6-4-0-sources-jar/context/secondFlywayContainerContext.xml
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- * /flyway-spring5-test-6-4-0-sources-jar/org/flywaydb/test/junit/FlywayTestExecutionListener.java
- *
- /flyway-spring5-test-6-4-0-sources-jar/org/flywaydb/test/ExecutionListenerHelper.java
- * /flyway-spring5-test-6-4-0-sources-jar/org/flywaydb/test/junit/FlywayHelperFactory.java
- * /flyway-spring5-test-6-4-0-sources-jar/org/flywaydb/test/junit5/annotation/package-info.java
- * /flyway-spring5-test-6-4-0-sources-jar/org/flywaydb/test/package-info.java
- * /flyway-spring5-test-6-4-0-sources-jar/org/flywaydb/test/junit/package-info.java
- * /flyway-spring5-test-6-4-0-sources-jar/org/flywaydb/test/FlywayTestExecutionListener.java
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1.218 flyway-core 7.3.1

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- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/configuration/package-info.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/license/VersionPrinter.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/command/DbRepair.java
- *
- /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/informix/package-info.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/InsertRowLock.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/oracle/OracleDatabase.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/parser/PlaceholderReplacingReader.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/clazz/NoopClassProvider.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/api/output/MigrateResult.java
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- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/cockroachdb/CockroachDBConnection.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/base/SchemaObject.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/jdbc/JdbcNullTypes.java
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- /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/mysql/MySQLDatabase.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/strategy/BackoffStrategy.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/sqlserver/synapse/SynapseDatabaseType.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/util/Locations.java
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- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/oracle/OracleParser.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/redshift/RedshiftDatabaseType.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/scanner/classpath/jboss/package-info.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/base/DatabaseType.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/informix/InformixDatabase.java
- *
- /flyway-core-7-3-1-sources-jar/org/flywaydb/core/api/logging/LogFactory.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/sqlserver/package-info.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/sqlscript/SqlStatement.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/util/DateUtils.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/logging/log4j2/Log4j2Log.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/redshift/RedshiftDatabase.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/db2/DB2Table.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/api/output/BaselineResult.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/parser/PositionTrackingReader.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/scanner/ClasspathClassScanner.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/api/Location.java
- *
- /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/oracle/OracleSchema.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/api/callback/Warning.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/util/package-info.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/callback/SimpleContext.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/api/output/OperationResult.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/sybasease/SybaseASETable.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/configuration/ConfigUtils.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/jdbc/WarningImpl.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/db2/DB2Connection.java

- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/postgresql/PostgreSQLConnection.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/parser/Recorder.java
- *
- /flyway-core-7-3-1-sources-
- jar/org/flywaydb/core/internal/logging/apachecommons/ApacheCommonsLogCreator.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/logging/apachecommons/package-info.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/derby/DerbyParser.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/api/output/ErrorOutput.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/scanner/classpath/JarUtils.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/api/android/ContextHolder.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/sqlite/SQLiteParser.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/oracle/OracleResults.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/api/output/ValidateOutput.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/scanner/filesystem/FileSystemScanner.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/api/output/ValidateResult.java
- *
- /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/authentication/ExternalAuthPropertiesProvider.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/api/output/package-info.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/callback/SqlScriptCallbackFactory.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/parser/ParsingContext.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/redshift/RedshiftType.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/logging/slf4j/Slf4jLog.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/authentication/postgres/PgpassFileReader.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/sqlite/SQLiteDatabase.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/api/migration/Context.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/resolver/ResolvedMigrationImpl.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/logging/javautil/JavaUtilLog.java
- *
- /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/resolver/package-info.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/resource/s3/AwsS3Resource.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/util/CloseableIterator.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/exception/FlywayDbUpgradeRequiredException.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/h2/package-info.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/cockroachdb/package-info.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/mysql/MySQLParser.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/h2/H2DatabaseType.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/derby/DerbyDatabase.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/sybasease/package-info.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/api/configuration/Configuration.java
- *
- /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/util/AsciiTable.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/jdbc/ExecutionTemplateFactory.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/resolver/sql/package-info.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/util/SqlCallable.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/hsqldb/HSQLDBParser.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/postgresql/PostgreSQLDatabaseType.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/api/output/RepairOutput.java
- * /flyway-core-7-3-1-sources-

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jar/org/flywaydb/core/internal/database/sybasease/SybaseASEJConnectDatabaseType.java
* /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/db2/DB2Type.java
* /flyway-core-7-3-1-sources-jar/org/flywaydb/core/api/resolver/package-info.java
* /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/sqlscript/SqlScriptMetadata.java
*
/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/authentication/ExternalAuthFileReader.java
* /flyway-core-7-3-1-sources-jar/org/flywaydb/core/api/MigrationPattern.java
* /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/info/package-info.java
* /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/mysql/MySQLTable.java
* /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/saphana/SAPHANADatabase.java
* /flyway-core-7-3-1-sources-jar/org/flywaydb/core/Flyway.java
* /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/resource/classpath/ClassPathResource.java
* /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/resource/classpath/package-info.java
* /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/scanner/package-info.java
* /flyway-core-7-3-1-sources-jar/org/flywaydb/core/api/FlywayException.java
* /flyway-core-7-3-1-sources-jar/org/flywaydb/core/api/callback/Context.java
*
/flyway-core-7-3-1-sources-jar/org/flywaydb/core/api/migration/JavaMigration.java
* /flyway-core-7-3-1-sources-jar/org/flywaydb/core/api/output/RepairResult.java
* /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/postgresql/PostgreSQLDatabase.java
* /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/schemahistory/SchemaHistory.java
* /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/logging/android/AndroidLogCreator.java
* /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/informix/InformixTable.java
* /flyway-core-7-3-1-sources-
jar/org/flywaydb/core/internal/scanner/classpath/JarFileClassPathLocationScanner.java
* /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/derby/DerbyDatabaseType.java
* /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/sqlscript/SqlScriptFactory.java
* /flyway-core-7-3-1-sources-jar/org/flywaydb/core/api/exception/FlywayValidateException.java
* /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/jdbc/StatementInterceptor.java
*
/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/redshift/RedshiftSchema.java
* /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/info/MigrationInfoContext.java
* /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/sqlscript/ParserSqlScript.java
* /flyway-core-7-3-1-sources-jar/org/flywaydb/core/api/resolver/ChecksumMatcher.java
* /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/util/BomFilter.java
* /flyway-core-7-3-1-sources-jar/org/flywaydb/core/api/callback/Statement.java
* /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/jdbc/ErrorImpl.java
* /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/logging/LogCreatorFactory.java
* /flyway-core-7-3-1-sources-jar/org/flywaydb/core/api/migration/package-info.java
* /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/logging/slf4j/package-info.java
* /flyway-core-7-3-1-sources-jar/org/flywaydb/core/api/output/MigrateOutput.java
*
/flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/sqlserver/SQLServerTable.java
* /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/parser/ParserContext.java
* /flyway-core-7-3-1-sources-jar/org/flywaydb/core/api/logging/package-info.java
* /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/saphana/SAPHANAParser.java
* /flyway-core-7-3-1-sources-jar/org/flywaydb/core/api/output/CommandResultFactory.java
* /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/resolver/java/JavaMigrationExecutor.java

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- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/snowflake/package-info.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/base/Database.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/util/FileCopyUtils.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/mysql/MySQLNamedLockTemplate.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/hsqldb/HSQLDBDatabase.java
- *
- /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/util/BooleanEvaluator.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/scanner/classpath/package-info.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/callback/CallbackExecutor.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/sqlserver/SQLServerSchema.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/derby/DerbyTable.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/scanner/cloud/s3/AwsS3Scanner.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/db2/package-info.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/resolver/sql/DefaultSqlMigrationExecutorFactory.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/snowflake/SnowflakeParser.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/logging/javautil/JavaUtilLogCreator.java
- *
- /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/cockroachdb/CockroachDBTable.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/oracle/package-info.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/sqlserver/SQLServerConnection.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/redshift/RedshiftParser.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/resource/StringResource.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/resource/gcs/package-info.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/parser/PositionTracker.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/jdbc/PlainExecutionTemplate.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/resolver/CompositeMigrationResolver.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/scanner/classpath/jboss/JBossVFSv2UriResolver.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/h2/H2Database.java
- *
- /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/parser/Statement.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/api/callback/BaseCallback.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/api/resolver/ResolvedMigration.java
- * /flyway-core-7-3-1-sources-
- jar/org/flywaydb/core/internal/database/postgresql/PostgreSQLCopyParsedStatement.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/db2/DB2Parser.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/firebird/FirebirdTable.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/scanner/classpath/ResourceAndClassScanner.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/oracle/OracleConnection.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/DefaultExecutionStrategy.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/resource/LoadableResource.java
- *
- /flyway-core-7-3-1-sources-jar/org/flywaydb/core/api/MigrationType.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/api/output/CleanResult.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/util/ClassUtils.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/logging/apachecommons/ApacheCommonsLog.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/api/package-info.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/h2/H2Table.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/api/callback/package-info.java

- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/license/FlywayTeamsUpgradeMessage.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/api/ErrorDetails.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/firebird/FirebirdDatabase.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/db2/DB2DatabaseType.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/sqlserver/synapse/SynapseDatabase.java
- *
- /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/postgresql/PostgreSQLType.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/package-info.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/base/Function.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/resource/ResourceType.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/parser/TokenType.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/util/AbbreviationUtils.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/api/ErrorCode.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/hsqldb/HSQLDBTable.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/jdbc/JdbcConnectionFactory.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/base/Connection.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/sqlserver/SQLServerDatabaseType.java
- *
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- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/api/callback/Event.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/api/executor/package-info.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/sqlscript/ParsedSqlStatement.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/sqlserver/SQLServerDatabase.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/sqlscript/Delimiter.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/base/TestContainersDatabaseType.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/util/ExceptionUtils.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/saphana/SAPHANAConnection.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/parser/RecordingReader.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/scanner/Scanner.java
- *
- /flyway-core-7-3-1-sources-
- jar/org/flywaydb/core/internal/scanner/classpath/jboss/JBossVFSv3ClassPathLocationScanner.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/authentication/mysql/MySQLOptionFileReader.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/util/IOUtils.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/util/UrlUtils.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/hsqldb/HSQLDBSchema.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/exception/package-info.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/resource/android/AndroidResource.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/parser/PeekingReader.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/resolver/ChecksumCalculator.java
- * /flyway-core-7-3-1-sources-
- jar/org/flywaydb/core/internal/database/sqlserver/SQLServerApplicationLockTemplate.java
- *
- /flyway-core-7-3-1-sources-jar/org/flywaydb/core/api/output/InfoOutput.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/cockroachdb/CockroachDBParser.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/api/callback/Error.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/resource/Resource.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/resource/gcs/GCSResource.java

- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/scanner/classpath/OsgiClassPathLocationScanner.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/api/InfoOutputProvider.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/license/FlywayEditionUpgradeRequiredException.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/postgresql/PostgreSQLSchema.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/hsqldb/HSQLDBConnection.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/api/resolver/Context.java
- *
- /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/util/BomStrippingReader.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/api/output/UndoOutput.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/license/FlywayTeamsUpgradeRequiredException.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/DatabaseTypeRegister.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/sybasease/SybaseASESchema.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/jdbc/TableLockingExecutionTemplate.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/util/TimeFormat.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/util/StopWatch.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/logging/android/AndroidLog.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/resource/s3/package-info.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/info/MigrationInfoServiceImpl.java
- *
- /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/base/Schema.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/api/configuration/S3ClientFactory.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/derby/DerbyConnection.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/scanner/classpath/UrlResolver.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/parser/package-info.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/sqlserver/SQLServerParser.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/api/logging/LogCreator.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/jdbc/RowMapper.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/redshift/RedshiftConnection.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/resource/ResourceNameValidator.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/api/executor/MigrationExecutor.java
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- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/scanner/android/package-info.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/scanner/classpath/ClassPathLocationScanner.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/sqlscript/SqlScript.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/mysql/MySQLConnection.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/util/FeatureDetector.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/postgresql/PostgreSQLParser.java
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- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/resource/ResourceName.java
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- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/snowflake/SnowflakeSchema.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/resolver/java/package-info.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/h2/H2Connection.java

- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/postgresql/package-info.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/package-info.java
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- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/logging/package-info.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/api/MigrationState.java
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- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/resource/NoopResourceProvider.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/resolver/sql/SqlMigrationExecutorFactory.java
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- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/callback/NoopCallbackExecutor.java
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- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/sybasease/SybaseASEDatabase.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/jdbc/JdbcTemplate.java
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- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/saphana/SAPHANADatabaseType.java
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- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/sqlserver/synapse/SynapseConnection.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/schemahistory/JdbcTableSchemaHistory.java
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- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/command/DbBaseline.java
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- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/database/snowflake/SnowflakeTable.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/strategy/RetryStrategy.java
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- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/resolver/java/ResolvedJavaMigration.java

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- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/schemahistory/SchemaHistoryFactory.java
- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/info/AppliedMigrationAttributes.java
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- * /flyway-core-7-3-1-sources-jar/org/flywaydb/core/internal/resource/filesystem/FileSystemResource.java
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- * /flyway-core-7-3-1-sources-jar/META-INF/maven/org.flywaydb/flyway-core/pom.xml

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1.221 Lombok 1.18.12

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1.222 reactive-streams 1.0.3

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```

* /reactive-streams-1-0-3-sources-3-jar/org/reactivestreams/Publisher.java
* /reactive-streams-1-0-3-sources-3-jar/org/reactivestreams/FlowAdapters.java
* /reactive-streams-1-0-3-sources-3-jar/org/reactivestreams/Processor.java
*
/ reactive-streams-1-0-3-sources-3-jar/org/reactivestreams/Subscription.java
* /reactive-streams-1-0-3-sources-3-jar/org/reactivestreams/Subscriber.java
```

1.223 commons-dbcp 1.4

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1.224 jul-to-slf4j 1.7.30

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```
* /jul-to-slf4j-1-7-30-sources-1-jar/org/slf4j/bridge/SLF4JBridgeHandler.java
```

1.225 spring-retry 1.2.5.RELEASE

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```

* /spring-retry-1-2-5-release-sources-1-
jar/org/springframework/retry/backoff/ExponentialRandomBackOffPolicy.java
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```

* /spring-retry-1-2-5-release-sources-1-jar/org/springframework/retry/backoff/NoBackOffPolicy.java
* /spring-retry-1-2-5-release-sources-1-jar/org/springframework/retry/policy/ExceptionClassifierRetryPolicy.java
* /spring-retry-1-2-5-release-sources-1-jar/org/springframework/retry/policy/AlwaysRetryPolicy.java
*
/spring-retry-1-2-5-release-sources-1-jar/org/springframework/retry/ExhaustedRetryException.java
* /spring-retry-1-2-5-release-sources-1-
jar/org/springframework/retry/policy/RetryCacheCapacityExceededException.java
* /spring-retry-1-2-5-release-sources-1-jar/org/springframework/classify/PatternMatchingClassifier.java
* /spring-retry-1-2-5-release-sources-1-jar/org/springframework/classify/annotation/Classifier.java
* /spring-retry-1-2-5-release-sources-1-jar/org/springframework/classify/BackToBackPatternClassifier.java
* /spring-retry-1-2-5-release-sources-1-jar/org/springframework/retry/support/RetrySimulator.java

```

```

* /spring-retry-1-2-5-release-sources-1-
jar/org/springframework/retry/policy/SoftReferenceMapRetryContextCache.java
* /spring-retry-1-2-5-release-sources-1-
jar/org/springframework/retry/interceptor/NewMethodArgumentsIdentifier.java
* /spring-retry-1-2-5-release-sources-1-jar/org/springframework/retry/RetryPolicy.java
* /spring-retry-1-2-5-release-sources-1-jar/org/springframework/classify/ClassifierSupport.java
*
/spring-retry-1-2-5-release-sources-1-jar/org/springframework/retry/policy/MapRetryContextCache.java
* /spring-retry-1-2-5-release-sources-1-jar/org/springframework/retry/RecoveryCallback.java
* /spring-retry-1-2-5-release-sources-1-jar/org/springframework/retry/backoff/BackOffInterruptedException.java
* /spring-retry-1-2-5-release-sources-1-jar/org/springframework/classify/Classifier.java
* /spring-retry-1-2-5-release-sources-1-jar/org/springframework/retry/backoff/SleepingBackOffPolicy.java
* /spring-retry-1-2-5-release-sources-1-jar/org/springframework/retry/policy/RetryContextCache.java
* /spring-retry-1-2-5-release-sources-1-jar/org/springframework/retry/RetryStatistics.java
* /spring-retry-1-2-5-release-sources-1-jar/org/springframework/retry/backoff/ObjectWaitSleeper.java
* /spring-retry-1-2-5-release-sources-1-jar/org/springframework/retry/RetryCallback.java
* /spring-retry-1-2-5-release-sources-1-jar/org/springframework/retry/support/RetrySimulation.java
*
/spring-retry-1-2-5-release-sources-1-
jar/org/springframework/retry/interceptor/MethodArgumentsKeyGenerator.java
* /spring-retry-1-2-5-release-sources-1-jar/org/springframework/classify/PatternMatcher.java
* /spring-retry-1-2-5-release-sources-1-jar/org/springframework/retry/RetryContext.java
* /spring-retry-1-2-5-release-sources-1-jar/org/springframework/retry/policy/CompositeRetryPolicy.java
* /spring-retry-1-2-5-release-sources-1-jar/org/springframework/retry/RetryListener.java
* /spring-retry-1-2-5-release-sources-1-jar/org/springframework/retry/policy/TimeoutRetryPolicy.java
* /spring-retry-1-2-5-release-sources-1-jar/org/springframework/retry/interceptor/MethodInvocationRecoverer.java
* /spring-retry-1-2-5-release-sources-1-jar/org/springframework/classify/ClassifierAdapter.java
* /spring-retry-1-2-5-release-sources-1-jar/org/springframework/retry/RetryState.java
* /spring-retry-1-2-5-release-sources-1-jar/org/springframework/retry/TerminatedRetryException.java
*
/spring-retry-1-2-5-release-sources-1-jar/org/springframework/retry/listener/RetryListenerSupport.java
* /spring-retry-1-2-5-release-sources-1-jar/org/springframework/retry/backoff/Sleeper.java
* /spring-retry-1-2-5-release-sources-1-jar/org/springframework/retry/backoff/BackOffContext.java
* /spring-retry-1-2-5-release-sources-1-jar/org/springframework/retry/backoff/BackOffPolicy.java
* /spring-retry-1-2-5-release-sources-1-jar/org/springframework/retry/policy/NeverRetryPolicy.java
* /spring-retry-1-2-5-release-sources-1-jar/org/springframework/retry/RetryException.java
* /spring-retry-1-2-5-release-sources-1-jar/org/springframework/retry/backoff/StatelessBackOffPolicy.java
* /spring-retry-1-2-5-release-sources-1-jar/org/springframework/retry/RetryOperations.java
* /spring-retry-1-2-5-release-sources-1-jar/org/springframework/retry/support/RetrySynchronizationManager.java
* /spring-retry-1-2-5-release-sources-1-jar/org/springframework/retry/support/DefaultRetryState.java
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* /spring-retry-1-2-5-release-sources-1-jar/org/springframework/retry/stats/RetryStatisticsFactory.java

* /spring-retry-1-2-5-release-sources-1-jar/org/springframework/retry/stats/StatisticsListener.java

* /spring-retry-1-2-5-release-sources-1-jar/org/springframework/retry/stats/DefaultStatisticsRepository.java

*

/spring-retry-1-2-5-release-sources-1-jar/org/springframework/retry/stats/ExponentialAverageRetryStatistics.java

* /spring-retry-1-2-5-release-sources-1-jar/org/springframework/retry/stats/DefaultRetryStatisticsFactory.java

* /spring-retry-1-2-5-release-sources-1-jar/org/springframework/retry/stats/DefaultRetryStatistics.java

* /spring-retry-1-2-5-release-sources-1-jar/org/springframework/retry/stats/StatisticsRepository.java

* /spring-retry-1-2-5-release-sources-1-jar/org/springframework/retry/stats/MutableRetryStatistics.java

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* /spring-retry-1-2-5-release-sources-1-jar/org/springframework/retry/backoff/UniformRandomBackOffPolicy.java
* /spring-retry-1-2-5-release-sources-1-jar/org/springframework/retry/context/RetryContextSupport.java
* /spring-retry-1-2-5-release-sources-1-jar/org/springframework/retry/support/RetryTemplate.java
*
* /spring-retry-1-2-5-release-sources-1-jar/org/springframework/retry/backoff/FixedBackOffPolicy.java
* /spring-retry-1-2-5-release-sources-1-jar/org/springframework/retry/backoff/ExponentialBackOffPolicy.java
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- * /spring-retry-1-2-5-release-sources-1-jar/org/springframework/retry/annotation/RetryConfiguration.java
- * /spring-retry-1-2-5-release-sources-1-jar/org/springframework/retry/backoff/ThreadWaitSleeper.java
- *
- /spring-retry-1-2-5-release-sources-1-jar/org/springframework/retry/annotation/Retryable.java
- * /spring-retry-1-2-5-release-sources-1-jar/org/springframework/retry/interceptor/Retryable.java
- * /spring-retry-1-2-5-release-sources-1-jar/org/springframework/classify/util/SimpleMethodInvoker.java

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- * /spring-retry-1-2-5-release-sources-1-jar/org/springframework/retry/annotation/Backoff.java
- * /spring-retry-1-2-5-release-sources-1-jar/org/springframework/retry/annotation/EnableRetry.java

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- * /spring-retry-1-2-5-release-sources-1-jar/org/springframework/retry/interceptor/FixedKeyGenerator.java
- * /spring-retry-1-2-5-release-sources-1-jar/org/springframework/retry/policy/CircuitBreakerRetryPolicy.java
- * /spring-retry-1-2-5-release-sources-1-jar/org/springframework/retry/policy/ExpressionRetryPolicy.java

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* /spring-retry-1-2-5-release-sources-1-jar/org/springframework/classify/util/AnnotationMethodResolver.java
* /spring-retry-1-2-5-release-sources-1-jar/org/springframework/classify/util/MethodResolver.java
* /spring-retry-1-2-5-release-sources-1-jar/org/springframework/classify/util/MethodInvoker.java

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* /spring-retry-1-2-5-release-sources-1-jar/org/springframework/classify/BinaryExceptionClassifier.java
* /spring-retry-1-2-5-release-sources-1-jar/org/springframework/retry/policy/SimpleRetryPolicy.java
* /spring-retry-1-2-5-release-sources-1-jar/org/springframework/classify/SubclassClassifier.java

```

1.226 asm 5.0.4

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- * /asm-5-0-4-sources-6-jar/org/objectweb/asm/optimizer/shrink-resize.properties
- * /asm-5-0-4-sources-6-jar/org/objectweb/asm/optimizer/shrink-signatures.properties
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- */
- /**
- * Creates a new JSRInliner. <i>Subclasses must not use this constructor</i>. Instead, they must use the
- * { @link #JSRInlinerAdapter(int, MethodVisitor, int, String, String, String, String[])} version.
- *
- * @param mv
- *
- the <code>MethodVisitor</code> to send the resulting inlined
- * method code to (use <code>null</code> for none).
- * @param access
- * the method's access flags (see { @link Opcodes}). This
- * parameter also indicates if the method is synthetic and/or
- * deprecated.
- * @param name
- * the method's name.
- * @param desc
- * the method's descriptor (see { @link Type}).
- * @param signature
- * the method's signature. May be <tt>null</tt>.
- * @param exceptions
- * the internal names of the method's exception classes (see
- * { @link Type#getInternalName() getInternalName}). May be
- * <tt>null</tt>.
- * @throws IllegalStateException

* If a subclass calls this constructor.

*/

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*/

/**

* Constructs a new { @link LocalVariableAnnotationNode }. <i>Subclasses must

* not use this constructor</i>. Instead, they must use the

* { @link #LocalVariableAnnotationNode(int, TypePath, LabelNode[], LabelNode[], int[], String)}

* version.

*

* @param typeRef

* a reference to the annotated type. See { @link TypeReference }.

* @param typePath

* the path to the annotated type argument, wildcard bound, array

```

*      element type, or static inner type within 'typeRef'. May be
*      <tt>null</tt> if the annotation targets 'typeRef' as a whole.
* @param start
*      the first instructions corresponding to the continuous ranges
*      that make the scope of this local variable (inclusive).
* @param end
*      the last instructions corresponding to the continuous ranges
*      that make the scope of this local variable (exclusive). This
*      array must have the same size as the 'start' array.
* @param index
*      the local variable's index in each range. This array must have
*      the same size as the 'start' array.
* @param desc
*      the class descriptor of
the annotation class.
*/

```

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* /asm-5-0-4-sources-6-jar/org/objectweb/asm/tree/LocalVariableAnnotationNode.java

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/**

* Constructs a new { @link ClassNode}. <i>Subclasses must not use this
* constructor</i>. Instead, they must use the { @link #ClassNode(int)}
* version.
*
* @throws IllegalStateException
* If a subclass calls this constructor.
*/

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/**

* Creates a new { @link GeneratorAdapter}. <i>Subclasses must not use this

```

* constructor</i>. Instead, they must use the
* { @link #GeneratorAdapter(int, MethodVisitor, int, String, String)}
* version.
*
* @param mv
*     the
method visitor to which this adapter delegates calls.
* @param access
*     the method's access flags (see { @link Opcodes}).
* @param name
*     the method's name.
* @param desc
*     the method's descriptor (see { @link Type Type}).
* @throws IllegalStateException
*     If a subclass calls this constructor.
*/

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- * /asm-5-0-4-sources-6-jar/org/objectweb/asm/xml/SAXAnnotationAdapter.java
- * /asm-5-0-4-sources-6-jar/org/objectweb/asm/xml/Processor.java
- * /asm-5-0-4-sources-6-jar/org/objectweb/asm/xml/SAXFieldAdapter.java

*

/asm-5-0-4-sources-6-jar/org/objectweb/asm/xml/ASMContentHandler.java

* /asm-5-0-4-sources-6-jar/org/objectweb/asm/xml/SAXCodeAdapter.java

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- */
- /**
- * Creates a new { @link AnalyzerAdapter}. <i>Subclasses must not use this constructor</i>. Instead, they must use the
- * { @link #AnalyzerAdapter(int, String, int, String, String, MethodVisitor)}
- * version.
- *
- * @param owner
- *
- * the owner's class name.
- * @param access
- * the method's access flags (see { @link Opcodes}).
- * @param name
- * the method's name.
- * @param desc
- * the method's descriptor (see { @link Type Type}).
- * @param mv
- * the method visitor to which this adapter delegates calls. May
- * be <tt>null</tt>.
- * @throws IllegalStateException
- * If a subclass calls this constructor.
- */

Found in path(s):

* /asm-5-0-4-sources-6-jar/org/objectweb/asm/commons/AnalyzerAdapter.java

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*/

/**

* Constructs a new { @link Textifier}. <i>Subclasses must not use this

* constructor</i>. Instead, they must use the { @link #Textifier(int)}

* version.

*

* @throws IllegalStateException

* If a subclass calls this constructor.

*/

Found in path(s):

* /asm-5-0-4-sources-6-jar/org/objectweb/asm/util/Textifier.java

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- */

Found in path(s):

- * /asm-5-0-4-sources-6-jar/org/objectweb/asm/util/Textifiable.java
- * /asm-5-0-4-sources-6-jar/org/objectweb/asm/util/ASMifiable.java

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* /asm-5-0-4-sources-6-jar/org/objectweb/asm/Label.java
 * /asm-5-0-4-sources-6-jar/org/objectweb/asm/Type.java
 * /asm-5-0-4-sources-6-jar/org/objectweb/asm/AnnotationWriter.java
 * /asm-5-0-4-sources-6-jar/org/objectweb/asm/tree/analysis/SimpleVerifier.java
 *
 /asm-5-0-4-sources-6-jar/org/objectweb/asm/optimizer/NameMapping.java
 * /asm-5-0-4-sources-6-jar/org/objectweb/asm/util/Printer.java
 * /asm-5-0-4-sources-6-jar/org/objectweb/asm/optimizer/Shrinker.java
 * /asm-5-0-4-sources-6-jar/org/objectweb/asm/commons/Method.java
 * /asm-5-0-4-sources-6-jar/org/objectweb/asm/util/CheckAnnotationAdapter.java
 * /asm-5-0-4-sources-6-jar/org/objectweb/asm/commons/RemappingSignatureAdapter.java
 * /asm-5-0-4-sources-6-jar/org/objectweb/asm/commons/RemappingFieldAdapter.java
 * /asm-5-0-4-sources-6-jar/org/objectweb/asm/ClassWriter.java
 * /asm-5-0-4-sources-6-jar/org/objectweb/asm/Attribute.java
 * /asm-5-0-4-sources-6-jar/org/objectweb/asm/tree/analysis/SourceInterpreter.java
 * /asm-5-0-4-sources-6-jar/org/objectweb/asm/tree/MethodInsnNode.java
 * /asm-5-0-4-sources-6-jar/org/objectweb/asm/MethodVisitor.java
 * /asm-5-0-4-sources-6-jar/org/objectweb/asm/util/TraceFieldVisitor.java
 * /asm-5-0-4-sources-6-jar/org/objectweb/asm/tree/analysis/SourceValue.java
 *
 /asm-5-0-4-sources-6-jar/org/objectweb/asm/commons/AdviceAdapter.java
 * /asm-5-0-4-sources-6-jar/org/objectweb/asm/commons/Remapper.java
 * /asm-5-0-4-sources-6-jar/org/objectweb/asm/tree/analysis/BasicValue.java
 * /asm-5-0-4-sources-6-jar/org/objectweb/asm/FieldWriter.java
 * /asm-5-0-4-sources-6-jar/org/objectweb/asm/ByteVector.java
 * /asm-5-0-4-sources-6-jar/org/objectweb/asm/tree/AbstractInsnNode.java
 * /asm-5-0-4-sources-6-jar/org/objectweb/asm/tree/analysis/Interpreter.java
 * /asm-5-0-4-sources-6-jar/org/objectweb/asm/tree/JumpInsnNode.java
 * /asm-5-0-4-sources-6-jar/org/objectweb/asm/commons/TableSwitchGenerator.java
 * /asm-5-0-4-sources-6-jar/org/objectweb/asm/tree/FieldNode.java
 * /asm-5-0-4-sources-6-jar/org/objectweb/asm/tree/FieldInsnNode.java
 * /asm-5-0-4-sources-6-jar/org/objectweb/asm/tree/LabelNode.java
 * /asm-5-0-4-sources-6-jar/org/objectweb/asm/optimizer/ClassConstantsCollector.java

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* /asm-5-0-4-sources-6-jar/org/objectweb/asm/util/CheckSignatureAdapter.java
* /asm-5-0-4-sources-6-jar/org/objectweb/asm/tree/analysis/BasicVerifier.java
*
/asm-5-0-4-sources-6-jar/org/objectweb/asm/commons/CodeSizeEvaluator.java
* /asm-5-0-4-sources-6-jar/org/objectweb/asm/commons/InstructionAdapter.java
* /asm-5-0-4-sources-6-jar/org/objectweb/asm/tree/IntInsnNode.java
* /asm-5-0-4-sources-6-jar/org/objectweb/asm/commons/RemappingClassAdapter.java
* /asm-5-0-4-sources-6-jar/org/objectweb/asm/tree/MultiANewArrayInsnNode.java
* /asm-5-0-4-sources-6-jar/org/objectweb/asm/ClassReader.java
* /asm-5-0-4-sources-6-jar/org/objectweb/asm/tree/VarInsnNode.java
* /asm-5-0-4-sources-6-jar/org/objectweb/asm/commons/RemappingMethodAdapter.java
* /asm-5-0-4-sources-6-jar/org/objectweb/asm/tree/analysis/Value.java
* /asm-5-0-4-sources-6-jar/org/objectweb/asm/commons/StaticInitMerger.java
* /asm-5-0-4-sources-6-jar/org/objectweb/asm/optimizer/AnnotationConstantsCollector.java
* /asm-5-0-4-sources-6-jar/org/objectweb/asm/AnnotationVisitor.java
* /asm-5-0-4-sources-6-jar/org/objectweb/asm/tree/InsnNode.java
*
/asm-5-0-4-sources-6-jar/org/objectweb/asm/signature/SignatureReader.java
* /asm-5-0-4-sources-6-jar/org/objectweb/asm/tree/LdcInsnNode.java
* /asm-5-0-4-sources-6-jar/org/objectweb/asm/tree/LookupSwitchInsnNode.java
* /asm-5-0-4-sources-6-jar/org/objectweb/asm/tree/LineNumberNode.java
* /asm-5-0-4-sources-6-jar/org/objectweb/asm/optimizer/JarOptimizer.java
* /asm-5-0-4-sources-6-jar/org/objectweb/asm/commons/LocalVariablesSorter.java
* /asm-5-0-4-sources-6-jar/org/objectweb/asm/util/TraceAnnotationVisitor.java
* /asm-5-0-4-sources-6-jar/org/objectweb/asm/optimizer/Constant.java
* /asm-5-0-4-sources-6-jar/org/objectweb/asm/tree/TypeAnnotationNode.java
* /asm-5-0-4-sources-6-jar/org/objectweb/asm/Handle.java
* /asm-5-0-4-sources-6-jar/org/objectweb/asm/tree/TryCatchBlockNode.java
* /asm-5-0-4-sources-6-jar/org/objectweb/asm/optimizer/ClassOptimizer.java
* /asm-5-0-4-sources-6-jar/org/objectweb/asm/util/ASMifier.java
* /asm-5-0-4-sources-6-jar/org/objectweb/asm/util/TraceClassVisitor.java
*
/asm-5-0-4-sources-6-jar/org/objectweb/asm/tree/TableSwitchInsnNode.java
* /asm-5-0-4-sources-6-jar/org/objectweb/asm/tree/analysis/Frame.java
* /asm-5-0-4-sources-6-jar/org/objectweb/asm/tree/InvokeDynamicInsnNode.java
* /asm-5-0-4-sources-6-jar/org/objectweb/asm/tree/analysis/AnalyzerException.java
* /asm-5-0-4-sources-6-jar/org/objectweb/asm/tree/analysis/Subroutine.java
* /asm-5-0-4-sources-6-jar/org/objectweb/asm/commons/SerialVersionUIDAdder.java
* /asm-5-0-4-sources-6-jar/org/objectweb/asm/tree/InnerClassNode.java
* /asm-5-0-4-sources-6-jar/org/objectweb/asm/tree/ParameterNode.java
* /asm-5-0-4-sources-6-jar/org/objectweb/asm/tree/LocalVariableNode.java
* /asm-5-0-4-sources-6-jar/org/objectweb/asm/tree/analysis/Analyzer.java
* /asm-5-0-4-sources-6-jar/org/objectweb/asm/tree/analysis/SmallSet.java
* /asm-5-0-4-sources-6-jar/org/objectweb/asm/commons/RemappingAnnotationAdapter.java
* /asm-5-0-4-sources-6-jar/org/objectweb/asm/tree/TypeInsnNode.java
*
/asm-5-0-4-sources-6-jar/org/objectweb/asm/util/TraceSignatureVisitor.java
* /asm-5-0-4-sources-6-jar/org/objectweb/asm/tree/IincInsnNode.java

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- * /asm-5-0-4-sources-6-jar/org/objectweb/asm/optimizer/MethodOptimizer.java
- * /asm-5-0-4-sources-6-jar/org/objectweb/asm/util/CheckFieldAdapter.java
- * /asm-5-0-4-sources-6-jar/org/objectweb/asm/Frame.java
- * /asm-5-0-4-sources-6-jar/org/objectweb/asm/util/CheckMethodAdapter.java
- * /asm-5-0-4-sources-6-jar/org/objectweb/asm/commons/SimpleRemapper.java
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- * /asm-5-0-4-sources-6-jar/org/objectweb/asm/FieldVisitor.java
- * /asm-5-0-4-sources-6-jar/org/objectweb/asm/Context.java
- * /asm-5-0-4-sources-6-jar/org/objectweb/asm/util/TraceMethodVisitor.java
- * /asm-5-0-4-sources-6-jar/org/objectweb/asm/optimizer/MethodConstantsCollector.java
- * /asm-5-0-4-sources-6-jar/org/objectweb/asm/Handler.java
- * /asm-5-0-4-sources-6-jar/org/objectweb/asm/tree/MethodNode.java
- * /asm-5-0-4-sources-6-jar/org/objectweb/asm/tree/InsnList.java
- *
- /asm-5-0-4-sources-6-jar/org/objectweb/asm/optimizer/FieldConstantsCollector.java
- * /asm-5-0-4-sources-6-jar/org/objectweb/asm/MethodWriter.java
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- * /asm-5-0-4-sources-6-jar/org/objectweb/asm/commons/TryCatchBlockSorter.java
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- * /asm-5-0-4-sources-6-jar/org/objectweb/asm/tree/FrameNode.java
- * /asm-5-0-4-sources-6-jar/org/objectweb/asm/optimizer/ConstantPool.java
- * /asm-5-0-4-sources-6-jar/org/objectweb/asm/Opcodes.java
- * /asm-5-0-4-sources-6-jar/org/objectweb/asm/util/CheckClassAdapter.java
- * /asm-5-0-4-sources-6-jar/org/objectweb/asm/signature/SignatureVisitor.java

1.227 jakarta-annotation-api 1.3.5

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* /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/internal/events/InvocationScopedEventSink.java

* /ehcache-3-8-1-sources-1-jar/org/ehcache/config/ResourceUnit.java

*


```

/ehcache-3-8-1-sources-1-jar/org/ehcache/core/Jsr107Cache.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/config/SizedResourcePoolImpl.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/serialization/CompactJavaSerializer.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/jsr107/Eh107IdentityCopier.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/spi/service/OptionalServiceDependencies.java
* /ehcache-3-8-1-sources-1-
jar/org/ehcache/impl/internal/spi/loaderwriter/DefaultCacheLoaderWriterProviderFactory.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/jsr107/CacheResources.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/internal/sizeof/DefaultSizeOfEngineProviderFactory.java
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* /ehcache-3-8-1-sources-1-jar/org/ehcache/core/spi/store/heap/SizeOfEngineProvider.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/core/InternalStatus.java
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* /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/internal/executor/PooledExecutionService.java
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* /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/internal/store/loaderwriter/LocalLoaderWriterStore.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/CacheIterationException.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/config/builders/package-info.java
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* /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/store/DefaultStoreEventDispatcher.java
*
/ehcache-3-8-1-sources-1-jar/org/ehcache/impl/serialization/CharSerializer.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/xml/provider/WriteBehindProviderConfigurationParser.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/config/persistence/CacheManagerPersistenceConfiguration.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/spi/service/ServiceDependencies.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/config/Eviction.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/jsr107/Jsr107Service.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/internal/store/offheap/OffHeapStore.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/internal/store/offheap/HeuristicConfiguration.java

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- * /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/serialization/LongSerializer.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/internal/store/disk/factories/EhcachePersistentSegmentFactory.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/core/config/DefaultConfiguration.java
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- /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/config/serializer/DefaultSerializationProviderConfiguration.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/core/internal/util/ValueSuppliers.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/internal/store/heap/holders/LookupOnlyOnHeapKey.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/serialization/ByteArraySerializer.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/core/spi/time/TimeSourceService.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/internal/store/heap/holders/OnHeapKey.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/spi/copy/CopyProvider.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/spi/service/ServiceCreationConfiguration.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/spi/service/ServiceProvider.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/spi/resilience/ResilienceStrategyProvider.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/core/events/StoreEventDispatcher.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/xml/JaxbHelper.java
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- /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/events/EventDispatchTask.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/config/copy/DefaultCopyProviderConfiguration.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/xml/model/CacheSpec.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/internal/store/BinaryValueHolder.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/jsr107/internal/WrappedCacheLoaderWriter.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/internal/store/offheap/portability/SerializerPortability.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/core/statistics/DefaultStatisticsService.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/config/units/package-info.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/config/builders/PooledExecutionServiceConfigurationBuilder.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/internal/store/offheap/BinaryOffHeapValueHolder.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/xml/ServiceConfigurationParser.java
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- /ehcache-3-8-1-sources-1-jar/org/ehcache/xml/XmlConfiguration.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/core/statistics/TierStatistics.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/core/config/store/package-info.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/xml/service/SimpleCoreServiceConfigurationParser.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/xml/model/CacheDefinition.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/config/loaderwriter/DefaultCacheLoaderWriterConfiguration.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/serialization/TransientStateRepository.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/jsr107/Unwrap.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/core/spi/time/SystemTimeSource.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/internal/executor/PartitionedUnorderedExecutor.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/jsr107/EhcacheExpiryWrapper.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/jsr107/NullCompletionListener.java
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- /ehcache-3-8-1-sources-1-jar/org/ehcache/core/InternalCache.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/internal/store/heap/SimpleBackend.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/internal/store/offheap/OffHeapStoreProviderFactory.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/internal/store/offheap/AbstractOffHeapStore.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/config/BaseCacheConfiguration.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/config/package-info.java

- * /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/persistence/package-info.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/core/statistics/DefaultTierStatistics.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/internal/loaderwriter/writebehind/AbstractWriteBehind.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/config/builders/CacheManagerBuilder.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/internal/store/disk/DiskWriteThreadPool.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/jsr107/config/Jsr107Configuration.java
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- /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/internal/persistence/DefaultDiskResourceServiceFactory.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/jsr107/config/package-info.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/spi/loaderwriter/BulkCacheWritingException.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/copy/IdentityCopier.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/internal/TimeSourceConfiguration.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/core/spi/store/tiering/CachingTier.java
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- * /ehcache-3-8-1-sources-1-jar/org/ehcache/event/CacheEvent.java
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- * /ehcache-3-8-1-sources-1-jar/org/ehcache/package-info.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/config/builders/WriteBehindConfigurationBuilder.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/event/EventFiring.java
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- * /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/internal/resilience/RobustResilienceStrategy.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/StateTransitionException.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/core/events/StateChangeListener.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/expiry/Expiry.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/internal/events/CloseableStoreEventSink.java
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- * /ehcache-3-8-1-sources-1-jar/org/ehcache/xml/provider/PooledExecutionServiceConfigurationParser.java
- * /ehcache-3-8-1-sources-1-
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- * /ehcache-3-8-1-sources-1-jar/org/ehcache/core/events/EventListenerWrapper.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/config/FluentConfigurationBuilder.java
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- * /ehcache-3-8-1-sources-1-jar/org/ehcache/xml/CacheManagerServiceConfigurationParser.java
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- * /ehcache-3-8-1-sources-1-jar/org/ehcache/core/spi/store/events/StoreEvent.java

- * /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/internal/store/offheap/OffHeapValueHolder.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/config/SizedResourcePool.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/internal/classes/ClassInstanceConfiguration.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/config/units/EntryUnit.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/core/spi/store/tiering/package-info.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/internal/executor/OnDemandExecutionService.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/core/events/CacheManagerListener.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/internal/store/loaderwriter/LoaderWriterStoreProviderFactory.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/jsr107/ConfigurationMerger.java
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- * /ehcache-3-8-1-sources-1-jar/org/ehcache/config/builders/ConfigurationBuilder.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/xml/ResourceConfigurationParser.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/internal/sizeof/listeners/exceptions/VisitorListenerException.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/spi/service/Service.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/expiry/Duration.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/spi/loaderwriter/CacheLoaderWriterConfiguration.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/internal/executor/OutOfBandScheduledExecutor.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/config/event/DefaultCacheEventListenerConfiguration.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/core/spi/ServiceLocator.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/core/EhcacheManager.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/config/units/MemoryUnit.java
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- /ehcache-3-8-1-sources-1-jar/org/ehcache/core/statistics/HigherCachingTierOperationOutcomes.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/config/ResourcePools.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/copy/package-info.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/internal/loaderwriter/writebehind/WriteBehind.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/config/event/DefaultCacheEventDispatcherConfiguration.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/core/PersistentUserManagedEhcache.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/spi/loaderwriter/package-info.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/PersistentUserManagedCache.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/internal/spi/serialization/DefaultSerializationProvider.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/config/builders/CacheEventListenerConfigurationBuilder.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/config/event/DefaultEventSourceConfiguration.java
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- /ehcache-3-8-1-sources-1-jar/org/ehcache/core/package-info.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/core/statistics/DelegatingOperationObserver.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/core/statistics/LowerCachingTierOperationsOutcome.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/core/spi/store/tiering/AuthoritativeTier.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/core/spi/store/events/StoreEventSource.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/core/CacheConfigurationProperty.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/copy/SerializingCopier.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/core/DefaultCacheManagerProviderService.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/config/builders/CacheConfigurationBuilder.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/xml/XmlModel.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/config/builders/ExpiryPolicyBuilder.java
- * /ehcache-3-8-1-sources-1-
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/ehcache-3-8-1-sources-1-jar/org/ehcache/core/internal/resilience/ThrowingResilienceStrategy.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/Cache.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/internal/store/offheap/OffHeapStoreUtils.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/internal/spi/resilience/DefaultResilienceStrategyProvider.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/spi/loaderwriter/CacheLoaderWriterProvider.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/expiry/package-info.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/internal/store/disk/OffHeapDiskStore.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/config/persistence/package-info.java
* /ehcache-3-8-1-sources-1-
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* /ehcache-3-8-1-sources-1-jar/org/ehcache/core/statistics/TierOperationOutcomes.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/config/ResourcePool.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/CachePersistenceException.java
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/ehcache-3-8-1-sources-1-jar/org/ehcache/core/events/CacheEventDispatcher.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/spi/service/MaintainableService.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/xml/DomUtil.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/config/builders/UserManagedCacheBuilder.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/config/executor/package-info.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/internal/spi/loaderwriter/DefaultCacheLoaderWriterProvider.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/internal/events/CacheEventDispatcherFactoryImpl.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/spi/serialization/package-info.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/core/spi/store/InternalCacheManager.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/xml/model/CacheTemplate.java
* /ehcache-3-8-1-sources-1-
jar/org/ehcache/impl/config/loaderwriter/writebehind/DefaultWriteBehindConfiguration.java
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* /ehcache-3-8-1-sources-1-jar/org/ehcache/jsr107/config/ConfigurationElementState.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/internal/TimeSourceServiceFactory.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/spi/loaderwriter/WriteBehindConfiguration.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/core/exceptions/StorePassThroughException.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/core/spi/store/events/StoreEventListener.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/xml/provider/DefaultCopyProviderConfigurationParser.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/core/events/StoreEventSink.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/xml/service/DefaultCopierConfigurationParser.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/internal/store/offheap/BasicOffHeapValueHolder.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/internal/store/offheap/EhcacheOffHeapBackingMap.java
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* /ehcache-3-8-1-sources-1-jar/org/ehcache/core/spi/store/heap/package-info.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/jsr107/Eh107CompleteConfiguration.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/internal/loaderwriter/writebehind/operations/DeleteOperation.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/Status.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/spi/serialization/UnsupportedTypeException.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/config/store/heap/DefaultSizeOfEngineProviderConfiguration.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/internal/store/heap/holders/OnHeapValueHolder.java

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- * /ehcache-3-8-1-sources-1-jar/org/ehcache/core/SpecIterator.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/core/exceptions/ExceptionFactory.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/jsr107/internal/DefaultJs107Service.java
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- * /ehcache-3-8-1-sources-1-jar/org/ehcache/core/spi/LifeCycledAdapter.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/internal/util/Pacer.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/spi/loaderwriter/WriteBehindProvider.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/config/event/CacheEventDispatcherFactoryConfiguration.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/xml/provider/CacheEventDispatcherFactoryConfigurationParser.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/core/CacheConfigurationChangeListener.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/core/spi/time/TickingTimeSource.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/serialization/package-info.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/spi/copy/Copier.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/internal/store/heap/holders/BaseOnHeapKey.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/events/CacheEventDispatcherImpl.java
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- /ehcache-3-8-1-sources-1-jar/org/ehcache/jsr107/Eh107CacheEntryEvent.java
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- * /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/internal/sizeof/DefaultSizeOfEngine.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/event/package-info.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/config/serializer/package-info.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/persistence/FileBasedStateRepository.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/core/spi/service/ServiceFactory.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/xml/service/DefaultCacheEventListenerConfigurationParser.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/core/config/package-info.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/spi/persistence/PersistableResourceService.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/config/FluentCacheConfigurationBuilder.java
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- /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/config/loaderwriter/writebehind/DefaultBatchingConfiguration.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/core/statistics/package-info.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/internal/events/FireableStoreEventHandler.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/internal/store/tiering/TieredStoreProviderFactory.java
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- * /ehcache-3-8-1-sources-1-jar/org/ehcache/jsr107/Eh107CacheStatisticsMXBean.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/core/config/ExpiryUtils.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/internal/executor/PartitionedScheduledExecutor.java
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- * /ehcache-3-8-1-sources-1-
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- * /ehcache-3-8-1-sources-1-jar/org/ehcache/xml/CoreServiceConfigurationParser.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/jsr107/config/Jsr107CacheConfiguration.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/core/osgi/EhcacheActivator.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/xml/service/DefaultResilienceStrategyConfigurationParser.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/core/spi/store/WrapperStore.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/internal/store/loaderwriter/LoaderWriterValueHolder.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/core/spi/store/AbstractWrapperStoreProvider.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/store/BaseStore.java
- *
- /ehcache-3-8-1-sources-1-jar/org/ehcache/spi/serialization/SerializerException.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/internal/store/heap/holders/CopiedOnHeapKey.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/config/event/package-info.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/core/spi/LifeCycled.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/internal/store/loaderwriter/LoaderWriterStoreProvider.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/config/store/disk/OffHeapDiskStoreConfiguration.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/xml/provider/OffHeapDiskStoreProviderConfigurationParser.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/spi/resilience/ResilienceStrategy.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/expiry/Expirations.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/xml/model/ListenersConfig.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/config/builders/UserManagedCacheConfiguration.java
- *
- /ehcache-3-8-1-sources-1-jar/org/ehcache/core/exceptions/package-info.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/jsr107/EventListenerAdaptors.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/xml/service/DefaultWriteBehindConfigurationParser.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/core/statistics/OperationObserver.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/internal/store/disk/OffHeapDiskStoreProviderFactory.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/config/ResourceType.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/internal/spi/event/DefaultCacheEventListenerProviderFactory.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/internal/loaderwriter/writebehind/StripedWriteBehind.java
- * /ehcache-3-8-1-sources-1-
- jar/org/ehcache/impl/internal/loaderwriter/writebehind/operations/KeyBasedOperation.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/core/spi/store/events/StoreEventFilter.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/spi/serialization/SerializationProvider.java
- *
- /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/internal/resilience/RobustLoaderWriterResilienceStrategy.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/core/spi/service/CacheManagerProviderService.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/internal/events/StoreEventImpl.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/internal/resilience/AbstractResilienceStrategy.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/spi/loaderwriter/CacheWritingException.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/core/statistics/CachingTierOperationOutcomes.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/internal/store/heap/Backend.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/xml/service/OffHeapDiskStoreConfigurationParser.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/core/spi/service/ExecutionService.java
- * /ehcache-3-8-1-sources-1-
- jar/org/ehcache/impl/config/resilience/DefaultResilienceStrategyProviderConfiguration.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/jsr107/internal/tck/Eh107MBeanServerBuilder.java
- *

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/ehcache-3-8-1-sources-1-jar/org/ehcache/core/resilience/DefaultRecoveryStore.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/core/spi/store/tiering/LowerCachingTier.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/jsr107/Eh107CacheLoaderWriter.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/core/config/store/StoreEventSourceConfiguration.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/core/statistics/AuthoritativeTierOperationOutcomes.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/core/util/ClassLoading.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/config/persistence/UserManagedPersistenceContext.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/jsr107/ListenerResources.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/xml/service/DefaultCacheEventDispatcherConfigurationParser.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/core/statistics/ChainedObserver.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/internal/store/offheap/OffHeapMapStatistics.java
*
/ehcache-3-8-1-sources-1-
jar/org/ehcache/impl/internal/loaderwriter/writebehind/BatchingLocalHeapWriteBehindQueue.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/core/statistics/DefaultStatisticsServiceFactory.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/internal/sizeof/NoopSizeOfEngine.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/internal/executor/DefaultExecutionServiceFactory.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/events/CacheEventAdapter.java
* /ehcache-3-8-1-sources-1-
jar/org/ehcache/impl/internal/spi/resilience/DefaultResilienceStrategyProviderFactory.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/internal/util/ThreadFactoryUtil.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/core/spi/store/events/package-info.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/xml/BaseConfigParser.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/core/statistics/DelegatedMappedOperationStatistics.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/core/spi/store/package-info.java
*
/ehcache-3-8-1-sources-1-jar/org/ehcache/core/events/CacheEventListenerConfiguration.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/internal/sizeof/DefaultSizeOfEngineProvider.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/internal/executor/PartitionedOrderedExecutor.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/config/builders/CacheManagerConfiguration.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/internal/store/offheap/SwitchableEvictionAdvisor.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/spi/resilience/RecoveryStore.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/xml/multi/XmlMultiConfiguration.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/spi/serialization/StatefulSerializer.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/core/spi/time/package-info.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/jsr107/Eh107Expiry.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/core/store/StoreSupport.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/store/HashUtils.java
*
/ehcache-3-8-1-sources-1-jar/org/ehcache/core/statistics/BulkOps.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/jsr107/Eh107CacheLoaderWriterProvider.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/internal/store/heap/holders/SerializedOnHeapValueHolder.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/core/collections/ConcurrentWeakIdentityHashMap.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/jsr107/EhcacheCachingProvider.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/xml/model/SizeOfEngineLimits.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/config/store/heap/package-info.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/internal/events/DisabledCacheEventNotificationService.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/spi/service/PluralService.java

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* /ehcache-3-8-1-sources-1-jar/org/ehcache/core/spi/service/StatisticsService.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/core/spi/store/heap/LimitExceededException.java
*
/ehcache-3-8-1-sources-1-jar/org/ehcache/core/spi/store/tiering/HigherCachingTier.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/core/spi/package-info.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/internal/executor/ExecutorUtil.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/UserManagedCache.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/xml/provider/CacheManagerPersistenceConfigurationParser.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/core/statistics/StatsUtils.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/core/spi/service/DiskResourceService.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/core/spi/time/TimeSource.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/internal/store/offheap/LazyOffHeapValueHolder.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/spi/resilience/package-info.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/internal/store/tiering/CompoundCachingTier.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/jsr107/Eh107CacheMXBean.java
*
/ehcache-3-8-1-sources-1-jar/org/ehcache/core/Ehcache.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/jsr107/Eh107CacheManager.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/internal/loaderwriter/writebehind/operations/BatchOperation.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/internal/persistence/DefaultLocalPersistenceServiceFactory.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/events/package-info.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/xml/provider/ThreadPoolServiceCreationConfigurationParser.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/config/executor/PooledExecutionServiceConfiguration.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/xml/provider/DefaultSerializationProviderConfigurationParser.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/config/ResourcePoolsImpl.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/internal/store/tiering/TieredStore.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/config/builders/ResourcePoolsBuilder.java
*
/ehcache-3-8-1-sources-1-jar/org/ehcache/impl/persistence/DefaultDiskResourceService.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/persistence/FileUtils.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/core/util/CollectionUtil.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/xml/CoreServiceCreationConfigurationParser.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/core/HumanReadable.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/internal/store/tiering/CompoundCachingTierProviderFactory.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/jsr107/Eh107ReverseConfiguration.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/config/EvictionAdvisor.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/spi/copy/package-info.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/core/statistics/ValueStatistic.java
* /ehcache-3-8-1-sources-1-
jar/org/ehcache/impl/internal/loaderwriter/writebehind/NonBatchingLocalHeapWriteBehindQueue.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/internal/events/FudgingInvocationScopedEventSink.java
*
/ehcache-3-8-1-sources-1-jar/org/ehcache/config/CacheConfiguration.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/internal/DefaultTimeSourceService.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/core/statistics/DefaultCacheStatistics.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/core/config/store/StoreStatisticsConfiguration.java
* /ehcache-3-8-1-sources-1-
jar/org/ehcache/impl/internal/store/offheap/portability/OffHeapValueHolderPortability.java

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- * /ehcache-3-8-1-sources-1-jar/org/ehcache/config/Builder.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/core/statistics/CacheOperationOutcomes.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/jsr107/internal/Js107ServiceConfigurationParser.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/core/statistics/DelegatingOperationStatistic.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/core/events/CacheEventDispatcherFactory.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/core/EhcacheRuntimeConfiguration.java
- *
- /ehcache-3-8-1-sources-1-jar/org/ehcache/spi/persistence/package-info.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/ValueSupplier.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/internal/events/StoreEvents.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/persistence/DefaultLocalPersistenceService.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/core/statistics/ChainedOperationObserver.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/core/osgi/SafeOsgi.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/core/statistics/StoreOperationOutcomes.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/jsr107/Eh107Cache.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/serialization/IntegerSerializer.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/core/events/NullStoreEventDispatcher.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/internal/store/heap/holders/CopiedOnHeapValueHolder.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/serialization/TransientStateHolder.java
- *
- /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/config/store/heap/DefaultSizeOfEngineConfiguration.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/config/store/disk/package-info.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/jsr107/internal/Js107CacheLoaderWriter.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/config/copy/DefaultCopierConfiguration.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/xml/service/DefaultCacheLoaderWriterConfigurationParser.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/xml/model/Expiry.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/spi/serialization/Serializer.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/core/spi/service/ServiceUtils.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/internal/events/ThreadLocalStoreEventDispatcher.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/internal/store/offheap/MemorySizeParser.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/CacheManager.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/core/spi/service/FileBasedPersistenceContext.java
- *
- /ehcache-3-8-1-sources-1-jar/org/ehcache/core/util/ByteBufferInputStream.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/jsr107/Eh107MXBean.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/xml/CacheResourceConfigurationParser.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/core/EhcacheBase.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/xml/ConfigurationParser.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/spi/resilience/StoreAccessException.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/xml/service/DefaultSizeOfEngineConfigurationParser.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/xml/exceptions/XmlConfigurationException.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/internal/store/heap/OnHeapStore.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/xml/ServiceCreationConfigurationParser.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/spi/persistence/StateRepository.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/config/Configuration.java
- *
- /ehcache-3-8-1-sources-1-jar/org/ehcache/core/statistics/SuppliedValueStatistic.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/config/loaderwriter/writebehind/package-info.java

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* /ehcache-3-8-1-sources-1-jar/org/ehcache/core/spi/store/heap/SizeOfEngine.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/event/CacheEventListener.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/spi/persistence/StateHolder.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/internal/store/heap/KeyCopyBackend.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/internal/classes/ClassInstanceProviderConfiguration.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/internal/sizeof/listeners/EhcacheVisitorListener.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/core/events/CacheEvents.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/core/osgi/OsgiServiceLoader.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/core/statistics/ZeroOperationStatistic.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/core/spi/store/Store.java
*
/ehcache-3-8-1-sources-1-jar/org/ehcache/impl/internal/util/ServiceUtil.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/serialization/FloatSerializer.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/internal/events/AbstractStoreEventDispatcher.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/config/copy/package-info.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/core/CacheConfigurationChangeEvent.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/config/resilience/DefaultResilienceStrategyConfiguration.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/core/statistics/SourceStatistic.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/core/spi/store/ConfigurationChangeSupport.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/config/AbstractResourcePool.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/event/EventOrdering.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/core/statistics/CacheStatistics.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/config/CacheRuntimeConfiguration.java
*
/ehcache-3-8-1-sources-1-jar/org/ehcache/xml/CoreCacheConfigurationParser.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/jsr107/internal/Jsr107CacheConfigurationParser.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/spi/service/package-info.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/core/statistics/Jsr107LatencyMonitor.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/xml/provider/DefaultSizeOfEngineProviderConfigurationParser.java
* /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/internal/spi/event/DefaultCacheEventListenerProvider.java
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- * /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/internal/classes/commonslang/ArrayUtils.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/internal/classes/commonslang/reflect/MemberUtils.java
- *
- /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/internal/classes/commonslang/ClassUtils.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/internal/classes/commonslang/reflect/MethodUtils.java
- * /ehcache-3-8-1-sources-1-jar/org/ehcache/impl/internal/classes/commonslang/reflect/ConstructorUtils.java

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org.ehcache.jsr107.internal.Jsr107CacheConfigurationParser

Found in path(s):

- * /ehcache-3-8-1-sources-1-jar/META-INF/services/org.ehcache.xml.CacheServiceConfigurationParser

1.231 classmate 1.5.1

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Java ClassMate library was originally written by Tatu Saloranta (tatu.saloranta@iki.fi)

Other developers who have contributed code are:

- * Brian Langel

1.232 commons-lang3 3.10

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* /jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/constraints/FutureOrPresent.java

* /jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/constraints/Null.java

* /jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/ConstraintValidatorContext.java

* /jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/metadata/ExecutableDescriptor.java

* /jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/groups/Default.java

* /jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/MessageInterpolator.java

*

/jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/metadata/package-info.java

* /jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/valueextraction/Unwrapping.java

* /jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/valueextraction/ValueExtractor.java

* /jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/constraintvalidation/ValidationTarget.java

* /jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/metadata/MethodDescriptor.java

* /jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/package-info.java

- * /jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/UnexpectedTypeException.java
- * /jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/metadata/BeanDescriptor.java
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- * /jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/bootstrap/ProviderSpecificBootstrap.java
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- /jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/valueextraction/UnwrapByDefault.java
- * /jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/constraints/NegativeOrZero.java
- * /jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/ConstraintViolation.java
- * /jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/ConstraintDefinitionException.java
- * /jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/metadata/ValidateUnwrappedValue.java
- * /jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/constraintvalidation/SupportedValidationTarget.java
- * /jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/groups/package-info.java
- * /jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/spi/ValidationProvider.java
- * /jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/ElementKind.java
- * /jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/metadata/GroupConversionDescriptor.java
- * /jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/valueextraction/ExtractedValue.java
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- /jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/bootstrap/GenericBootstrap.java
- * /jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/metadata/MethodType.java
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- jar/javax/validation/valueextraction/ValueExtractorDeclarationException.java
- * /jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/metadata/ConstructorDescriptor.java
- * /jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/constraintvalidation/package-info.java
- * /jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/constraints/AssertTrue.java
- * /jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/Path.java
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- * /jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/valueextraction/package-info.java
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- jar/javax/validation/valueextraction/ValueExtractorDefinitionException.java
- * /jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/BootstrapConfiguration.java
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- * /jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/metadata/ContainerElementTypeDescriptor.java
- * /jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/GroupDefinitionException.java
- * /jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/constraints/Min.java
- * /jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/groups/ConvertGroup.java
- * /jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/metadata/Scope.java
- * /jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/constraints/Max.java
- * /jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/ReportAsSingleViolation.java
- * /jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/metadata/ReturnValueDescriptor.java
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- /jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/ParameterNameProvider.java
- * /jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/constraints/Pattern.java
- * /jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/NoProviderFoundException.java
- * /jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/Validation.java
- * /jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/ValidatorContext.java
- * /jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/constraints/NotBlank.java

- * /jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/spi/package-info.java
- * /jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/Constraint.java
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- * /jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/executable/ValidateOnExecution.java
- * /jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/constraints/Size.java
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- * /jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/bootstrap/package-info.java
- * /jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/TraversableResolver.java
- * /jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/executable/ExecutableValidator.java
- * /jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/ValidationProviderResolver.java
- * /jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/ValidatorFactory.java
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- * /jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/metadata/ParameterDescriptor.java
- * /jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/constraints/NotNull.java
- * /jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/constraints/package-info.java
- * /jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/GroupSequence.java
- * /jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/constraints/Negative.java
- * /jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/ConstraintValidatorFactory.java
- * /jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/ValidationException.java
- * /jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/OverridesAttribute.java
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- * /jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/metadata/PropertyDescriptor.java
- * /jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/ConstraintValidator.java
- * /jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/executable/ExecutableType.java
- * /jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/constraints/AssertFalse.java
- * /jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/constraints/Future.java
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- * /jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/spi/ConfigurationState.java
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- /jakarta-validation-api-2-0-2-sources-3-jar/javax/validation/constraints/DecimalMin.java
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1.236 log4j-to-slf4j 2.13.3

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1.237 javassist 3.24.0-GA

1.237.1 Available under license :

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Found in path(s):

* /javassist-3-24-0-ga-sources-5-jar/javassist/bytecode/annotation/MemberValue.java
 * /javassist-3-24-0-ga-sources-5-jar/javassist/bytecode/annotation/AnnotationMemberValue.java
 * /javassist-3-24-0-ga-sources-5-jar/javassist/bytecode/annotation/StringMemberValue.java
 *
 /javassist-3-24-0-ga-sources-5-jar/javassist/bytecode/annotation/Annotation.java
 * /javassist-3-24-0-ga-sources-5-jar/javassist/bytecode/annotation/MemberValueVisitor.java
 * /javassist-3-24-0-ga-sources-5-jar/javassist/bytecode/annotation/ClassMemberValue.java
 * /javassist-3-24-0-ga-sources-5-jar/javassist/bytecode/annotation/DoubleMemberValue.java
 * /javassist-3-24-0-ga-sources-5-jar/javassist/bytecode/annotation/FloatMemberValue.java
 * /javassist-3-24-0-ga-sources-5-jar/javassist/bytecode/annotation/EnumMemberValue.java
 * /javassist-3-24-0-ga-sources-5-jar/javassist/bytecode/annotation/CharMemberValue.java
 * /javassist-3-24-0-ga-sources-5-jar/javassist/bytecode/annotation/ByteMemberValue.java
 * /javassist-3-24-0-ga-sources-5-jar/javassist/bytecode/annotation/BooleanMemberValue.java
 * /javassist-3-24-0-ga-sources-5-jar/javassist/bytecode/annotation/IntegerMemberValue.java
 * /javassist-3-24-0-ga-sources-5-jar/javassist/bytecode/annotation/ShortMemberValue.java
 *
 /javassist-3-24-0-ga-sources-5-jar/javassist/bytecode/annotation/ArrayMemberValue.java
 * /javassist-3-24-0-ga-sources-5-jar/javassist/bytecode/annotation/LongMemberValue.java
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- * /javassist-3-24-0-ga-sources-5-jar/javassist/tools/rmi/StubGenerator.java
- * /javassist-3-24-0-ga-sources-5-jar/javassist/compiler/ast/BinExpr.java
- * /javassist-3-24-0-ga-sources-5-jar/javassist/compiler/SymbolTable.java
- *
- /javassist-3-24-0-ga-sources-5-jar/javassist/bytecode/BadBytecode.java
- * /javassist-3-24-0-ga-sources-5-jar/javassist/tools/web/Webserver.java
- * /javassist-3-24-0-ga-sources-5-jar/javassist/bytecode/NestMembersAttribute.java
- * /javassist-3-24-0-ga-sources-5-jar/javassist/convert/TransformBefore.java
- * /javassist-3-24-0-ga-sources-5-jar/javassist/tools/rmi/Proxy.java
- * /javassist-3-24-0-ga-sources-5-jar/javassist/bytecode/analysis/SubroutineScanner.java
- * /javassist-3-24-0-ga-sources-5-jar/javassist/bytecode/InstructionPrinter.java
- * /javassist-3-24-0-ga-sources-5-jar/javassist/tools/Callback.java
- * /javassist-3-24-0-ga-sources-5-jar/javassist/runtime/Inner.java
- * /javassist-3-24-0-ga-sources-5-jar/javassist/CtNewWrappedConstructor.java
- * /javassist-3-24-0-ga-sources-5-jar/javassist/util/proxy/DefineClassHelper.java
- * /javassist-3-24-0-ga-sources-5-jar/javassist/ByteArrayClassPath.java
- * /javassist-3-24-0-ga-sources-5-jar/javassist/bytecode/DuplicateMemberException.java
- *
- /javassist-3-24-0-ga-sources-5-jar/javassist/expr/NewArray.java
- * /javassist-3-24-0-ga-sources-5-jar/javassist/CtBehavior.java
- * /javassist-3-24-0-ga-sources-5-jar/javassist/bytecode/ExceptionTable.java
- * /javassist-3-24-0-ga-sources-5-jar/javassist/tools/reflect/ClassMetaobject.java
- * /javassist-3-24-0-ga-sources-5-jar/javassist/tools/rmi/ObjectImporter.java
- * /javassist-3-24-0-ga-sources-5-jar/javassist/bytecode/stackmap/TypedBlock.java
- * /javassist-3-24-0-ga-sources-5-jar/javassist/compiler/ProceedHandler.java
- * /javassist-3-24-0-ga-sources-5-jar/javassist/bytecode/ByteStream.java
- * /javassist-3-24-0-ga-sources-5-jar/javassist/bytecode/stackmap/MapMaker.java
- * /javassist-3-24-0-ga-sources-5-jar/javassist/scopedpool/ScopedClassPoolFactoryImpl.java
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jar/org/springframework/security/config/annotation/web/configurers/PortMapperConfigurer.java
*

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/spring-security-config-5-3-4-release-sources-
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* /spring-security-config-5-3-4-release-sources-
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* /spring-security-config-5-3-4-release-sources-
jar/org/springframework/security/config/annotation/web/configurers/AnonymousConfigurer.java
* /spring-security-config-5-3-4-release-sources-
jar/org/springframework/security/config/annotation/web/configurers/RequestCacheConfigurer.java
* /spring-security-config-5-3-4-release-sources-
jar/org/springframework/security/config/annotation/AbstractSecurityBuilder.java
* /spring-security-config-5-3-4-release-sources-
jar/org/springframework/security/config/annotation/authentication/configurers/userdetails/UserDetailsServiceConfigurer.java
* /spring-security-config-5-3-4-release-sources-
jar/org/springframework/security/config/annotation/web/configuration/SpringWebMvcImportSelector.java
*
/spring-security-config-5-3-4-release-sources-
jar/org/springframework/security/config/annotation/authentication/configurers/provisioning/InMemoryUserDetails
ManagerConfigurer.java
* /spring-security-config-5-3-4-release-sources-
jar/org/springframework/security/config/annotation/authentication/configurers/userdetails/AbstractDaoAuthenticatio
nConfigurer.java
* /spring-security-config-5-3-4-release-sources-
jar/org/springframework/security/config/annotation/authentication/builders/AuthenticationManagerBuilder.java
* /spring-security-config-5-3-4-release-sources-
jar/org/springframework/security/config/annotation/web/configurers/JeeConfigurer.java
* /spring-security-config-5-3-4-release-sources-
jar/org/springframework/security/config/annotation/web/configurers/FormLoginConfigurer.java
* /spring-security-config-5-3-4-release-sources-
jar/org/springframework/security/config/annotation/web/servlet/configuration/EnableWebMvcSecurity.java
* /spring-security-config-5-3-4-release-sources-
jar/org/springframework/security/config/annotation/SecurityConfigurer.java
*
/spring-security-config-5-3-4-release-sources-
jar/org/springframework/security/config/annotation/method/configuration/EnableGlobalMethodSecurity.java
* /spring-security-config-5-3-4-release-sources-
jar/org/springframework/security/config/annotation/SecurityConfigurerAdapter.java
* /spring-security-config-5-3-4-release-sources-
jar/org/springframework/security/config/annotation/AbstractConfiguredSecurityBuilder.java
* /spring-security-config-5-3-4-release-sources-
jar/org/springframework/security/config/annotation/authentication/ProviderManagerBuilder.java
* /spring-security-config-5-3-4-release-sources-
jar/org/springframework/security/config/annotation/authentication/configuration/EnableGlobalAuthentication.java
* /spring-security-config-5-3-4-release-sources-
jar/org/springframework/security/config/annotation/SecurityBuilder.java
* /spring-security-config-5-3-4-release-sources-
jar/org/springframework/security/config/annotation/authentication/configurers/provisioning/JdbcUserDetailsManage
rConfigurer.java

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/spring-security-config-5-3-4-release-sources-
jar/org/springframework/security/config/annotation/web/configurers/PermitAllSupport.java
* /spring-security-config-5-3-4-release-sources-
jar/org/springframework/security/config/annotation/web/configurers/AbstractHttpConfigurer.java
* /spring-security-config-5-3-4-release-sources-
jar/org/springframework/security/config/annotation/authentication/configurers/userdetails/UserDetailsAwareConfig
urer.java
* /spring-security-config-5-3-4-release-sources-
jar/org/springframework/security/config/annotation/AlreadyBuiltException.java
* /spring-security-config-5-3-4-release-sources-
jar/org/springframework/security/config/annotation/web/configurers/AbstractConfigAttributeRequestMatcherRegist
ry.java
* /spring-security-config-5-3-4-release-sources-
jar/org/springframework/security/config/annotation/authentication/configurers/userdetails/DaoAuthenticationConfig
urer.java
*
/spring-security-config-5-3-4-release-sources-
jar/org/springframework/security/config/annotation/method/configuration/GlobalMethodSecurityAspectJAutoProxy
Registrar.java
* /spring-security-config-5-3-4-release-sources-
jar/org/springframework/security/config/annotation/ObjectPostProcessor.java
* /spring-security-config-5-3-4-release-sources-
jar/org/springframework/security/config/annotation/web/configuration/AutowiredWebSecurityConfigurersIgnorePar
ents.java
* /spring-security-config-5-3-4-release-sources-
jar/org/springframework/security/config/annotation/web/builders/FilterComparator.java
* /spring-security-config-5-3-4-release-sources-
jar/org/springframework/security/config/annotation/web/configurers/AbstractInterceptUrlConfigurer.java
* /spring-security-config-5-3-4-release-sources-
jar/org/springframework/security/config/annotation/authentication/configurers/provisioning/UserDetailsManagerCo
nfigurer.java
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jar/org/springframework/security/config/annotation/web/WebSecurityConfigurer.java
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jar/org/springframework/security/config/annotation/authentication/configuration/GlobalAuthenticationConfigurerAdapter.java
*
/spring-security-config-5-3-4-release-sources-
jar/org/springframework/security/config/annotation/web/reactive/EnableWebFluxSecurity.java
* /spring-security-config-5-3-4-release-sources-
jar/org/springframework/security/config/core/userdetails/UserDetailsMapFactoryBean.java
* /spring-security-config-5-3-4-release-sources-
jar/org/springframework/security/config/annotation/method/configuration/EnableReactiveMethodSecurity.java
* /spring-security-config-5-3-4-release-sources-
jar/org/springframework/security/config/annotation/web/configurers/oauth2/client/ImplicitGrantConfigurer.java
* /spring-security-config-5-3-4-release-sources-
jar/org/springframework/security/config/web/server/SecurityWebFiltersOrder.java
* /spring-security-config-5-3-4-release-sources-
jar/org/springframework/security/config/core/userdetails/ReactiveUserDetailsServiceResourceFactoryBean.java
* /spring-security-config-5-3-4-release-sources-
jar/org/springframework/security/config/provisioning/UserDetailsManagerResourceFactoryBean.java
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/spring-security-config-5-3-4-release-sources-
jar/org/springframework/security/config/web/server/AbstractServerWebExchangeMatcherRegistry.java
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* /spring-security-config-5-3-4-release-sources-
jar/org/springframework/security/config/web/servlet/session/SessionConcurrencyDsl.kt
* /spring-security-config-5-3-4-release-sources-
jar/org/springframework/security/config/http/OAuth2ClientBeanDefinitionParser.java
*
/spring-security-config-5-3-4-release-sources-
jar/org/springframework/security/config/web/server/ServerHttpSecurity.java
* /spring-security-config-5-3-4-release-sources-
jar/org/springframework/security/config/web/servlet/headers/FrameOptionsDsl.kt
* /spring-security-config-5-3-4-release-sources-
jar/org/springframework/security/config/web/servlet/headers/ReferrerPolicyDsl.kt
* /spring-security-config-5-3-4-release-sources-
jar/org/springframework/security/config/web/servlet/headers/XssProtectionConfigDsl.kt
* /spring-security-config-5-3-4-release-sources-
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jar/org/springframework/security/config/web/servlet/oauth2/resourceserver/JwtDsl.kt
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jar/org/springframework/security/config/web/servlet/SecurityMarker.kt
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* /spring-security-config-5-3-4-release-sources-
jar/org/springframework/security/config/web/servlet/oauth2/login/UserInfoEndpointDsl.kt
* /spring-security-config-5-3-4-release-sources-
jar/org/springframework/security/config/web/servlet/oauth2/login/TokenEndpointDsl.kt
* /spring-security-config-5-3-4-release-sources-
jar/org/springframework/security/config/web/servlet/session/SessionFixationDsl.kt
* /spring-security-config-5-3-4-release-sources-
jar/org/springframework/security/config/web/servlet/oauth2/client/AuthorizationCodeGrantDsl.kt

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* /spring-security-config-5-3-4-release-sources-
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/spring-security-config-5-3-4-release-sources-
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* /spring-security-config-5-3-4-release-sources-
jar/org/springframework/security/config/web/servlet/headers/HttpStrictTransportSecurityDsl.kt
* /spring-security-config-5-3-4-release-sources-
jar/org/springframework/security/config/web/servlet/headers/ContentTypeOptionsDsl.kt
* /spring-security-config-5-3-4-release-sources-jar/org/springframework/security/config/Elements.java
* /spring-security-config-5-3-4-release-sources-
jar/org/springframework/security/config/web/servlet/headers/ContentSecurityPolicyDsl.kt
* /spring-security-config-5-3-4-release-sources-
jar/org/springframework/security/config/web/servlet/headers/CacheControlDsl.kt
* /spring-security-config-5-3-4-release-sources-
jar/org/springframework/security/config/oauth2/client/ClientRegistrationsBeanDefinitionParser.java
*
/spring-security-config-5-3-4-release-sources-
jar/org/springframework/security/config/web/servlet/SessionManagementDsl.kt
* /spring-security-config-5-3-4-release-sources-
jar/org/springframework/security/config/http/HttpSecurityBeanDefinitionParser.java
* /spring-security-config-5-3-4-release-sources-
jar/org/springframework/security/config/annotation/web/configurers/oauth2/server/resource/OAuth2ResourceServer
Configurer.java
* /spring-security-config-5-3-4-release-sources-
jar/org/springframework/security/config/web/servlet/AbstractRequestMatcherDsl.kt
* /spring-security-config-5-3-4-release-sources-
jar/org/springframework/security/config/annotation/web/builders/WebSecurity.java
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* /spring-security-config-5-3-4-release-sources-
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* /spring-security-config-5-3-4-release-sources-
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* /spring-security-config-5-3-4-release-sources-
jar/org/springframework/security/config/web/servlet/oauth2/login/AuthorizationEndpointDsl.kt
* /spring-security-config-5-3-4-release-sources-
jar/org/springframework/security/config/web/servlet/OAuth2ResourceServerDsl.kt
* /spring-security-config-5-3-4-release-sources-

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jar/org/springframework/security/config/web/servlet/HttpBasicDsl.kt
* /spring-security-config-5-3-4-release-sources-
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*
/spring-security-config-5-3-4-release-sources-
jar/org/springframework/security/config/web/servlet/RequiresChannelDsl.kt
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jar/org/springframework/security/config/http/RememberMeBeanDefinitionParser.java
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* /spring-security-config-5-3-4-release-sources-jar/org/springframework/security/config/authentication/JdbcUserServiceBeanDefinitionParser.java
* /spring-security-config-5-3-4-release-sources-jar/org/springframework/security/config/authentication/AuthenticationProviderBeanDefinitionParser.java
*
* /spring-security-config-5-3-4-release-sources-jar/org/springframework/security/config/http/FilterChainBeanDefinitionParser.java
* /spring-security-config-5-3-4-release-sources-jar/org/springframework/security/config/authentication/PasswordEncoderParser.java
* /spring-security-config-5-3-4-release-sources-jar/org/springframework/security/config/http/HttpFirewallBeanDefinitionParser.java
* /spring-security-config-5-3-4-release-sources-jar/org/springframework/security/config/http/ChannelAttributeFactory.java
* /spring-security-config-5-3-4-release-sources-jar/org/springframework/security/config/BeanIds.java
* /spring-security-config-5-3-4-release-sources-jar/org/springframework/security/config/method/ProtectPointcutPostProcessor.java
* /spring-security-config-5-3-4-release-sources-jar/org/springframework/security/config/package-info.java
* /spring-security-config-5-3-4-release-sources-jar/org/springframework/security/config/http/package-info.java
*
* /spring-security-config-5-3-4-release-sources-jar/org/springframework/security/config/ldap/ContextSourceSettingPostProcessor.java
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* /spring-security-config-5-3-4-release-sources-


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jar/org/springframework/security/config/method/InterceptMethodsBeanDefinitionDecorator.java
* /spring-security-config-5-3-4-release-sources-jar/org/springframework/security/config/authentication/package-
info.java
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jar/org/springframework/security/config/http/FilterChainMapBeanDefinitionDecorator.java
* /spring-security-config-5-3-4-release-sources-
jar/org/springframework/security/config/authentication/AbstractUserDetailsServiceBeanDefinitionParser.java
* /spring-security-config-5-3-4-release-sources-jar/org/springframework/security/config/ldap/package-info.java
*
/spring-security-config-5-3-4-release-sources-jar/org/springframework/security/config/method/package-info.java
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* /spring-security-config-5-3-4-release-sources-
jar/org/springframework/security/config/http/FilterInvocationSecurityMetadataSourceParser.java
* /spring-security-config-5-3-4-release-sources-
jar/org/springframework/security/config/http/SessionCreationPolicy.java
* /spring-security-config-5-3-4-release-sources-
jar/org/springframework/security/config/http/PortMappingsBeanDefinitionParser.java
* /spring-security-config-5-3-4-release-sources-
jar/org/springframework/security/config/http/UserDetailsServiceFactoryBean.java
* /spring-security-config-5-3-4-release-sources-
jar/org/springframework/security/config/annotation/web/messaging/MessageSecurityMetadataSourceRegistry.java
* /spring-security-config-5-3-4-release-sources-
jar/org/springframework/security/config/DebugBeanDefinitionParser.java
*
/spring-security-config-5-3-4-release-sources-
jar/org/springframework/security/config/authentication/UserServiceBeanDefinitionParser.java
* /spring-security-config-5-3-4-release-sources-
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* /spring-security-config-5-3-4-release-sources-
jar/org/springframework/security/config/method/MethodSecurityMetadataSourceBeanDefinitionParser.java
* /spring-security-config-5-3-4-release-sources-
jar/org/springframework/security/config/core/GrantedAuthorityDefaults.java
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* /spring-security-config-5-3-4-release-sources-

jar/org/springframework/security/config/annotation/rsocket/RSocketSecurityConfiguration.java

* /spring-security-config-5-3-4-release-sources-

jar/org/springframework/security/config/annotation/rsocket/EnableRSocketSecurity.java

*

/spring-security-config-5-3-4-release-sources-

jar/org/springframework/security/config/annotation/rsocket/SecuritySocketAcceptorInterceptorConfiguration.java

* /spring-security-config-5-3-4-release-sources-

jar/org/springframework/security/config/annotation/rsocket/PayloadInterceptorOrder.java

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Found in path(s):

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jar/org/springframework/security/config/annotation/web/configurers/oauth2/client/OAuth2LoginConfigurer.java

* /spring-security-config-5-3-4-release-sources-

jar/org/springframework/security/config/annotation/web/servlet/configuration/WebMvcSecurityConfiguration.java

*

/spring-security-config-5-3-4-release-sources-

jar/org/springframework/security/config/http/HeadersBeanDefinitionParser.java

* /spring-security-config-5-3-4-release-sources-

jar/org/springframework/security/config/annotation/web/configuration/WebMvcSecurityConfiguration.java

* /spring-security-config-5-3-4-release-sources-

jar/org/springframework/security/config/annotation/method/configuration/Js250MetadataSourceConfiguration.java

* /spring-security-config-5-3-4-release-sources-

jar/org/springframework/security/config/annotation/web/AbstractRequestMatcherRegistry.java

* /spring-security-config-5-3-4-release-sources-

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jar/org/springframework/security/config/annotation/web/configurers/openid/OpenIDLoginConfigurer.java
* /spring-security-config-5-3-4-release-sources-
jar/org/springframework/security/config/annotation/method/configuration/GlobalMethodSecurityConfiguration.java
* /spring-security-config-5-3-4-release-sources-
jar/org/springframework/security/config/annotation/web/configuration/OAuth2ClientConfiguration.java
*
/spring-security-config-5-3-4-release-sources-
jar/org/springframework/security/config/annotation/web/configurers/AbstractAuthenticationFilterConfigurer.java
* /spring-security-config-5-3-4-release-sources-
jar/org/springframework/security/config/annotation/authentication/configuration/InitializeAuthenticationProviderBeanManagerConfigurer.java
* /spring-security-config-5-3-4-release-sources-
jar/org/springframework/security/config/annotation/web/configurers/oauth2/client/OAuth2ClientConfigurer.java
* /spring-security-config-5-3-4-release-sources-
jar/org/springframework/security/config/annotation/web/configurers/HeadersConfigurer.java
* /spring-security-config-5-3-4-release-sources-
jar/org/springframework/security/config/annotation/web/configuration/WebSecurityConfiguration.java
* /spring-security-config-5-3-4-release-sources-
jar/org/springframework/security/config/annotation/web/configuration/OAuth2ImportSelector.java
* /spring-security-config-5-3-4-release-sources-
jar/org/springframework/security/config/crypto/RsaKeyConversionServicePostProcessor.java
*
/spring-security-config-5-3-4-release-sources-
jar/org/springframework/security/config/annotation/web/configurers/HttpBasicConfigurer.java
* /spring-security-config-5-3-4-release-sources-
jar/org/springframework/security/config/annotation/web/configurers/LogoutConfigurer.java
* /spring-security-config-5-3-4-release-sources-
jar/org/springframework/security/config/annotation/web/configurers/CsrfConfigurer.java
* /spring-security-config-5-3-4-release-sources-
jar/org/springframework/security/config/annotation/web/configurers/saml2/Saml2LoginConfigurer.java
* /spring-security-config-5-3-4-release-sources-
jar/org/springframework/security/config/annotation/web/reactive/ServerHttpSecurityConfiguration.java
* /spring-security-config-5-3-4-release-sources-
jar/org/springframework/security/config/annotation/web/reactive/ReactiveOAuth2ClientImportSelector.java
* /spring-security-config-5-3-4-release-sources-
jar/org/springframework/security/config/annotation/authentication/configuration/AuthenticationConfiguration.java
*
/spring-security-config-5-3-4-release-sources-
jar/org/springframework/security/config/annotation/web/socket/AbstractSecurityWebSocketMessageBrokerConfigurer.java
* /spring-security-config-5-3-4-release-sources-
jar/org/springframework/security/config/annotation/web/builders/HttpSecurity.java
* /spring-security-config-5-3-4-release-sources-
jar/org/springframework/security/config/annotation/authentication/configuration/InitializeUserDetailsBeanManagerConfigurer.java
* /spring-security-config-5-3-4-release-sources-
jar/org/springframework/security/config/annotation/method/configuration/ReactiveMethodSecurityConfiguration.java

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* /spring-security-config-5-3-4-release-sources-
jar/org/springframework/security/config/annotation/configuration/ObjectPostProcessorConfiguration.java
* /spring-security-config-5-3-4-release-sources-
jar/org/springframework/security/config/annotation/web/configurers/SessionManagementConfigurer.java
*
/spring-security-config-5-3-4-release-sources-jar/org/springframework/security/config/Customizer.java
* /spring-security-config-5-3-4-release-sources-
jar/org/springframework/security/config/ldap/LdapServerBeanDefinitionParser.java
* /spring-security-config-5-3-4-release-sources-
jar/org/springframework/security/config/annotation/web/reactive/WebFluxSecurityConfiguration.java
* /spring-security-config-5-3-4-release-sources-
jar/org/springframework/security/config/http/LogoutBeanDefinitionParser.java
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Found in path(s):

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* /spring-security-config-5-3-4-release-sources-
jar/org/springframework/security/config/annotation/method/configuration/MethodSecurityMetadataSourceAdvisorR
egistrar.java
* /spring-security-config-5-3-4-release-sources-
jar/org/springframework/security/config/websocket/WebSocketMessageBrokerSecurityBeanDefinitionParser.java
*
/spring-security-config-5-3-4-release-sources-
jar/org/springframework/security/config/annotation/method/configuration/GlobalMethodSecuritySelector.java
* /spring-security-config-5-3-4-release-sources-
jar/org/springframework/security/config/annotation/web/configurers/oauth2/client/OAuth2ClientConfigurerUtils.jav
a
* /spring-security-config-5-3-4-release-sources-
jar/org/springframework/security/config/annotation/authentication/configurers/ldap/LdapAuthenticationProviderCon
figurer.java
* /spring-security-config-5-3-4-release-sources-
jar/org/springframework/security/config/annotation/web/configuration/WebSecurityConfigurerAdapter.java
* /spring-security-config-5-3-4-release-sources-

```

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jar/org/springframework/security/config/annotation/web/configuration/EnableWebSecurity.java
* /spring-security-config-5-3-4-release-sources-
jar/org/springframework/security/config/annotation/web/configurers/ExpressionUrlAuthorizationConfigurer.java
* /spring-security-config-5-3-4-release-sources-
jar/org/springframework/security/config/http/FormLoginBeanDefinitionParser.java
*
/spring-security-config-5-3-4-release-sources-
jar/org/springframework/security/config/method/GlobalMethodSecurityBeanDefinitionParser.java
* /spring-security-config-5-3-4-release-sources-
jar/org/springframework/security/config/annotation/web/configurers/ServletApiConfigurer.java
* /spring-security-config-5-3-4-release-sources-
jar/org/springframework/security/config/oauth2/client/CommonOAuth2Provider.java
* /spring-security-config-5-3-4-release-sources-
jar/org/springframework/security/config/authentication/AuthenticationManagerBeanDefinitionParser.java
* /spring-security-config-5-3-4-release-sources-
jar/org/springframework/security/config/http/CorsBeanDefinitionParser.java
* /spring-security-config-5-3-4-release-sources-
jar/org/springframework/security/config/annotation/web/configurers/UrlAuthorizationConfigurer.java
* /spring-security-config-5-3-4-release-sources-
jar/org/springframework/security/config/annotation/configuration/AutowireBeanFactoryObjectPostProcessor.java
*
/spring-security-config-5-3-4-release-sources-
jar/org/springframework/security/config/core/userdetails/UserDetailsResourceFactoryBean.java
* /spring-security-config-5-3-4-release-sources-
jar/org/springframework/security/config/annotation/web/configurers/SecurityContextConfigurer.java
* /spring-security-config-5-3-4-release-sources-
jar/org/springframework/security/config/annotation/web/configurers/ExceptionHandlerConfigurer.java
* /spring-security-config-5-3-4-release-sources-
jar/org/springframework/security/config/annotation/web/configurers/CorsConfigurer.java
* /spring-security-config-5-3-4-release-sources-
jar/org/springframework/security/config/annotation/web/configurers/X509Configurer.java
* /spring-security-config-5-3-4-release-sources-
jar/org/springframework/security/config/authentication/AuthenticationManagerFactoryBean.java
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jar/org/springframework/security/config/http/GrantedAuthorityDefaultsParserUtils.java

* /spring-security-config-5-3-4-release-sources-

jar/org/springframework/security/config/http/HandlerMappingIntrospectorFactoryBean.java

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1.241 objenesis 3.1

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1.251 grpc-go 1.9.1

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1.252 libdrm 2.4.45

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1.253 cryptsetup 1.7.5

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AES in libhcrypto

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rijndael-alg-fst.c

@version 3.0 (December 2000)

Optimised ANSI C code for the Rijndael cipher (now AES)

@author Vincent Rijmen <vincent.rijmen@esat.kuleuven.ac.be>
@author Antoon Bosselaers <antoon.bosselaers@esat.kuleuven.ac.be>
@author Paulo Barreto <paulo.barreto@terra.com.br>

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DES core in libcrypto

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D3DES (V5.09) -

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Thanks to: Dan Hoey for his excellent Initial and Inverse permutation code; Jim Gillogly & Phil Karn for the DES key schedule code; Dennis Ferguson, Eric Young and Dana How for comparing notes; and Ray Lau, for humouring me on.

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lib/hcrypto/test_dh.c

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1.258 jackson-databind-nullable 0.2.1

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1.260 log4j-api 2.13.3

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rrule.js: Library for working with recurrence rules for calendar dates.

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1.266 react-day-picker 7.4.8

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1.267 open-ldap 2.4.58

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1.268 runc 1.0.0-rc9

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1.269 berkeley-db 4.4.20

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1.270 importlib-metadata 0.18

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1.271 urllib3 1.25.3

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Contributions to the urllib3 project

Creator & Maintainer

* Andrey Petrov <andrey.petrov@shazow.net>

Contributors

In chronological order:

* victor.vde <<http://code.google.com/u/victor.vde/>>

* HTTPS patch (which inspired HTTPSConnectionPool)

* erikcederstrand <<http://code.google.com/u/erikcederstrand/>>

* NTLM-authenticated HTTPSConnectionPool

* Basic-authenticated HTTPSConnectionPool (merged into make_headers)

* niphlod <niphlod@gmail.com>

* Client-verified SSL certificates for HTTPSConnectionPool

* Response gzip and deflate encoding support

* Better unicode support for filepost using StringIO buffers

* btoconnor <brian@btoconnor.net>

* Non-multipart encoding for POST requests

* p.dobrogost <<http://code.google.com/u/@WBRSRIBZDhBFXQB6/>>

* Code review, PEP8 compliance, benchmark fix

* kennethreitz <me@kennethreitz.com>

* Bugfixes, suggestions, Requests integration

* georgemarshall <<https://github.com/georgemarshall>>

* Bugfixes, Improvements and Test

coverage

* Thomas Kluyver <thomas@kluyver.me.uk>

* Python 3 support

* brandon-rhodes <<http://rhodesmill.org/brandon>>

* Design review, bugfixes, test coverage.

* studer <theo.studer@gmail.com>

* IPv6 url support and test coverage

* Shivaram Lingamneni <slingamn@cs.stanford.edu>

* Support for explicitly closing pooled connections

- * hartator <hartator@gmail.com>
- * Corrected multipart behavior for params

- * Thomas Weischuh <thomas@t-8ch.de>
- * Support for TLS SNI
- * API unification of ssl_version/cert_reqs
- * SSL fingerprint and alternative hostname verification
- * Bugfixes in testsuite

- * Sune Kirkeby <mig@ibofobi.dk>
- * Optional SNI-support for Python 2 via PyOpenSSL.

- * Marc Schlaich <marc.schlaich@gmail.com>
- * Various bugfixes and test improvements.

- * Bryce Boe <bbzbryce@gmail.com>
- * Correct six.moves conflict
- * Fixed pickle support of some exceptions

- * Boris Figovsky <boris.figovsky@ravellosystems.com>
- * Allowed to skip SSL hostname verification

- * Cory Benfield
- <<https://lukasa.co.uk/about/>>
- * Stream method for Response objects.
- * Return native strings in header values.
- * Generate 'Host' header when using proxies.

- * Jason Robinson <jaywink@basshero.org>
- * Add missing WrappedSocket.fileno method in PyOpenSSL

- * Audrius Butkevicius <audrius.butkevicius@elastichosts.com>
- * Fixed a race condition

- * Stanislav Vitkovskiy <stas.vitkovsky@gmail.com>
- * Added HTTPS (CONNECT) proxy support

- * Stephen Holsapple <sholsapp@gmail.com>
- * Added abstraction for granular control of request fields

- * Martin von Gagern <Martin.vGagern@gmx.net>
- * Support for non-ASCII header parameters

- * Kevin Burke <kev@inburke.com> and Pavel Kirichenko <juanych@yandex-team.ru>
- * Support for separate connect and request timeouts

- * Peter Waller <p@pwaller.net>

- * `HTTPResponse.tell()` for determining amount received over the wire
- * Nipunn Koorapati <nipunn1313@gmail.com>
- * Ignore default ports when comparing hosts for equality
- * Danilo @dbrgn <https://dbrgn.ch/>
- * Disabled TLS compression by default on Python 3.2+
- * Disabled TLS compression in `pyopenssl` contrib module
- * Configurable cipher suites in `pyopenssl` contrib module
- * Roman Bogorodskiy <roman.bogorodskiy@ericsson.com>
- * Account retries on proxy errors
- * Nicolas Delaby <nicolas.delaby@ezeep.com>
- * Use the platform-specific CA certificate locations
- * Josh Schneier <https://github.com/jschneier>
- * `HTTPHeaderDict` and associated tests and docs
- * Bugfixes, docs, test coverage
- * Tahia Khan <http://tahia.tk/>
- * Added Timeout examples in docs
- * Arthur Grunseid <https://grunseid.com>
- * `source_address` support and tests (with <https://github.com/bui>)
- * Ian Cordasco <graffatcolmingov@gmail.com>
- * PEP8 Compliance and Linting
- * Add ability to pass socket options to an HTTP Connection
- * Erik Tollerud <erik.tollerud@gmail.com>
- * Support for standard library `io` module.
- * Krishna Prasad <kprasad.iitd@gmail.com>
- * Google App Engine documentation
- * Aaron Meurer
<asmeurer@gmail.com>
- * Added `Url.url`, which unparses a `Url`
- * Evgeny Kapun <abacabadabacaba@gmail.com>
- * Bugfixes
- * Benjamin Meyer <bm_witness@yahoo.com>
- * Security Warning Documentation update for proper capture
- * Shivan Sornarajah <github@sornars.com>
- * Support for using `ConnectionPool` and `PoolManager` as context managers.

- * Alex Gaynor <alex.gaynor@gmail.com>
- * Updates to the default SSL configuration

- * Tomas Tomecek <ttomecek@redhat.com>
- * Implemented generator for getting chunks from chunked responses.

- * tlynn <https://github.com/tlynn>
- * Respect the warning preferences at import.

- * David D. Riddle <ddriddle@illinois.edu>
- * IPv6 bugfixes in testsuite

- * Thea Flowers <magicalgirl@google.com>
- * App Engine environment tests.
- * Documentation re-write.

- * John Krauss <https://github.com/talos>
- * Clues to debugging problems with `cryptography` dependency in docs

- * Disassem <https://github.com/Disassem>
- * Fix pool-default headers not applying for url-encoded requests like GET.

- * James Atherfold <jlatherfold@hotmail.com>
- * Bugfixes relating to cleanup of connections during errors.

- * Christian Pedersen <https://github.com/chripede>
- * IPv6 HTTPS proxy bugfix

- * Jordan Moldow <https://github.com/jmoldow>
- * Fix low-level exceptions leaking from ``HTTPResponse.stream()``.
- * Bugfix for ``ConnectionPool.urlopen(release_conn=False)``.
- * Creation of ``HTTPConnectionPool.ResponseCls``.

- * Predrag Gruevski <https://github.com/obi1kenobi>
- * Made cert digest comparison use a constant-time algorithm.

- * Adam Talsma <https://github.com/a-tal>
- * Bugfix to ca_cert file paths.

- * Evan Meagher <https://evanmeagher.net>
- * Bugfix related to `memoryview` usage in PyOpenSSL adapter

- * John Vandenberg <jayvdb@gmail.com>
- * Python 2.6 fixes; pyflakes and pep8 compliance

- * Andy Caldwell <andy.m.caldwell@googlemail.com>

- * Bugfix related to reusing connections in indeterminate states.

- * Ville Skytt <ville.skytta@iki.fi>
- * Logging efficiency
- improvements, spelling fixes, Travis config.

- * Shige Takeda <smtakeda@gmail.com>
- * Started Recipes documentation and added a recipe about handling concatenated gzip data in HTTP response

- * Jess Shapiro <jesse@jesseshapiro.net>
- * Various character-encoding fixes/tweaks
- * Disabling IPv6 DNS when IPv6 connections not supported

- * David Foster <http://dafoster.net/>
- * Ensure order of request and response headers are preserved.

- * Jeremy Cline <jeremy@jcline.org>
- * Added connection pool keys by scheme

- * Aviv Palivoda <palaviv@gmail.com>
- * History list to Retry object.
- * HTTPResponse contains the last Retry object.

- * Nate Prewitt <nate.prewitt@gmail.com>
- * Ensure timeouts are not booleans and greater than zero.
- * Fixed infinite loop in ``stream`` when amt=None.
- * Added length_remaining to determine remaining data to be read.
- * Added enforce_content_length to raise exception when incorrect content-length received.

- * Seth Michael Larson <sethmichaellarson@protonmail.com>
- * Created selectors backport that supports PEP 475.

- * Alexandre Dias <alex.dias@smarkets.com>
- * Don't retry on timeout if method not in whitelist

- * Moinuddin Quadri <moin18@gmail.com>
- * Lazily load idna package

- * Tom White <s6yg1ez3@mail2tor.com>
- * Made SOCKS handler differentiate socks5h from socks5 and socks4a from socks4.

- * Tim Burke <tim.burke@gmail.com>
- * Stop buffering entire deflate-encoded responses.

- * Tuukka Mustonen <tuukka.mustonen@gmail.com>
- * Add counter for status_forcelist retries.

- * Erik Rose <erik@mozilla.com>

- * Bugfix to pyopenssl vendoring
- * Wolfgang Richter <wolfgang.richter@gmail.com>
- * Bugfix related to loading full certificate chains with PyOpenSSL backend.
- * Mike Miller <github@mikeage.net>
- * Logging improvements to include the HTTP(S) port when opening a new connection
- * Ioannis Tziakos <mail@itziakos.gr>
- * Fix ``util.selectors._fileobj_to_fd`` to accept ``long``.
- * Update appveyor tox setup to use the 64bit python.
- * Akamai
(through Jess Shapiro) <jshapiro@akamai.com>
- * Ongoing maintenance; 2017-2018
- * Dominique Leuenberger <dimstar@opensuse.org>
- * Minor fixes in the test suite
- * Will Bond <will@wbond.net>
- * Add Python 2.6 support to ``contrib.securetransport``
- * Aleksei Alekseev <alekseev.yeskela@gmail.com>
- * using auth info for socks proxy
- * Chris Wilcox <git@crwilcox.com>
- * Improve contribution guide
- * Add ``HTTPResponse.geturl`` method to provide ``urllib2.urlopen().geturl()`` behavior
- * Bruce Merry <https://www.brucemerry.org.za>
- * Fix leaking exceptions when system calls are interrupted with zero timeout
- * Hugo van Kemenade <https://github.com/hugovk>
- * Drop support for EOL Python 2.6
- * Tim Bell <https://github.com/timb07>
- * Bugfix for responses with Content-Type: message/* logging warnings
- * Justin Bramley <https://github.com/jbramleycl>
- * Add ability to handle multiple Content-Encodings
- * Katsuhiko YOSHIDA <https://github.com/kyoshidajp>
- * Remove Authorization header
regardless of case when redirecting to cross-site
- * [Your name or handle] <[email or website]>
- * [Brief summary of your changes]

1.272 python-requests 2.22.0

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1.273 attrs 19.1.0

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1.274 swagger 2.1.9

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 */
```

Found in path(s):

```
* /swagger-annotations-2-1-9-sources-jar/io/swagger/v3/oas/annotations/security/SecuritySchemes.java
* /swagger-annotations-2-1-9-sources-jar/io/swagger/v3/oas/annotations/headers/Header.java
* /swagger-annotations-2-1-9-sources-jar/io/swagger/v3/oas/annotations/responses/ApiResponse.java
* /swagger-annotations-2-1-9-sources-jar/io/swagger/v3/oas/annotations/media/Encoding.java
*
* /swagger-annotations-2-1-9-sources-jar/io/swagger/v3/oas/annotations/Hidden.java
* /swagger-annotations-2-1-9-sources-jar/io/swagger/v3/oas/annotations/security/OAuthScope.java
* /swagger-annotations-2-1-9-sources-jar/io/swagger/v3/oas/annotations/media/Schema.java
* /swagger-annotations-2-1-9-sources-jar/io/swagger/v3/oas/annotations/media/DiscriminatorMapping.java
* /swagger-annotations-2-1-9-sources-jar/io/swagger/v3/oas/annotations/security/SecurityRequirement.java
* /swagger-annotations-2-1-9-sources-jar/io/swagger/v3/oas/annotations/links/Link.java
* /swagger-annotations-2-1-9-sources-jar/io/swagger/v3/oas/annotations/ExternalDocumentation.java
* /swagger-annotations-2-1-9-sources-jar/io/swagger/v3/oas/annotations/servers/Servers.java
* /swagger-annotations-2-1-9-sources-jar/io/swagger/v3/oas/annotations/security/OAuthFlow.java
* /swagger-annotations-2-1-9-sources-jar/io/swagger/v3/oas/annotations/servers/Server.java
*
* /swagger-annotations-2-1-9-sources-jar/io/swagger/v3/oas/annotations/media/ExampleObject.java
* /swagger-annotations-2-1-9-sources-jar/io/swagger/v3/oas/annotations/callbacks/Callbacks.java
* /swagger-annotations-2-1-9-sources-jar/io/swagger/v3/oas/annotations/security/SecurityRequirements.java
* /swagger-annotations-2-1-9-sources-jar/io/swagger/v3/oas/annotations/OpenAPIDefinition.java
* /swagger-annotations-2-1-9-sources-jar/io/swagger/v3/oas/annotations/tags/Tags.java
* /swagger-annotations-2-1-9-sources-jar/io/swagger/v3/oas/annotations/security/SecurityScheme.java
* /swagger-annotations-2-1-9-sources-jar/io/swagger/v3/oas/annotations/info/Info.java
* /swagger-annotations-2-1-9-sources-jar/io/swagger/v3/oas/annotations/Operation.java
* /swagger-annotations-2-1-9-sources-jar/io/swagger/v3/oas/annotations/Parameter.java
```

- * /swagger-annotations-2-1-9-sources-jar/io/swagger/v3/oas/annotations/Parameters.java
- * /swagger-annotations-2-1-9-sources-jar/io/swagger/v3/oas/annotations/media/Content.java
- *
- /swagger-annotations-2-1-9-sources-jar/io/swagger/v3/oas/annotations/responses/ApiResponses.java
- * /swagger-annotations-2-1-9-sources-jar/io/swagger/v3/oas/annotations/info/Contact.java
- * /swagger-annotations-2-1-9-sources-jar/io/swagger/v3/oas/annotations/security/OAuthFlows.java
- * /swagger-annotations-2-1-9-sources-jar/io/swagger/v3/oas/annotations/info/License.java
- * /swagger-annotations-2-1-9-sources-jar/io/swagger/v3/oas/annotations/tags/Tag.java
- * /swagger-annotations-2-1-9-sources-jar/io/swagger/v3/oas/annotations/parameters/RequestBody.java
- * /swagger-annotations-2-1-9-sources-jar/io/swagger/v3/oas/annotations/callbacks/Callback.java
- * /swagger-annotations-2-1-9-sources-jar/io/swagger/v3/oas/annotations/links/LinkParameter.java
- * /swagger-annotations-2-1-9-sources-jar/io/swagger/v3/oas/annotations/extensions/Extensions.java
- * /swagger-annotations-2-1-9-sources-jar/io/swagger/v3/oas/annotations/servers/ServerVariable.java

1.275 swagger-integration 2.1.9

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Manifest-Version: 1.0

Bundle-Description: swagger-integration

Automatic-Module-Name: io.swagger.v3.oas.integration

Bundle-License: "Apache License 2.0";link="http://www.apache.org/licenses/LICENSE-2.0.html"

package: io.swagger

Bundle-SymbolicName: io.swagger.core.v3.swagger-integration

implementation-version: 2.1.9

Built-By: runner

Bundle-ManifestVersion: 2

Bundle-DocURL: <https://github.com/swagger-api/swagger-core/modules/swagger-integration>

Import-Package: com.fasterxml.jackson.annotation;version="[2.12,3)",com.fasterxml.jackson.databind;version="[2.12,3)",com.fasterxml.jackson.databind.annotation;version="[2.12,3)",io.github.classgraph;version="[4.8,5)",io.swagger.v3.core.converter;version="[2.1,3)",io.swagger.v3.core.jackson;version="[2.1,3)",io.swagger.v3.core.util;version="[2.1,3)",io.swagger.v3.oas.annotations;version="[2.1,3)",io.swagger.v3.oas.integration,io.swagger.v3.oas.integration.api,io.swagger.v3.oas.models;version="[2.1,3)",io.swagger.v3.oas.models.media;version="[2.1,3)",org.apache.commons.lang3;version="[3.7,4)",org.apache.commons.lang3.tuple;version="[3.7,4)",org.slf4j;version="[1.7,2)"

Require-Capability: osgi.ee;filter="(&(osgi.ee=JavaSE)(version=1.8))"

Bundle-Developers: fehguy;email="fehguy@gmail.com";name="Tony Tam",web
ron;email="webron@gmail.com";name="Ron Ratovsky"

url: <https://github.com/swagger-api/swagger-core/modules/swagger-integration>

mode: development

Export-Package: io.swagger.v3.oas.integration;uses:="com.fasterxml.jackson.databind,io.swagger.v3.core.converter,io.swagger.v3.core.util,io.swagger.v3.oas.integration.api,io.swagger.v3.oas.models,org.apache.commons.lang3.tuple,org.slf4j";version="2.1.9",io.swagger.v3.oas.integration.api;uses:="com.fasterxml.jackson.databind,io.swagger.v3.core.converter,io.swagger.v3.oas.integration,io.swagger.v3.oas.models";version="2.1.9"

Bundle-Name: swagger-integration

Bundle-Version:

2.1.9

Bundle-SCM: url="https://github.com/swagger-api/swagger-core/modules/swagger-integration",connection="scm:git:git@github.com:swagger-api/swagger-core.git/modules/swagger-integration",developer-connection="scm:git:git@github.com:swagger-api/swagger-core.git/modules/swagger-integration",tag=HEAD

Created-By: Apache Maven 3.6.3

Build-Jdk: 1.8.0_282

Found in path(s):

* /swagger-integration-2-1-9-jar/META-INF/MANIFEST.MF

1.276 swagger-models 2.1.9

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Found in path(s):

* /swagger-models-2-1-9-sources-jar/io/swagger/v3/oas/models/security/Scopes.java

* /swagger-models-2-1-9-sources-jar/io/swagger/v3/oas/models/media/ByteArraySchema.java

* /swagger-models-2-1-9-sources-jar/io/swagger/v3/oas/models/security/OAuthFlows.java

* /swagger-models-2-1-9-sources-jar/io/swagger/v3/oas/models/Paths.java

```

*
/swagger-models-2-1-9-sources-jar/io/swagger/v3/oas/models/media/ComposedSchema.java
* /swagger-models-2-1-9-sources-jar/io/swagger/v3/oas/models/media/DateTimeSchema.java
* /swagger-models-2-1-9-sources-jar/io/swagger/v3/oas/models/tags/Tag.java
* /swagger-models-2-1-9-sources-jar/io/swagger/v3/oas/models/media/EncodingProperty.java
* /swagger-models-2-1-9-sources-jar/io/swagger/v3/oas/models/parameters/CookieParameter.java
* /swagger-models-2-1-9-sources-jar/io/swagger/v3/oas/models/security/SecurityScheme.java
* /swagger-models-2-1-9-sources-jar/io/swagger/v3/oas/models/servers/ServerVariable.java
* /swagger-models-2-1-9-sources-jar/io/swagger/v3/oas/models/media/Content.java
* /swagger-models-2-1-9-sources-jar/io/swagger/v3/oas/models/examples/Example.java
* /swagger-models-2-1-9-sources-jar/io/swagger/v3/oas/models/security/OAuthFlow.java
* /swagger-models-2-1-9-sources-jar/io/swagger/v3/oas/models/media/StringSchema.java
* /swagger-models-2-1-9-sources-jar/io/swagger/v3/oas/models/Operation.java
*
/swagger-models-2-1-9-sources-jar/io/swagger/v3/oas/models/media/UUIDSchema.java
* /swagger-models-2-1-9-sources-jar/io/swagger/v3/oas/models/info/License.java
* /swagger-models-2-1-9-sources-jar/io/swagger/v3/oas/models/media/XML.java
* /swagger-models-2-1-9-sources-jar/io/swagger/v3/oas/models/info/Info.java
* /swagger-models-2-1-9-sources-jar/io/swagger/v3/oas/models/media/DateSchema.java
* /swagger-models-2-1-9-sources-jar/io/swagger/v3/oas/models/media/MediaType.java
* /swagger-models-2-1-9-sources-jar/io/swagger/v3/oas/models/servers/ServerVariables.java
* /swagger-models-2-1-9-sources-jar/io/swagger/v3/oas/models/parameters/PathParameter.java
* /swagger-models-2-1-9-sources-jar/io/swagger/v3/oas/models/info/Contact.java
* /swagger-models-2-1-9-sources-jar/io/swagger/v3/oas/models/responses/ApiResponse.java
* /swagger-models-2-1-9-sources-jar/io/swagger/v3/oas/models/ExternalDocumentation.java
* /swagger-models-2-1-9-sources-jar/io/swagger/v3/oas/models/links/Link.java
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/swagger-models-2-1-9-sources-jar/io/swagger/v3/oas/models/media/MapSchema.java
* /swagger-models-2-1-9-sources-jar/io/swagger/v3/oas/models/responses/ApiResponses.java
* /swagger-models-2-1-9-sources-jar/io/swagger/v3/oas/models/parameters/RequestBody.java
* /swagger-models-2-1-9-sources-jar/io/swagger/v3/oas/models/media/NumberSchema.java
* /swagger-models-2-1-9-sources-jar/io/swagger/v3/oas/models/parameters/Parameter.java
* /swagger-models-2-1-9-sources-jar/io/swagger/v3/oas/models/servers/Server.java
* /swagger-models-2-1-9-sources-jar/io/swagger/v3/oas/models/callbacks/Callback.java
* /swagger-models-2-1-9-sources-jar/io/swagger/v3/oas/models/media/FileSchema.java
* /swagger-models-2-1-9-sources-jar/io/swagger/v3/oas/models/media/BinarySchema.java
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* /swagger-models-2-1-9-sources-jar/io/swagger/v3/oas/models/media/Encoding.java
* /swagger-models-2-1-9-sources-jar/io/swagger/v3/oas/models/media/PasswordSchema.java
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/swagger-models-2-1-9-sources-jar/io/swagger/v3/oas/models/parameters/HeaderParameter.java
* /swagger-models-2-1-9-sources-jar/io/swagger/v3/oas/models/links/LinkParameter.java
* /swagger-models-2-1-9-sources-jar/io/swagger/v3/oas/models/media/BooleanSchema.java
* /swagger-models-2-1-9-sources-jar/io/swagger/v3/oas/models/media/EmailSchema.java
* /swagger-models-2-1-9-sources-jar/io/swagger/v3/oas/models/Components.java
* /swagger-models-2-1-9-sources-jar/io/swagger/v3/oas/models/OpenAPI.java
* /swagger-models-2-1-9-sources-jar/io/swagger/v3/oas/models/media/ObjectSchema.java
* /swagger-models-2-1-9-sources-jar/io/swagger/v3/oas/models/PathItem.java

```

* /swagger-models-2-1-9-sources-jar/io/swagger/v3/oas/models/media/IntegerSchema.java
* /swagger-models-2-1-9-sources-jar/io/swagger/v3/oas/models/media/Schema.java
* /swagger-models-2-1-9-sources-jar/io/swagger/v3/oas/models/parameters/QueryParameter.java
* /swagger-models-2-1-9-sources-jar/io/swagger/v3/oas/models/media/ArraySchema.java
*
/swagger-models-2-1-9-sources-jar/io/swagger/v3/oas/models/security/SecurityRequirement.java

1.277 lz4 1.9.2-2ubuntu0.20.04.1

1.277.1 Available under license :

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Upstream-Name: lz4

Source: <https://github.com/Cyan4973/lz4>

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Files: lib/lz4frame.c

lib/lz4frame_static.h

lib/xxhash.c

lib/xxhash.h

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Files: ./examples/printVersion.c

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Files: ./examples/blockStreaming_lineByLine.c

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Files: ./examples/HCStreaming_ringBuffer.c

./examples/blockStreaming_ringBuffer.c

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Files: ./examples/compress_functions.c

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1.278 xalan-c 1.11-9build1

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procfs provides functions to retrieve system, kernel and process metrics from the pseudo-filesystem proc.

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CAST128

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DES

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MD2

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MD4

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MD5

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SHA224, SHA256, SHA384, and SHA512

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* /gson-2-8-6-sources-1-jar/com/google/gson/Gson.java
* /gson-2-8-6-sources-1-jar/com/google/gson/JsonIOException.java
* /gson-2-8-6-sources-1-jar/com/google/gson/JsonObject.java
* /gson-2-8-6-sources-1-jar/com/google/gson/JsonSerializer.java
* /gson-2-8-6-sources-1-jar/com/google/gson/internal/ObjectConstructor.java
* /gson-2-8-6-sources-1-jar/com/google/gson/JsonNull.java
* /gson-2-8-6-sources-1-jar/com/google/gson/JsonDeserializationContext.java
* /gson-2-8-6-sources-1-jar/com/google/gson/JsonElement.java
* /gson-2-8-6-sources-1-jar/com/google/gson/GsonBuilder.java
*
/gson-2-8-6-sources-1-jar/com/google/gson/FieldNamingPolicy.java
* /gson-2-8-6-sources-1-jar/com/google/gson/FieldNamingStrategy.java
* /gson-2-8-6-sources-1-jar/com/google/gson/DefaultDateTypeAdapter.java
* /gson-2-8-6-sources-1-jar/com/google/gson/annotations/Until.java
* /gson-2-8-6-sources-1-jar/com/google/gson/annotations/SerializedName.java
* /gson-2-8-6-sources-1-jar/com/google/gson/annotations/Expose.java
* /gson-2-8-6-sources-1-jar/com/google/gson/InstanceCreator.java

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* /gson-2-8-6-sources-1-jar/com/google/gson/annotations/JsonAdapter.java

* /gson-2-8-6-sources-1-jar/com/google/gson/internal/bind/JsonAdapterAnnotationTypeAdapterFactory.java

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* /gson-2-8-6-sources-1-jar/com/google/gson/LongSerializationPolicy.java

* /gson-2-8-6-sources-1-jar/com/google/gson/JsonStreamParser.java

* /gson-2-8-6-sources-1-jar/com/google/gson/FieldAttributes.java

* /gson-2-8-6-sources-1-jar/com/google/gson/JsonParser.java

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- * /gson-2-8-6-sources-1-jar/com/google/gson/internal/LinkedHashMap.java

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- * /gson-2-8-6-sources-1-jar/com/google/gson/JsonSyntaxException.java
- * /gson-2-8-6-sources-1-jar/com/google/gson/internal/Streams.java

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- * /gson-2-8-6-sources-1-jar/com/google/gson/stream/JsonToken.java
- * /gson-2-8-6-sources-1-jar/com/google/gson/stream/JsonWriter.java
- * /gson-2-8-6-sources-1-jar/com/google/gson/stream/JsonScope.java
- * /gson-2-8-6-sources-1-jar/com/google/gson/stream/MalformedJsonException.java
- * /gson-2-8-6-sources-1-jar/com/google/gson/stream/JsonReader.java

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```
* /gson-2-8-6-sources-1-jar/com/google/gson/internal/reflect/PreJava9ReflectionAccessor.java
* /gson-2-8-6-sources-1-jar/com/google/gson/internal/PreJava9DateFormatProvider.java
* /gson-2-8-6-sources-1-jar/com/google/gson/internal/reflect/ReflectionAccessor.java
* /gson-2-8-6-sources-1-jar/com/google/gson/internal/reflect/UnsafeReflectionAccessor.java
*
```

```
/gson-2-8-6-sources-1-jar/com/google/gson/internal/JavaVersion.java
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* /gson-2-8-6-sources-1-jar/com/google/gson/internal/bind/CollectionTypeAdapterFactory.java
* /gson-2-8-6-sources-1-jar/com/google/gson/internal/bind/TypeAdapters.java
* /gson-2-8-6-sources-1-jar/com/google/gson/internal/bind/JsonTreeReader.java
* /gson-2-8-6-sources-1-jar/com/google/gson/internal/bind/ArrayTypeAdapter.java
```

```

*
/gson-2-8-6-sources-1-jar/com/google/gson/internal/bind/ObjectTypeAdapter.java
* /gson-2-8-6-sources-1-jar/com/google/gson/internal/bind/MapTypeAdapterFactory.java
* /gson-2-8-6-sources-1-jar/com/google/gson/TypeAdapter.java
* /gson-2-8-6-sources-1-jar/com/google/gson/internal/JsonReaderInternalAccess.java
* /gson-2-8-6-sources-1-jar/com/google/gson/internal/bind/JsonTreeWriter.java
* /gson-2-8-6-sources-1-jar/com/google/gson/TypeAdapterFactory.java
* /gson-2-8-6-sources-1-jar/com/google/gson/internal/bind/ReflectiveTypeAdapterFactory.java
* /gson-2-8-6-sources-1-jar/com/google/gson/internal/bind/TypeAdapterRuntimeTypeWrapper.java
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```

* /gson-2-8-6-sources-1-jar/com/google/gson/internal/GsonBuildConfig.java

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1.291 procps 3.2.8

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1.296 pyjwt 2.3.0

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1.298 nginx 1.18.0

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>>> JOpt Simple (net.sf.jopt-simple:jopt-simple)
>>> ASM 4.0 (org.ow2.asm:asm)
```

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>>> Apache HttpCore (org.apache.httpcomponents:httpcore)
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>>> Maven Aether Provider (org.apache.maven:maven-aether-provider)
>>> Maven Model (org.apache.maven:maven-model)
>>> Maven Model Builder (org.apache.maven:maven-model-builder)
>>>
Maven Repository Metadata Model (org.apache.maven:maven-repository-metadata)
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>>> Plexus :: Component Annotations (org.codehaus.plexus:plexus-component-annotations)
>>> Plexus Common Utilities (org.codehaus.plexus:plexus-utils)
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procfs provides functions to retrieve system, kernel and process metrics from the pseudo-filesystem proc.

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1.308 kubernetes-client 1.8.11

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procfs provides functions to retrieve system, kernel and process metrics from the pseudo-filesystem proc.

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1.309 kubernetes-apimachinery 1.8.11

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Protocol Buffers for Go with Gadgets

Go support for Protocol Buffers - Google's data interchange format

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1.310 kubernetes-api 1.8.11

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Data model artifacts for Prometheus.

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procfs provides functions to retrieve system, kernel and process metrics from the pseudo-filesystem proc.

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Protocol Buffers for Go with Gadgets

Go support for Protocol Buffers - Google's data interchange format

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<https://github.com/golang/protobuf>

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procfs provides functions to retrieve system, kernel and process metrics from the pseudo-filesystem proc.

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Gocheck - A rich testing framework for Go

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```
=====\n*\n\nimport { backend_util, FusedDepthwiseConv2D, FusedDepthwiseConv2DAttrs,\nFusedDepthwiseConv2DInputs, KernelConfig, KernelFunc, Tensor4D } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nimport { FusibleActivation } from './types';\n\nlet\nwasmFusedDepthwiseConv2d:\n  (xId: number, batchSize: number, inputHeight: number, inputWidth: number,\n  filterId: number, filterHeight: number, filterWidth: number,\n  biasId: number, padTop: number, padRight:\n  number, padBottom: number,\n  padLeft: number, isSamePad: number, dilationHeight: number,\n  dilationWidth: number, strideHeight: number, strideWidth: number,\n  inputChannels: number, outputChannels:\n  number, activation: number,\n  preluActivationWeightsId:\n  number, leakyreluAlpha: number, outId: number) =>\n  void;\n\nfunction setup(backend: BackendWasm) {\n  wasmFusedDepthwiseConv2d =\n    backend.wasm.cwrap(FusedDepthwiseConv2D, null /* void */, [\n      'number', // xId\n      'number', // batchSize\n      'number', // inputHeight\n      'number', // inputWidth\n      'number', // filterId\n      'number', // filterHeight\n      'number', // filterWidth\n      'number', // biasId\n      'number', // padTop\n      'number', // padRight\n      'number', // padBottom\n      'number', // padLeft\n      'number', // isSamePad\n      'number', // dilationHeight\n      'number', // dilationWidth\n      'number', // strideHeight\n      'number', // strideWidth\n      'number', // inputChannels\n      'number', // outputChannels\n      'number', // activation\n      'number', // preluActivationWeightsId\n      'number', // leakyreluAlpha\n      'number',
```

```

// outId\n    ]);\n}\n\nfunction fusedDepthwiseConv2d(args: {\n  inputs: FusedDepthwiseConv2DInputs,\n  backend: BackendWasm,\n  attrs: FusedDepthwiseConv2DAttrs\n}) {\n  const {inputs, attrs, backend} = args;\n  const {x, filter, bias, preluActivationWeights} = inputs;\n  const {\n    strides,\n    pad,\n    dilations,\n    dataFormat,\n    dimRoundingMode,\n    activation,\n    leakyreluAlpha\n  } = attrs;\n  const convInfo =\n    backend_util.computeConv2DInfo(\n      (x as Tensor4D).shape, (filter as Tensor4D).shape, strides, dilations,\n      pad, dimRoundingMode, true /* depthwise */);\n  const fusedActivation =\n    FusableActivation[activation as {\n    as keyof typeof FusableActivation\n  }];\n  if (fusedActivation == null) {\n    throw new Error(\n      `${activation}\n      activation not yet supported for FusedDepthwiseConv2D`\n      +\n      `in the wasm backend.`);\n  }\n  const xId =\n    backend.dataIdMap.get(x.dataId).id;\n  const filterId = backend.dataIdMap.get(filter.dataId).id;\n  const outputChannels = convInfo.outChannels;\n  let biasId = 0;\n  if (bias != null) {\n    const biasData =\n      backend.dataIdMap.get(bias.dataId);\n    if (biasData.shape.length !== 1) {\n      throw new Error(\n        `FusedDepthwiseConv2D only supports rank-1 bias but got`\n        +\n        `rank ${biasData.shape.length}`);\n    }\n    if (biasData.shape[0] !== outputChannels) {\n      throw new Error(\n        `FusedDepthwiseConv2D bias shape\n        (${biasData.shape}) does not`\n        +\n        `match the number of output channels (${outputChannels})`);\n    }\n    biasId = biasData.id;\n  }\n  const filterHeight = convInfo.filterHeight;\n  const filterWidth =\n    convInfo.filterWidth;\n  const padTop = convInfo.padInfo.top;\n  const padRight = convInfo.padInfo.right;\n  const\n    padBottom = convInfo.padInfo.bottom;\n  const padLeft = convInfo.padInfo.left;\n  const dilationHeight =\n    convInfo.dilationHeight;\n  const dilationWidth = convInfo.dilationWidth;\n  const strideHeight =\n    convInfo.strideHeight;\n  const strideWidth = convInfo.strideWidth;\n  const inputChannels = convInfo.inChannels;\n  const isSamePad =\n    convInfo.padInfo.type === 'SAME' ? 1 : 0;\n  const batchSize = convInfo.batchSize;\n  const inHeight =\n    convInfo.inHeight;\n  const inWidth = convInfo.inWidth;\n  if (dataFormat !== 'NHWC') {\n    throw new Error(\n      `wasm backend FusedDepthwiseConv2D does not support dataFormat:``\n      +\n      `${dataFormat}`. Please use\n      'NHWC'.`);\n  }\n  const out = backend.makeOutput(convInfo.outShape, 'float32');\n  const outId =\n    backend.dataIdMap.get(out.dataId).id;\n  const preluActivationWeightsId = preluActivationWeights == null ?\n    0\n    :\n    backend.dataIdMap.get(preluActivationWeights.dataId).id;\n  wasmFusedDepthwiseConv2d(\n    xId,\n    batchSize, inHeight, inWidth, filterId, filterHeight, filterWidth,\n    biasId, padTop, padRight, padBottom, padLeft,\n    isSamePad, dilationHeight,\n    dilationWidth, strideHeight, strideWidth, inputChannels, outputChannels,\n    fusedActivation, preluActivationWeightsId, leakyreluAlpha || 0, outId);\n  return out;\n}\n\nexport const\n  fusedDepthwiseConv2DConfig: KernelConfig = {\n  kernelName: FusedDepthwiseConv2D,\n  backendName:\n    'wasm',\n  setupFunc: setup,\n  kernelFunc: fusedDepthwiseConv2d as {\n  } as KernelFunc\n};\n}

```

Found in path(s):

* /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/FusedDepthwiseConv2D.js.map

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* /tfjs-backend-wasm-zip/tfjs-backend-wasm/starter/webpack/src/index.js

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the License.\n
=====
*\n\nimport {gather_util, GatherNd, GatherNdInputs, KernelConfig, TensorInfo} from '@tensorflow/tfjs-
core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport {CppType} from './types';\n\nlet
wasmGatherNd: (\n  xId: number, dtype: CppDType, indicesId: number, numSlices: number,\n  sliceRank:
number, sliceSize: number, strides: Uint8Array, outId: number) =>\n  void;\n\nfunction setup(backend:
BackendWasm): void {\n  wasmGatherNd = backend.wasm.cwrap(GatherNd, null /*void*/, [\n    'number', // xId\n
'number', // dtype\n    'number', // indicesId\n    'number', // numSlices\n    'number', // sliceRank\n    'number', // sliceSize\n    'array', // strides\n
'number' // outId\n  ]);\n\n  function gatherNd(args: {backend: BackendWasm, inputs: GatherNdInputs}): \n
TensorInfo {\n    const {backend, inputs} = args;\n    const {params, indices} = inputs;\n\n    const [resultShape,
numSlices, sliceSize, strides] =\n      gather_util.prepareAndValidate(params, indices);\n\n    const out =
backend.makeOutput(resultShape, params.dtype);\n    if (numSlices === 0) {\n      return out;\n    }\n\n    const
indicesShape = indices.shape;\n    const sliceRank = indicesShape[indicesShape.length - 1];\n\n    const xData =
backend.dataIdMap.get(params.dataId);\n    const xId = xData.id;\n    const indicesData =
backend.dataIdMap.get(indices.dataId);\n    const indicesId = indicesData.id;\n\n    const stridesBytes = new
Uint8Array(new Int32Array(strides).buffer);\n\n    const outId = backend.dataIdMap.get(out.dataId).id;\n\n
wasmGatherNd(\n    xId,\n    CppDType[params.dtype], indicesId, numSlices, sliceRank, sliceSize,\n    stridesBytes, outId);\n\n    return
out;\n  }\n\n  export const gatherNdConfig: KernelConfig = {\n    kernelName: GatherNd,\n    backendName: 'wasm',\n
setupFunc: setup,\n    kernelFunc: gatherNd\n  };
}

```

Found in path(s):

* /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/GatherNd.js.map

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  on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
  implied.\n * See the License for the specific
  language governing permissions and\n * limitations under the License.\n *
  =====\n
  *\nimport { GreaterEqual, KernelConfig } from '@tensorflow/tfjs-core';\nimport { createBinaryKernelConfig }
  from './binary_kernel';\n\nconst supportsFullBroadcast = false;\n\nexport const greaterEqualConfig: KernelConfig =\n  createBinaryKernelConfig(GreaterEqual, supportsFullBroadcast, 'bool');\n\n"] }
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Found in path(s):

* /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/GreaterEqual.js.map

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- *
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```

***** */
/**

```

```

* @deprecated Use `setWasmPaths` instead.
* Sets the path to the `.wasm` file which will be fetched when the wasm
* backend is initialized. See
* https://github.com/tensorflow/tfjs/blob/master/tfjs-backend-wasm/README.md#using-bundlers
* for more details.
* @param path wasm file path or url
* @param

```

```
*   the wasm file, default to false.
*
* @doc {heading: 'Environment', namespace: 'wasm'}
*/
```

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* /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/tf-backend-wasm.node.js
* /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/miniprogram/index.js
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No license file was found, but licenses were detected in source scan.

* /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Equal.js.map
No license file was found, but licenses were detected in source scan.

Found in path(s):

* /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Sub.js.map

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```
=====
*\n\nimport {backend_util, GatherV2, GatherV2Attrs, GatherV2Inputs,
  KernelConfig, KernelFunc, Tensor, TensorInfo, TypedArray, util} from '@tensorflow/tfjs-core';\n\nimport
{BackendWasm} from '../backend_wasm';\n\nimport {reshape} from './Reshape';\n\nimport {CppType} from
'./types';\n\nlet wasmGather: (\n  xId: number, dtype: CppDType, xStrides: Uint8Array, stridesSize: number,\n  indicesId: number, batchSize: number, outStrides: Uint8Array,\n  outId: number) => void;\n\nfunction
setup(backend: BackendWasm): void {\n  wasmGather = backend.wasm.cwrap('Gather', null /*void*/, [\n
'number', // xId\n 'number', // dtype\n 'array', // xStrides\n 'number', // stridesSize\n 'number', //
indicesId\n 'number', // batchSize\n 'array', // outStrides\n 'number' // outId\n ]);\n\nfunction gatherV2(\n
  args: {backend: BackendWasm, inputs: GatherV2Inputs, attrs: GatherV2Attrs});\n  TensorInfo {\n const
{backend, inputs, attrs} = args;\n  const {x, indices} = inputs;\n  const {axis, batchDims} = attrs;\n\n  //
Throw error when any index is out of bound.\n  const parsedAxis = util.parseAxisParam(axis, x.shape)[0];\n  const
indicesVals = backend.readSync(indices.dataId) as TypedArray;\n  const axisDim = x.shape[parsedAxis];\n  for (let
i = 0; i < indicesVals.length; ++i) {\n    const index = indicesVals[i];\n    util.assert(\n      index <= axisDim - 1 &&
index >= 0,\n      () =>\n        `GatherV2: the index value ${index} is not in [0, ${axisDim - 1}]`);\n  }\n  const
shapeInfo = backend_util.segment_util.collectGatherOpShapeInfo(\n    x as Tensor, indices as Tensor, parsedAxis,
batchDims);\n\n  const flattenX = reshape({\n    inputs: {x},\n    attrs: {\n      shape: [\n        shapeInfo.batchSize,
shapeInfo.outerSize, shapeInfo.dimSize,\n        shapeInfo.sliceSize\n      ]\n    },\n    backend\n  });\n  const
indicesSize = util.sizeFromShape(indices.shape);\n  const flattenIndex = reshape({\n    inputs: {x: indices},\n    attrs:
{shape: [shapeInfo.batchSize, indicesSize / shapeInfo.batchSize]},\n    backend\n  });\n  const flattenOutputShape = [\n
shapeInfo.batchSize, shapeInfo.outerSize, indicesSize /
shapeInfo.batchSize,\n  shapeInfo.sliceSize\n ];\n\n  const out = backend.makeOutput(flattenOutputShape,
x.dtype);\n  if (util.sizeFromShape(x.shape) === 0) {\n    return out;\n  }\n  const stridesSize = flattenX.shape.length
- 1;\n\n  const xData = backend.dataIdMap.get(flattenX.dataId);\n  const xId = xData.id;\n\n  const indicesData =
backend.dataIdMap.get(flattenIndex.dataId);\n  const indicesId = indicesData.id;\n\n  const outId =
backend.dataIdMap.get(out.dataId).id;\n\n  const xStridesBytes = new Uint8Array(\n    new
Int32Array(util.computeStrides(flattenX.shape)).buffer);\n  const outStridesBytes = new Uint8Array(\n    new
Int32Array(util.computeStrides(flattenOutputShape)).buffer);\n\n  wasmGather(\n    xId, CppDType[x.dtype],
xStridesBytes, stridesSize, indicesId,\n    shapeInfo.batchSize, outStridesBytes, outId);\n\n  backend.disposeData(flattenX.dataId);\n
  backend.disposeData(flattenIndex.dataId);\n\n  // reshape\n  out.shape = shapeInfo.outputShape;\n  return
out;\n}\n\nexport const gatherV2Config: KernelConfig = {\n  kernelName: GatherV2,\n  backendName: 'wasm',\n
setupFunc: setup,\n  kernelFunc: gatherV2 as {} as KernelFunc\n};\n\n}}
```

Found in path(s):

* /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/GatherV2.js.map

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law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
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```
=====\n*\n\nimport { KernelConfig, KernelFunc, slice_util, StridedSlice, StridedSliceAttrs,  
StridedSliceInputs, TensorInfo, util } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from  
 './backend_wasm';\nimport { reshape } from './Reshape';\nimport { slice } from './Slice';\n\nlet wasmStridedSlice: (\n  xId: number, xStridesBytes: Uint8Array, xRank: number,\n  beginBytes: Uint8Array, endBytes: Uint8Array,  
  stridesBytes: Uint8Array,\n  outShapeBytes: Uint8Array, outStridesBytes: Uint8Array,\n  outShapeLength:  
  number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n  wasmStridedSlice =  
  backend.wasm.cwrap(StridedSlice, null /*void*/, [\n    'number', // xId\n    'array', // xStrides\n    'number', //  
  xRank\n    'array', // beginBytes\n    'array', // endBytes\n    'array', // stridesBytes\n    'array', // outShapeBytes\n    'array', // outStridesBytes\n    'number', // outShapeLength\n    'number', // outId\n  ]);\n\n  next export function
```

```

stridedSlice(args: {\n backend: BackendWasm,\n inputs: StridedSliceInputs,\n
attrs: StridedSliceAttrs\n}): TensorInfo {\n const {backend, inputs, attrs} = args;\n const {x} = inputs;\n\n const
{\n begin,\n end,\n strides,\n beginMask,\n endMask,\n ellipsisMask,\n newAxisMask,\n
shrinkAxisMask\n } = attrs;\n\n const {\n finalShapeSparse,\n finalShape,\n isIdentity,\n sliceDim0,\n
isSimpleSlice,\n begin: $begin,\n end: $end,\n strides: $strides\n } =\n slice_util.sliceInfo(\n x.shape,
begin, end, strides, beginMask, endMask, ellipsisMask,\n newAxisMask, shrinkAxisMask);\n\n let result;\n\n
if (isIdentity) {\n // Optimization #1, slice is a no-op plus reshape\n result = reshape({inputs: {x}, backend, attrs:
{shape: finalShape}});\n } else if (sliceDim0 || isSimpleSlice) {\n // Optimization #2, slice is memory contiguous
(only occurs in dim 0)\n util.assert(\n x.shape.length >= 1,\n () => `Input must have rank at least 1, got:
${x.shape.length}`);\n\n const
size = slice_util.computeOutShape($begin, $end, $strides);\n // To tolerate begin[0] > end[0] (a 0-output slice),
we min(begin, end).\n const sliced = slice({inputs: {x}, backend, attrs: {begin: $begin, size}});\n result =\n
reshape({inputs: {x: sliced}, backend, attrs: {shape: finalShape}});\n backend.disposeData(sliced.dataId);\n } else
{\n const out = backend.makeOutput(finalShapeSparse, 'float32');\n\n const xId =
backend.dataIdMap.get(x.dataId).id;\n const xStridesBytes =\n new Uint8Array(new
Int32Array(util.computeStrides(x.shape)).buffer);\n const beginBytes = new Uint8Array(new
Int32Array($begin).buffer);\n const endBytes = new Uint8Array(new Int32Array($end).buffer);\n const
stridesBytes = new Uint8Array(new Int32Array($strides).buffer);\n\n const outputShapeBytes =\n new
Uint8Array(new Int32Array(finalShapeSparse).buffer);\n const outStridesBytes = new Uint8Array(\n new
Int32Array(util.computeStrides(finalShapeSparse)).buffer);\n\n
const outId = backend.dataIdMap.get(out.dataId).id;\n\n wasmStridedSlice(\n xId, xStridesBytes,
x.shape.length, beginBytes, endBytes, stridesBytes,\n outputShapeBytes, outStridesBytes,
finalShapeSparse.length, outId);\n\n result = reshape({inputs: {x: out}, backend, attrs: {shape: finalShape}});\n\n
backend.disposeData(out.dataId);\n }\n\n return result;\n }\n\n\nexport const stridedSliceConfig: KernelConfig = {\n
kernelName: StridedSlice,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: stridedSlice as { } as
KernelFunc\n};\n"}

```

Found in path(s):

* /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/StridedSlice.js.map

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```
=====\n\n*\n\nimport {backend_util, BinaryInputs, DataType, KernelConfig, TensorInfo, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nimport {CppType} from './types';\n\nexport function createBinaryKernelConfig(\n  kernelName: string, supportsFullBroadcast: boolean,\n  dtype?:\n  DataType): KernelConfig {\n  let wasmFunc: (\n    aId: number, aShape: Uint8Array, aShapeLen: number, bId:\n    number,\n    bShape: Uint8Array, bShapeLen: number, dtype: number, outId: number) => void;\n\n  function setupFunc(backend: BackendWasm): void {\n    wasmFunc = backend.wasm.cwrap(kernelName, null /*\n    void */, [\n      'number', // a_id,\n      'array', // a_shape\n      'number', // a_shape.length\n      'number', // b_id\n      'array', // b_shape\n      'number',\n      // b_shape.length\n      'number', // dtype\n      'number' // out_id\n    ]);\n\n    function kernelFunc(args:\n    {backend: BackendWasm, inputs: BinaryInputs}): TensorInfo {\n      const {backend, inputs} = args;\n      const {a, b} = inputs;\n      const aId = backend.dataIdMap.get(a.dataId).id;\n      const bId =\n      backend.dataIdMap.get(b.dataId).id;\n\n      const outputType = dtype != null ? dtype : a.dtype;\n      const newShape =\n      backend_util.assertAndGetBroadcastShape(a.shape, b.shape);\n      const out = backend.makeOutput(newShape,\n      outputType);\n\n      // Short-circuit zero-sized tensors.\n      if (util.sizeFromShape(newShape) === 0) {\n        return\n        out;\n      }\n\n      const aShapeBytes = new Uint8Array(new Int32Array(a.shape).buffer);\n      const bShapeBytes =\n      new Uint8Array(new Int32Array(b.shape).buffer);\n      const outId = backend.dataIdMap.get(out.dataId).id;\n\n      const kernelFunc = () => wasmFunc(\n        aId, aShapeBytes, a.shape.length, bId, bShapeBytes, b.shape.length,\n        CCppType[a.dtype], outId);\n\n      // Currently only some float operations support full broadcast.\n      if\n      (supportsFullBroadcast && a.dtype === 'float32') {\n        kernelFunc();\n        return out;\n      }\n\n      const\n      aBroadcastDims = backend_util.getBroadcastDims(a.shape, newShape);\n      const bBroadcastDims =\n      backend_util.getBroadcastDims(b.shape, newShape);\n      const loopsOverAllOfA = aBroadcastDims.every((v, i) =>\n      v === i);\n      const loopsOverAllOfB = bBroadcastDims.every((v, i) => v === i);\n      if (loopsOverAllOfA &&\n      loopsOverAllOfB) {\n        kernelFunc();\n        return out;\n      } else {\n        throw new Error(\n          `Broadcasting\n          along outer dims is not yet ` +\n          `supported for ${a.dtype} ${kernelName}.`);\n      }\n\n      return\n      {kernelName, backendName: 'wasm', setupFunc, kernelFunc};\n    }\n  }\n}
```

Found in path(s):

* /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/binary_kernel.js.map

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for the specific language governing permissions and\n * limitations under the License.\n *

=====\n\n*/\n\n// Import core for side effects (e.g. flag registration)\nimport '@tensorflow/tfjs-core';\n\n// tslint:disable-next-line: no-imports-from-dist\nimport '@tensorflow/tfjs-core/dist/public/chained_ops/register_all_chained_ops';\n\n// tslint:disable-next-line: no-imports-from-dist\nimport '@tensorflow/tfjs-core/dist/register_all_gradients';\n\n// tslint:disable-next-line: no-imports-from-dist\nimport { setTestEnvs, setupTestFilters, TestFilter } from
'@tensorflow/tfjs-core/dist/jasmine_util';\n\n// tslint:disable-next-line: no-imports-from-dist\nsetTestEnvs([{ name: 'test-wasm', backendName: 'wasm', isDataSync:


```

'index corresponds to start of a non-initial window', // argMin not yet\n
implemented,\n 'gradient' // Gradients not yet implemented\n ]\n },\n {\n startsWith: 'max ',\n excludes:
[\n 'gradient' // Gradients not yet implemented\n ]\n },\n {\n include: 'concat',\n excludes: [\n 'complex',
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include: 'clip',\n excludes: [\n 'gradient',\n 'propagates NaNs' // clip
delegates to XNNPACK which does not make\n // guarantees about behavior of nans.\n ]\n },\n
{\n include: 'addN'},\n {\n include: 'nonMaxSuppression'},\n {\n include: 'argmax', excludes: ['gradient']},\n {\n include: 'exp
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yet.\n ]\n },\n {\n include: 'maximum',\n excludes: [\n 'gradient', // Not yet
implemented.\n 'broadcasts 2x1 Tensor2D and 2x2 Tensor2D' // Broadcasting along inner\n

// dims not supported yet.\n ]\n },\n {\n include: 'log ',\n },\n {\n startsWith: 'equal ',\n excludes:
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yet.\n 'broadcasting Tensor3D shapes', // Same as above.\n 'broadcasting Tensor4D shapes', // Same as
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// Same as above.\n 'broadcasting Tensor4D shapes', // Same as above.\n 'string'\n ]\n },\n {\n include:
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'broadcasting Tensor4D shapes', // Same as above.\n 'string'\n ]\n },\n {\n include: 'less ',\n excludes: [\n 'broadcasting Tensor2D shapes', // Broadcasting along
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]\n },\n {\n startsWith: 'tan',\n excludes: ['gradient'] // Gradient not yet implemented.\n\n },\n {\n
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excludes: ['gradient'] // Gradient not yet implemented.\n },\n {\n startsWith: 'sqrt ',\n excludes: ['gradient'] //
Gradient not yet implemented.\n },\n {\n startsWith: 'where ',\n excludes: [\n '1D condition with higher rank
a and b', // Fill not yet implemented.\n 'gradient' // Gradient not yet implemented.\n ]\n },\n {\n
startsWith: 'zerosLike',\n // Complex numbers not supported yet.\n excludes: ['complex'],\n

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},\n {\n  startsWith: 'onesLike',\n  // Complex numbers not supported yet.\n  excludes: ['complex'],\n },\n {\n  include: 'prod'},\n {\n  include: 'floor'},\n {\n  include: 'topk'},\n {\n  include: 'expandDims'},\n {\n  include: 'stack'},\n {\n  include: 'round'},\n  // Pool is not supported yet.\n  excludes: ['pool'],\n },\n {\n  include: 'step kernel'},\n {\n  include: 'ceil'},\n {\n  include: 'mirrorPad'},\n {\n  startsWith: 'all',\n  excludes: [\n    'ignores NaNs' // Doesn't yet ignore NaN\n  ]\n },\n {\n  startsWith: 'any',\n  excludes: [\n    'ignores NaNs' // Doesn't yet ignore NaN\n  ]\n },\n {\n  include: 'image.transform'},\n {\n  include: 'batchToSpaceND'},\n {\n  include: 'spaceToBatchND'},\n ];\n\nconst customInclude = (testName: string) => {\n  // Include all regular describe() tests.\n  if (testName.indexOf('test-wasm') < 0) {\n    return true;\n  }\n  // Include all of the wasm specific tests.\n  if (testName.startsWith('wasm')) {\n    return true;\n  }\n  return false;\n};\n\nsetupTestFilters(TEST_FILTERS, customInclude);\n\n// Import and run all the tests from core.\n// tslint:disable-next-line:no-imports-from-dist\n// tslint:disable-next-line:no-require-imports\nrequire('@tensorflow/tfjs-core/dist/tests');\n}

```

Found in path(s):

* /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/setup_test.js.map

No license file was found, but licenses were detected in source scan.

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```

*\n\nimport { KernelConfig, KernelFunc, TensorInfo, Unpack, UnpackAttrs, UnpackInputs } from
'@tensorflow/tfjs-core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nimport { slice } from

```



```

*/\n\nimport { backend_util, BatchToSpaceND, BatchToSpaceNDAttrs, BatchToSpaceNDInputs, KernelConfig,
KernelFunc } from '@tensorflow/tfjs-core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nimport
{ reshape } from './Reshape';\n\nimport { slice } from './Slice';\n\nimport { transpose } from './Transpose';\n\n\nfunction
batchToSpaceND(args: { \n inputs: BatchToSpaceNDInputs,\n backend: BackendWasm,\n attrs:
BatchToSpaceNDAttrs\n }) { \n const { inputs, backend, attrs } = args;\n const { x } = inputs;\n const { blockShape,
crops } = attrs;\n\n const prod = blockShape.reduce((a, b) => a * b);\n\n const reshaped =
backend_util.getReshaped(x.shape, blockShape, prod);\n const permuted =
backend_util.getPermuted(reshaped.length, blockShape.length);\n const reshapedPermuted =\n
backend_util.getReshapedPermuted(x.shape, blockShape, prod);\n const sliceBeginCoords =\n
backend_util.getSliceBeginCoords(crops, blockShape.length);\n const sliceSize =\n
backend_util.getSliceSize(reshapedPermuted, crops, blockShape.length);\n\n const xReshaped = reshape({ inputs:
{ x }, backend, attrs: { shape: reshaped } });\n const xTransposed =\n transpose({ inputs: { x: xReshaped }, backend,
attrs: { perm: permuted } });\n const xTransposedReshaped = reshape(\n { inputs: { x: xTransposed }, backend,
attrs: { shape: reshapedPermuted } });\n const result = slice({ \n inputs: { x: xTransposedReshaped },\n backend,\n
attrs: { begin: sliceBeginCoords, size: sliceSize } \n });\n\n backend.disposeData(xReshaped.dataId);\n
backend.disposeData(xTransposed.dataId);\n backend.disposeData(xReshaped.dataId);\n\n return
result;\n }\n\n\nexport const batchToSpaceNDConfig: KernelConfig = { \n kernelName: BatchToSpaceND,\n
backendName: 'wasm',\n kernelFunc: batchToSpaceND as { } as KernelFunc\n }; \n ] }

```

Found in path(s):

* /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/BatchToSpaceND.js.map

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```
=====\n*\n\nimport { backend_util, KernelConfig, KernelFunc, Mean, MeanAttrs, MeanInputs, TensorInfo, util } from  
'@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nimport { cast } from './Cast';\nimport {  
  permuteAxesAndTranspose } from './kernel_utils';\n\nlet wasmMean: (xId: number, reduceSize: number, outId:  
number) => void;\n\nfunction setup(backend: BackendWasm): void {\n  wasmMean =\n    backend.wasm.cwrap(Mean, null /*void*/, ['number, number, number']);\n\n  export function mean(\n    args:  
    { backend: BackendWasm, inputs: MeanInputs, attrs: MeanAttrs }):\n    TensorInfo {\n    const { backend, inputs,  
      attrs } = args;\n    const  
      { axis, keepDims } = attrs;\n    const { x } = inputs;\n    const xId = backend.dataIdMap.get(x.dataId).id;\n    let inputId =  
      xId;\n    let input = x;\n\n    const { transposed, axes, originalAxes, inputWasTransposed } =\n      permuteAxesAndTranspose(x, axis, backend);\n\n    let reductionAxes = axes;\n    if (inputWasTransposed) {\n      const  
        transposedId = backend.dataIdMap.get(transposed.dataId).id;\n      if (transposedId !== xId) {\n        // transpose was  
        not a no-op. We will need to dispose of this\n        // once we are done.\n        input = transposed;\n        inputId =  
          transposedId;\n        reductionAxes = backend_util.getInnerMostAxes(\n          reductionAxes.length,  
          input.shape.length);\n      }\n      backend_util.assertAxesAreInnerMostDims(\n        'mean', reductionAxes,  
        input.shape.length);\n      const [outShape, reduceShape] =\n        backend_util.computeOutAndReduceShapes(input.shape, reductionAxes);\n      const reduceSize =  
        util.sizeFromShape(reduceShape);\n      let castedInput = input;\n      if (input.dtype  
        !== 'float32') {\n        castedInput =\n          cast({ backend, inputs: { x: input }, attrs: { dtype: 'float32' }});\n        inputId =  
          backend.dataIdMap.get(castedInput.dataId).id;\n      }\n      const out = backend.makeOutput(outShape, 'float32');\n      if  
        (util.sizeFromShape(input.shape) !== 0) {\n        const outId = backend.dataIdMap.get(out.dataId).id;\n        wasmMean(inputId, reduceSize, outId);\n      }\n      if (inputWasTransposed) {\n        // dispose of the transposed  
        tensor.\n        backend.disposeData(transposed.dataId);\n      }\n      if (keepDims) {\n        // reshape\n        const newShape =  
          backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n        out.shape = newShape;\n      }\n      if (input.dtype  
        !== 'float32') {\n        backend.disposeData(castedInput.dataId);\n      }\n      return out;\n    }\n\n    export const meanConfig:  
      KernelConfig = {\n        kernelName: Mean,\n        backendName: 'wasm',\n        setupFunc: setup,\n        kernelFunc: mean as {\n          as KernelFunc\n        }\n      }\n  }\n}
```

Found in path(s):

* /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Mean.js.map

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/**


```

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* =====
*/
/**
* @deprecated Use `setWasmPaths` instead.
* Sets the path to the `.wasm` file which will be fetched when the wasm
* backend is initialized. See
* https://github.com/tensorflow/tfjs/blob/master/tfjs-backend-wasm/README.md#using-bundlers
* for more details.
* @param path wasm file path or url
* @param usePlatformFetch optional boolean to use platform fetch to download
* the wasm file, default to false.
*
* @doc {heading: 'Environment', namespace: 'wasm'}
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```

Found in path(s):

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* /tfjs-backend-wasm-zip/tfjs-backend-wasm/src/backend_wasm.ts
* /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/backend_wasm.d.ts
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=====
\n
*/\n\nimport {AddN, KernelConfig, KernelFunc, TensorInfo, util} from '@tensorflow/tfjs-core';\n\nimport
{BackendWasm} from '../backend_wasm';\n\nimport {CppType} from './types';\n\nlet wasmFunc;\n (inputIds:
Uint8Array, inputIdsLen: number, dtype: number, outId: number) =>\n    void;\n\nfunction setupFunc(backend:
BackendWasm): void {\n    wasmFunc = backend.wasm.cwrap(AddN, null /* void */, [\n        'array', // input_ids\n
'number', // input_ids.length\n        'number', // dtype\n        'number', // out_id\n    ]);\n\n    function addn(args: {inputs:
TensorInfo[], backend: BackendWasm}) {\n        const {inputs, backend} = args;\n        const out =
backend.makeOutput(inputs[0].shape, inputs[0].dtype);\n\n        // Short-circuit zero-sized tensors.\n        if
(util.sizeFromShape(out.shape) === 0) {\n            return out;\n        }\n\n        const inputIds = inputs.map(x =>
backend.dataIdMap.get(x.dataId).id);\n        const inputIdsBytes = new Uint8Array(new Int32Array(inputIds).buffer);\n
        const outId = backend.dataIdMap.get(out.dataId).id;\n        wasmFunc(inputIdsBytes, inputIds.length,
CppType[out.dtype], outId);\n\n        return out;\n    }\n\n    export const addNConfig: KernelConfig = {\n        kernelName:
AddN,\n        backendName: 'wasm',\n        setupFunc,\n        kernelFunc: addn as {\n        } as KernelFunc,\n    };\n}

```

Found in path(s):

* /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/AddN.js.map

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=====\n\n*\n\nimport * as tf from '@tensorflow/tfjs-core';\nimport {registerBackend, removeBackend, test_util, util} from '@tensorflow/tfjs-core';\n// tslint:disable-next-line:no-imports-from-dist\nimport {ALL_ENVS, BROWSER_ENVS, describeWithFlags} from '@tensorflow/tfjs-core/dist/jasmine_util';\n\nimport {init, resetWasmPath} from './backend_wasm';\nimport

{BackendWasm, setWasmPath, setWasmPaths} from './index';\n\n/**\n * Tests specific to the wasm backend. The name of these tests must start with\n * 'wasm' so that they are always included in the test runner. See\n * `env.specFilter` in `setup_test.ts` for details.\n */\n\ndescribeWithFlags('wasm read/write', ALL_ENVS, () => {\n it('write and read values', async () => {\n const x = tf.tensor1d([1, 2, 3]);\n test_util.expectArraysClose([1, 2, 3], await x.data());\n });\n\n it('allocate repetitively and confirm reuse of heap space', () => {\n const backend = tf.backend() as BackendWasm;\n const size = 100;\n // Allocate for the first time, record the memory offset and dispose.\n const t1 = tf.zeros([size]);\n const memOffset1 = backend.getMemoryOffset(t1.dataId);\n t1.dispose();\n // Allocate again and make sure the offset is the same (memory was reused).\n const t2 = tf.zeros([size]);\n const memOffset2 = backend.getMemoryOffset(t2.dataId);\n });\n

// This should fail in case of a memory leak.\n expect(memOffset1).toBe(memOffset2);\n});\n\nit('allocates buffers with byteOffsets', async () => {\n const data = [-0.5, 0.5, 3.14];\n const buffer = new ArrayBuffer(32);\n const view = new Float32Array(buffer, 8, data.length);\n\n // Write values to buffer.\n for (let i = 0; i < data.length; ++i) {\n view[i] = data[i];\n }\n\n const t = tf.tensor(view);\n // Tensor values should match.\n test_util.expectArraysClose(await t.data(), view);\n});\n\n\ndescribeWithFlags('wasm init', BROWSER_ENVS, () => {\n beforeEach(() => {\n registerBackend('wasm-test', async () => {\n const {wasm} = await init();\n return new BackendWasm(wasm);\n }, 100);\n // Silences backend registration warnings.\n spyOn(console, 'warn');\n spyOn(console, 'log');\n });\n\n afterEach(() => {\n resetWasmPath();\n removeBackend('wasm-test');\n });\n\n it('backend init fails when the

```

path is invalid', async () => {\n  setWasmPath('invalid/path');\n  let wasmPath: string;\n  const realFetch =
fetch;\n  spyOn(self, 'fetch').and.callFake((path: string) => {\n    wasmPath = path;\n    return realFetch(path);\n
  });\n  expect(await tf.setBackend('wasm-test')).toBe(false);\n  expect(wasmPath).toBe('invalid/path');\n  });\n\nit('backend init fails when setWasmPaths is called with ' +\n  'an invalid prefix',\n  async () => {\n    setWasmPaths('invalid/prefix');\n    let wasmPath: string;\n    const realFetch = fetch;\n    spyOn(self,
'fetch').and.callFake((path: string) => {\n      wasmPath = path;\n      return realFetch(path);\n    });\n    expect(await tf.setBackend('wasm-test')).toBe(false);\n    expect(wasmPath).toContain('invalid/prefix');\n    });\n\nit('backend init fails when setWasmPaths is called with ' +\n  'an invalid fileMap',\n  async () => {\n    setWasmPaths({\n      'tfjs-backend-wasm.wasm':
'invalid/path',\n      'tfjs-backend-wasm-simd.wasm': 'invalid/path',\n      'tfjs-backend-wasm-threaded-
simd.wasm': 'invalid/path'\n    });\n    let wasmPathPrefix: string;\n    const realFetch = fetch;\n    spyOn(self,
'fetch').and.callFake((path: string) => {\n      wasmPathPrefix = path;\n      return realFetch(path);\n    });\n    expect(await tf.setBackend('wasm-test')).toBe(false);\n    expect(wasmPathPrefix).toBe('invalid/path');\n    });\n\nit('setWasmPaths throws error when called without specifying a path for ' +\n  'each binary',\n  async () => {\n    expect(() => {\n      setWasmPaths({\n        'tfjs-backend-wasm.wasm': '/base/wasm-out/tfjs-backend-
wasm.wasm'\n      });\n    }).toThrow();\n    });\n\nit('backend init works when the path is valid and use
platform fetch',\n  async () => {\n    const usePlatformFetch = true;\n    const validPrefix = '/base/wasm-out/';\n    setWasmPaths(validPrefix,
usePlatformFetch);\n    let wasmPath: string;\n    const realFetch = util.fetch;\n    spyOn(util,
'fetch').and.callFake((path: string) => {\n      wasmPath = path;\n      return realFetch(path);\n    });\n    expect(await tf.setBackend('wasm-test')).toBe(true);\n    const validPaths = new Set([\n      validPrefix + 'tfjs-
backend-wasm.wasm',\n      validPrefix + 'tfjs-backend-wasm-simd.wasm',\n      validPrefix + 'tfjs-backend-
wasm-threaded-simd.wasm',\n    ]);\n    expect(validPaths).toContain(wasmPath);\n    });\n\nit('backend init
works when the wasm paths overrides map is valid and ' +\n  'using platform fetch',\n  async () => {\n    const usePlatformFetch = true;\n    const validPrefix = '/base/wasm-out/';\n    setWasmPaths(\n      {\n        'tfjs-backend-wasm.wasm': '/base/wasm-out/tfjs-backend-wasm.wasm',\n        'tfjs-backend-wasm-simd.wasm':\n          '/base/wasm-out/tfjs-backend-wasm-simd.wasm',\n        'tfjs-backend-wasm-threaded-simd.wasm':\n          '/base/wasm-out/tfjs-backend-wasm-threaded-
simd.wasm'\n      },\n      usePlatformFetch);\n    let wasmPath: string;\n    const realFetch = util.fetch;\n    spyOn(util, 'fetch').and.callFake((path: string) => {\n      wasmPath = path;\n      return realFetch(path);\n
    });\n    expect(await tf.setBackend('wasm-test')).toBe(true);\n    const validPaths = new Set([\n      validPrefix +
'tfjs-backend-wasm.wasm',\n      validPrefix + 'tfjs-backend-wasm-simd.wasm',\n      validPrefix + 'tfjs-backend-
wasm-threaded-simd.wasm',\n    ]);\n    expect(validPaths).toContain(wasmPath);\n    });\n\nit('backend init
works when the path is valid and use platform fetch',\n  async () => {\n    const usePlatformFetch = true;\n    const validPath = '/base/wasm-out/tfjs-backend-wasm.wasm';\n    setWasmPath(validPath, usePlatformFetch);\n    let wasmPath:
string;\n    const realFetch = util.fetch;\n    spyOn(util, 'fetch').and.callFake((path: string) => {\n      wasmPath
= path;\n      return realFetch(path);\n    });\n    expect(await tf.setBackend('wasm-test')).toBe(true);\n    expect(wasmPath).toBe(validPath);\n    });\n\n// Disabling this test because it intermittently times out on CI.\n//
tslint:disable-next-line: ban\nxit('backend init fails when the path is invalid and use platform fetch',\n  async ()
=> {\n    const usePlatformFetch = true;\n    setWasmPath('invalid/path', usePlatformFetch);\n    let
wasmPath: string;\n    const realFetch = util.fetch;\n    spyOn(util, 'fetch').and.callFake((path: string) => {\n      wasmPath
= path;\n      return realFetch(path);\n    });\n    expect(await tf.setBackend('wasm-
test')).toBe(false);\n    expect(wasmPath).toBe('invalid/path');\n    });\n\nit('backend init succeeds with default
path', async () => {\n  expect(await
tf.setBackend('wasm-test')).toBe(true);\n  });\n\nit('setWasmPath called too late', async () => {\n  // Set an invalid
path.\n  setWasmPath('invalid/path');\n  await tf.setBackend('wasm-test');\n\n  // Setting the path too late.\n  expect(() => setWasmPath('too/late'))\n    .toThrowError(/The WASM backend was already initialized. Make

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sure/);\n });\n});\n"]}}

Found in path(s):

* /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/index_test.js.map

No license file was found, but licenses were detected in source scan.

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http://www.apache.org/licenses/LICENSE-2.0\n *\n *
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License.\n *
=====
*\n\nimport { KernelConfig, KernelFunc } from '@tensorflow/tfjs-core';\nimport { Fill, FillAttrs } from
'@tensorflow/tfjs-core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nexport function fill(args: { attrs:
FillAttrs, backend: BackendWasm }) {\n  const { attrs: { shape, value, dtype }, backend } = args;\n  const out =
backend.makeOutput(shape, dtype);\n  const outVals = backendtypedArrayFromHeap(out);\n  outVals.fill(value as
number);\n  return out;\n}\n\nexport const fillConfig: KernelConfig = {\n  kernelName: Fill,\n  backendName:
'wasm',\n  kernelFunc: fill as { } as KernelFunc,\n};\n"]}
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Found

in path(s):

* /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Fill.js.map

No license file was found, but licenses were detected in source scan.

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```
=====\n\n*/\n\nimport { backend_util, KernelConfig, KernelFunc, Sum, SumAttrs, SumInputs, TensorInfo, util } from  
'@tensorflow/tfjs-core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nimport  
{ permuteAxesAndTranspose } from './kernel_utils';\nimport { CppDType } from './types';\n\nlet wasmSum: (xId:  
number, reduceSize: number, dtype: number, outId: number) =>\n  void;\n\nfunction setup(backend:  
BackendWasm): void {\n  wasmSum = backend.wasm.cwrap(Sum, null /*void*/, [\n    'number', // input_id\n    'number', // reduce_size\n    'number', // dtype\n    'number', // out_id\n  ]);\n\n  function sum(args: { backend:  
BackendWasm, inputs: SumInputs, attrs: SumAttrs }):\n    TensorInfo {\n    const { backend, inputs, attrs } = args;\n    const { axis, keepDims } = attrs;\n    const { x } = inputs;\n    const xId = backend.dataIdMap.get(x.dataId).id;\n    let  
inputId = xId;\n    let input = x;\n    const { transposed, axes, originalAxes, inputWasTransposed } =\n      permuteAxesAndTranspose(x,  
axis, backend);\n    let reductionAxes = axes;\n    if (inputWasTransposed) {\n      const transposedId =  
backend.dataIdMap.get(transposed.dataId).id;\n      if (transposedId !== xId) {\n        // transpose was not a no-op. We  
will need to dispose of this\n        // once we are done.\n        input = transposed;\n        inputId = transposedId;\n        reductionAxes = backend_util.getInnerMostAxes(\n          reductionAxes.length, input.shape.length);\n      }\n    }\n    backend_util.assertAxesAreInnerMostDims(\n      'sum', reductionAxes, input.shape.length);\n    const [outShape,  
reduceShape] =\n      backend_util.computeOutAndReduceShapes(input.shape, reductionAxes);\n    const reduceSize  
= util.sizeFromShape(reduceShape);\n    const out = backend.makeOutput(outShape, input.dtype);\n    if  
(util.sizeFromShape(input.shape) !== 0) {\n      const outId = backend.dataIdMap.get(out.dataId).id;\n      wasmSum(inputId, reduceSize, CppDType[out.dtype], outId);\n    }\n    if (inputWasTransposed) {\n      // dispose of  
the transposed tensor.\n      backend.disposeData(transposed.dataId);\n    }\n    if (keepDims) {\n      // reshape\n      const newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n      out.shape = newShape;\n    }\n    return out;\n  }\n\n  export const sumConfig: KernelConfig = {\n    kernelName: Sum,\n    backendName: 'wasm',\n    setupFunc: setup,\n    kernelFunc: sum as {} as KernelFunc\n  };\n}
```

Found in path(s):

* /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Sum.js.map

No license file was found, but licenses were detected in source scan.

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EAAE,KAAK;CACjB,CAAC","sourcesContent":["/**\n
```

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```
=====\n\n*\n\nimport { ArgMax, ArgMaxAttrs, ArgMaxInputs, KernelConfig, KernelFunc, util } from '@tensorflow/tfjs-  
core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nimport { permuteAxesAndTranspose } from  
../kernel_utils;\n\nimport { CppDType } from './types';\n\nlet wasmFunc: (\n  xId: number, dtype: number, outerSize:  
number, innerSize: number,\n  outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n  wasmFunc =  
backend.wasm.cwrap(ArgMax, null /* void */, [\n    'number', // x_id\n    'number', // dtype\n    'number', //  
outer_size\n    'number', // inner_size\n    'number' // out_id\n  ]);\n\n  function argmax(\n    args: { inputs:  
ArgMaxInputs, backend: BackendWasm, attrs: ArgMaxAttrs }) {\n    const { backend, inputs, attrs } = args;\n    const { axis } = attrs as {} as ArgMaxAttrs;\n    const { x } = inputs as {} as ArgMaxInputs;\n    const xId =  
backend.dataIdMap.get(x.dataId).id;\n    let inputId = xId;\n    let input = x;\n\n    const { transposed, axes,  
inputWasTransposed } =\n      permuteAxesAndTranspose(x, axis, backend);\n\n    if (inputWasTransposed) {\n      const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n      if (transposedId !== xId) {\n        // transpose  
was not a no-op. We will need to dispose of this\n        // once we are done.\n        input = transposed;\n        inputId =  
transposedId;\n      }\n    }\n  }\n}
```



```

    }\n\n const outShape = input.shape.slice(0, -1);\n const out = backend.makeOutput(outShape, 'int32');\n const
outId = backend.dataIdMap.get(out.dataId).id;\n const outerSize = util.sizeFromShape(out.shape);\n const
innerSize = input.shape[axes[0]];\n wasmFunc(inputId, CppDType[input.dtype], outerSize, innerSize, outId);\n\n if
(inputWasTransposed) {\n // dispose of the transposed tensor.\n backend.disposeData(transposed.dataId);\n
}\n\n return out;\n}\n\nexport const argMaxConfig: KernelConfig = {\n kernelName: ArgMax,\n backendName:
'wasm',\n kernelFunc: argmax as { } as KernelFunc,\n setupFunc: setup\n};\n"}

```

Found in path(s):

* /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/ArgMax.js.map

No license file was found, but licenses were detected in source scan.

```

{"version":3,"file":"Elu.js","sourceRoot":"","sources":["../../src/kernels/Elu.ts"],"names":[],"mappings":"AAAA;::::;
;:::GAeG;AACH,OAAO,EAAC,GAAG,EAAe,MAAM,uBAAuB,CAAC;AAExD,OAAO,EAAC,uBAAuB,EAA
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C","sourcesContent":["/**\n * @license\n * Copyright 2021 Google LLC. All Rights Reserved.\n * Licensed under
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on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n
 * =====\n
*/\n\nimport {Elu, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from
'./unary_kernel';\n\nexport const eluConfig: KernelConfig = createUnaryKernelConfig(Elu);\n"}

```

Found in path(s):

* /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Elu.js.map

No license file was found, but licenses were detected in source scan.

```

{"version":3,"file":"ExpandDims.js","sourceRoot":"","sources":["../../src/kernels/ExpandDims.ts"],"names":[],"map
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AAC,GAAG,MAAM,CAAC;IACvB,MAAM,EAAC,GAAG,EAAC,GAAG,KAAK,CAAC;IAEpB,MAAM,SAAS,
GAAG,KAAK,CAAC,KAAK,CAAC,MAAM,CAAC;IACrC,MAAM,QAAQ,GAAG,KAAK,CAAC,KAAK,CAA
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```

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Found in path(s):

```
{ "version":3,"file":"Exp.js", "sourceRoot":"","sources":["../../src/kernels/Exp.ts"],"names":[],"mappings":"AAAA;::;
;::;GAEg;AACH,OAAO,EAAC,GAAG,EAAe,MAAM,uBAAuB,CAAC;AAExD,OAAO,EAAC,uBAAuB,EA
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AS,CAAC,CAAC","sourcesContent":["/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n *
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* =====

*/

/**

* @deprecated Use `setWasmPaths`

instead.

* Sets the path to the `.wasm` file which will be fetched when the wasm

* backend is initialized. See

* <https://github.com/tensorflow/tfjs/blob/master/tfjs-backend-wasm/README.md#using-bundlers>

* for more details.

* @param path wasm file path or url

* @param usePlatformFetch optional boolean to use platform fetch to download

* the wasm file, default to false.

*

* @doc {heading: 'Environment', namespace: 'wasm'}

*/

Found in path(s):

* /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/tf-backend-wasm.es2017.js

No license file was found, but licenses were detected in source scan.

```
{ "version": 3, "file": "Pow.js", "sourceRoot": "", "sources": [ "../src/kernels/Pow.ts" ], "names": [], "mappings": "AAAA;;;
;;;;;;;;;GAeG;AACH,OAAO,EAAe,GAAG,EAAC,MAAM,uBAAuB,CAAC;AAExD,OAAO,EAAC,wBAAwB,EAAC,MAAM,iBAAiB,CAAC;AACzD,MAAM,qBAAqB,GAAG,KAAK,CAAC;AACpC,MAAM,CAAC,MAAM,SAAS,GACIB,wBAAwB,CAAC,GAAG,EAAE,qBAAqB,CAAC,CAAC", "sourcesContent": [ "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\n * License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or\n * agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n * the specific language governing permissions\n * and\n * limitations under the License.\n */" ] }
```

```
=====\n
*\nimport { KernelConfig, Pow } from '@tensorflow/tfjs-core';\nimport { createBinaryKernelConfig } from\n'./binary_kernel';\nconst supportsFullBroadcast = false;\nexport const powConfig: KernelConfig =\ncreateBinaryKernelConfig(Pow, supportsFullBroadcast);\n"] }
```

Found in path(s):

* /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Pow.js.map

No license file was found, but licenses were detected in source scan.

```
{ "version": 3, "file": "index.js", "sources": [ "../src/kernels/types.ts", "../src/kernels/_FusedMatMul.ts", "../src/kernels/unary_kernel.ts", "../src/kernels/Abs.ts", "../src/kernels/binary_kernel.ts", "../src/kernels/Add.ts", "../src/kernels/AddN.ts", "../src/kernels/Identity.ts", "../src/kernels/Transpose.ts", "../src/kernels/kernel_utils.ts", "../src/kernels/All.ts", "../src/kernels/Any.ts", "../src/kernels/ArgMax.ts", "../src/kernels/AvgPool.ts", "../src/kernels/Resha
```

```

pe.ts", "../src/kernels/BatchMatMul.ts", "../node_modules/@tensorflow/tfjs-backend-
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cpu/dist/kernels/Range_impl.js", "../node_modules/@tensorflow/tfjs-backend-
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src/kernels/Ceil.ts", "../src/kernels/ClipByValue.ts", "../src/kernels/Concat.ts", "../src/kernels/Conv2D.ts", "../
src/kernels/Conv2DBackpropInput.ts", "../src/kernels/Cos.ts", "../src/kernels/Cosh.ts", "../src/kernels/CropAndR
esize.ts", "../src/kernels/Cumsum.ts", "../src/kernels/DepthToSpace.ts", "../src/kernels/DepthwiseConv2dNative.t
s", "../src/kernels/Elu.ts", "../src/kernels/Equal.ts", "../src/kernels/Exp.ts", "../src/kernels/ExpandDims.ts", "../s
rc/kernels/Fill.ts", "../src/kernels/FlipLeftRight.ts", "../src/kernels/Floor.ts", "../src/kernels/FloorDiv.ts", "../src/
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c/kernels/LogicalAnd.ts", "../src/kernels/Max.ts", "../src/kernels/Maximum.ts", "../src/kernels/MaxPool.ts", "../s
rc/kernels/Mean.ts", "../src/kernels/Min.ts", "../src/kernels/Minimum.ts", "../src/kernels/MirrorPad.ts", "../src/ke
rnels/Multiply.ts", "../src/kernels/Neg.ts", "../src/kernels/NonMaxSuppression_util.ts", "../src/kernels/NonMaxSu
ppressionV3.ts", "../src/kernels/NonMaxSuppressionV4.ts", "../src/kernels/NonMaxSuppressionV5.ts", "../src/ke
rnels/NotEqual.ts", "../src/kernels/OneHot.ts", "../src/kernels/OnesLike.ts", "../src/kernels/Pack.ts", "../src/kerne
ls/PadV2.ts", "../src/kernels/Pow.ts", "../src/kernels/Prelu.ts", "../src/kernels/Prod.ts", "../src/kernels/Range.ts", "
../src/kernels/RealDiv.ts", "../src/kernels/Relu.ts", "../src/kernels/Relu6.ts", "../src/kernels/ResizeBilinear.ts", "../
src/kernels/Reverse.ts", "../src/kernels/RotateWithOffset.ts", "../src/kernels/Round.ts", "../src/kernels/Rsqrt.ts"
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c/kernels/Softmax.ts", "../src/kernels/SpaceToBatchND.ts", "../src/kernels/SplitV.ts", "../src/kernels/Sqrt.ts", "../
src/kernels/Square.ts", "../src/kernels/SquaredDifference.ts", "../src/kernels/Step.ts", "../src/kernels/StridedSlice.
ts", "../src/kernels/Sub.ts", "../src/kernels/Sum.ts", "../src/kernels/Tan.ts", "../src/kernels/Tanh.ts", "../src/kerne
ls/Tile.ts", "../src/kernels/TopK.ts", "../src/kernels/Transform.ts", "../src/kernels/Unpack.ts", "../src/kernels/Zero
sLike.ts", "../src/register_all_kernels.ts", "../src/flags_wasm.ts", "../wasm-out/tfjs-backend-wasm-threaded-
simd.js", "../wasm-out/tfjs-backend-wasm-threaded-simd.worker.js", "../wasm-out/tfjs-backend-
wasm.js", "../src/backend_wasm.ts", "../src/version.ts", "../src/base.ts"], "sourcesContent": ["/**\n

```

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```

```

=====
*\n\n// This enum must align with the enum defined in cc/backend.h.\n\nexport enum CppDType {\n float32 = 0,\n
int32 = 1,\n bool = 2,\n string = 3,\n complex64 = 4\n}\n\n// Must match enum in cc/fusable_activations.h.\n\nexport
enum FusableActivation {\n linear = 0,\n relu = 1,\n relu6 = 2,\n prelu = 3,\n leakyrelu = 4,\n sigmoid = 5,\n elu
= 6\n}\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n

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```

```

=====
*\n\nimport { _FusedMatMul, _FusedMatMulAttrs, _FusedMatMulInputs, KernelConfig, KernelFunc } from

```

```

'@tensorflow/tfjs-core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nimport { FusibleActivation } from
'./types';\n\nlet wasmFusedMatMul: (\n  aId: number, aShape: Uint8Array, aShapeSize: number, bId: number,\n  bShape: Uint8Array, bShapeSize:
  number, transposeA: boolean,\n  transposeB: boolean, activation: number, biasId: number,\n  preluActivationWeightsId: number, leakyreluAlpha: number, outId: number) =>\n  void;\n\nfunction
setup(backend: BackendWasm) {\n  wasmFusedMatMul = backend.wasm.cwrap(_FusedMatMul, null /* void */, [\n
  'number', // a_id\n  'array', // a_shape\n  'number', // a_shape.length\n  'number', // b_id\n  'array', //
  b_shape\n  'number', // b_shape.length\n  'number', // transpose_a\n  'number', // transpose_b\n  'number', //
  activation\n  'number', // biasId\n  'number', // preluActivationWeightsId\n  'number', // leakyreluAlpha\n
  'number' // out_id\n  ]);\n}\n\nfunction fusedBatchMatMul(args: {\n  inputs: _FusedMatMulInputs,\n  backend:
  BackendWasm,\n  attrs: _FusedMatMulAttrs\n}) {\n  const { inputs, backend, attrs } = args;\n  const { a, b, bias,
  preluActivationWeights } = inputs;\n\n  if (a.dtype !== 'float32' || b.dtype !== 'float32') {\n
    throw new Error(\n      `_FusedMatMul for non non-float32 tensors not yet supported.`);\n  }\n\n  const
  { transposeA, transposeB, activation, leakyreluAlpha } = attrs;\n  const aId = backend.dataIdMap.get(a.dataId).id;\n
  const bId = backend.dataIdMap.get(b.dataId).id;\n\n  let biasId = 0;\n  if (bias != null) {\n    const biasData =
  backend.dataIdMap.get(bias.dataId);\n    if (biasData.shape.length !== 1) {\n      throw new Error(\n
        `_FusedMatMul only supports rank-1 bias but got ` +\n        `rank ${biasData.shape.length}.`);\n    }\n    biasId =
  biasData.id;\n  }\n\n  const preluActivationWeightsId = preluActivationWeights == null ?\n    0 :\n  backend.dataIdMap.get(preluActivationWeights.dataId).id;\n\n  const fusedActivation =\n  FusibleActivation[activation as {}] as keyof typeof FusibleActivation;\n\n  if (fusedActivation == null) {\n    throw
  new Error(\n      `${activation} activation not yet supported for FusedConv2D ` +\n      `in the wasm backend.`);\n  }\n\n  const leftDim = transposeA ? a.shape[2] : a.shape[1];\n  const rightDim = transposeB ? b.shape[1] :
  b.shape[2];\n\n  const batchDim = a.shape[0];\n\n  const out = backend.makeOutput([batchDim, leftDim, rightDim],
  a.dtype);\n\n  const outId = backend.dataIdMap.get(out.dataId).id;\n\n  const aShapeBytes = new Uint8Array(new
  Int32Array(a.shape).buffer);\n  const bShapeBytes = new Uint8Array(new Int32Array(b.shape).buffer);\n\n  wasmFusedMatMul(\n    aId, aShapeBytes, a.shape.length, bId, bShapeBytes, b.shape.length,\n    transposeA,
  transposeB, fusedActivation, biasId, preluActivationWeightsId,\n    leakyreluAlpha || 0, outId);\n\n  return
  out;\n}\n\nexport const fusedMatMulConfig: KernelConfig = {\n  kernelName: _FusedMatMul,\n  backendName:
  'wasm',\n  setupFunc: setup,\n  kernelFunc: fusedBatchMatMul as {} as KernelFunc\n};\n\n"/**\n * @license\n *
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  =====\n\n*/\n\nimport { DataType, KernelConfig, TensorInfo, UnaryInputs, util } from '@tensorflow/tfjs-core';\n\nimport
  { BackendWasm } from '../backend_wasm';\n\nimport { CppDType } from './types';\n\nexport function
  createUnaryKernelConfig(\n  kernelName: string, outType?: DataType): KernelConfig {\n  let wasmFunc: (xId:
  number, dtype: number, outId: number) => void;\n\n  function setupFunc(backend: BackendWasm): void {\n
    wasmFunc =
    backend.wasm.cwrap(kernelName, null /* void */, [\n      'number', // x_id\n      'number', // dtype\n      'number', //
    out_id\n    ]);\n  }\n\n  function kernelFunc(args: { backend: BackendWasm, inputs: UnaryInputs }):\n    TensorInfo
  {\n    const { backend, inputs: { x } } = args;\n    const xId = backend.dataIdMap.get(x.dataId).id;\n    const out =
  backend.makeOutput(x.shape, outType || x.dtype);\n    const outId = backend.dataIdMap.get(out.dataId).id;\n\n    //
  Short-circuit zero-sized tensors.\n    if (util.sizeFromShape(out.shape) === 0) {\n      return out;\n    }\n\n    wasmFunc(xId, CppDType[x.dtype], outId);\n    return out;\n  }\n\n  return { kernelName, backendName: 'wasm',

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setupFunc, kernelFunc};\n}\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in\n * compliance with the License.\n * You may obtain a copy of the License at\n * \n *  

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===== \n
*\nimport {Abs, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from\n './unary_kernel';\nexport const absConfig: KernelConfig = createUnaryKernelConfig(Abs);\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\n * License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or\n * agreed to in\n * writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT\n * WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific\n * language governing permissions and\n * limitations under the License.\n *  

===== \n
*\nimport {backend_util, BinaryInputs, DataType, KernelConfig, TensorInfo, util} from '@tensorflow/tfjs-\n core';\nimport {BackendWasm} from './backend_wasm';\nimport {CppType} from './types';\nexport\n function createBinaryKernelConfig(\n   kernelName: string, supportsFullBroadcast: boolean,\n   dtype?:\n   DataType): KernelConfig {\n   let wasmFunc:\n     (aId: number, aShape: Uint8Array, aShapeLen: number, bId:\n     number,\n     bShape: Uint8Array, bShapeLen: number, dtype: number, outId: number) =>\n     void;\n   function setupFunc(backend: BackendWasm): void {\n     wasmFunc = backend.wasm.cwrap(kernelName, null /*\n     void\n     */,\n     [\n       'number', // a_id,\n       'array', // a_shape\n       'number', // a_shape.length\n       'number', // b_id\n       'array', // b_shape\n       'number', // b_shape.length\n       'number', // dtype\n       'number' // out_id\n     ]);\n   }\n   function kernelFunc(args: {backend: BackendWasm, inputs: BinaryInputs}): TensorInfo {\n     const {backend,\n     inputs} = args;\n     const {a, b} = inputs;\n     const aId = backend.dataIdMap.get(a.dataId).id;\n     const bId =\n     backend.dataIdMap.get(b.dataId).id;\n     const outputType = dtype != null ? dtype : a.dtype;\n     const newShape =\n     backend_util.assertAndGetBroadcastShape(a.shape, b.shape);\n     const out = backend.makeOutput(newShape,\n     outputType);\n     // Short-circuit zero-sized tensors.\n     if (util.sizeFromShape(newShape) === 0) {\n       return\n       out;\n     }\n     const aShapeBytes = new Uint8Array(new Int32Array(a.shape).buffer);\n     const bShapeBytes =\n     new Uint8Array(new Int32Array(b.shape).buffer);\n     const\n     outId = backend.dataIdMap.get(out.dataId).id;\n     const kernelFunc = () => wasmFunc(\n       aId, aShapeBytes,\n       a.shape.length, bId, bShapeBytes, b.shape.length,\n       CCppType[a.dtype], outId);\n     // Currently only some\n     float operations support full broadcast.\n     if (supportsFullBroadcast && a.dtype === 'float32') {\n       kernelFunc();\n       return out;\n     }\n     const aBroadcastDims = backend_util.getBroadcastDims(a.shape,\n     newShape);\n     const bBroadcastDims = backend_util.getBroadcastDims(b.shape, newShape);\n     const\n     loopsOverAllOfA = aBroadcastDims.every((v, i) => v === i);\n     const loopsOverAllOfB =\n     bBroadcastDims.every((v, i) => v === i);\n     if (loopsOverAllOfA && loopsOverAllOfB) {\n       kernelFunc();\n       return out;\n     } else {\n       throw new Error(`Broadcasting along outer dims is not yet `+\n       `supported for ${a.dtype} ${kernelName}.`);\n     }\n   }\n   return {kernelName, backendName: 'wasm', setupFunc,\n   kernelFunc};\n}\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version\n * 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a\n * copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable

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=====\n\n*\n\nimport {Add, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from\n './binary_kernel';\n\nconst supportsFullBroadcast = true;\n\nexport const addConfig: KernelConfig =\n createBinaryKernelConfig(Add, supportsFullBroadcast);\n\n"/**\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\n * License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or\n * agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
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=====\n\n*\n\nimport {AddN, KernelConfig, KernelFunc, TensorInfo, util} from '@tensorflow/tfjs-core';\nimport\n {BackendWasm} from '../backend_wasm';\nimport {CppType} from './types';\n\nlet wasmFunc:\n (inputIds:\n Uint8Array, inputIdsLen: number, dtype: number, outId: number) =>\n void;\n\nfunction\n setupFunc(backend: BackendWasm): void {\n wasmFunc = backend.wasm.cwrap(AddN, null /* void */, [\n 'array', // input_ids\n 'number', // input_ids.length\n 'number', // dtype\n 'number', // out_id\n ]);\n\nfunction addn(args: {inputs: TensorInfo[], backend: BackendWasm}) {\n const {inputs, backend} =\n args;\n const out = backend.makeOutput(inputs[0].shape, inputs[0].dtype);\n // Short-circuit zero-sized tensors.\n if (util.sizeFromShape(out.shape) === 0) {\n return out;\n }\n const inputIds = inputs.map(x =>\n backend.dataIdMap.get(x.dataId).id);\n const inputIdsBytes = new Uint8Array(new Int32Array(inputIds).buffer);\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmFunc(inputIdsBytes, inputIds.length,\n CppDType[out.dtype], outId);\n return out;\n }\n\nexport const addNConfig: KernelConfig = {\n kernelName:\n AddN,\n backendName: 'wasm',\n setupFunc,\n kernelFunc: addn as {\n } as KernelFunc,\n};\n\n"/**\n * Copyright
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=====\n\n*\n\nimport {Identity, IdentityInputs, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';\nimport\n {TensorInfo} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\n\nexport function\n identity(args: {inputs: IdentityInputs, backend: BackendWasm}): \n TensorInfo {\n const {inputs:\n {x}, backend} = args;\n const out = backend.makeOutput(x.shape, x.dtype);\n const inVals =\n backend.toArrayFromHeap(x);\n const outVals = backend.toArrayFromHeap(out);\n outVals.set(inVals);\n return out;\n }\n\nexport const identityConfig: KernelConfig = {\n kernelName: Identity,\n backendName:\n 'wasm',\n kernelFunc: identity as {\n } as KernelFunc,\n};\n\n"/**\n * Copyright 2019 Google LLC. All\n * Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this\n * file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n * governing permissions and\n * limitations under the
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=====\\n
*/\\n\\nimport {KernelConfig, KernelFunc, TensorInfo, Transpose, TransposeAttrs, TransposeInputs} from
'@tensorflow/tfjs-core';\\n\\nimport {BackendWasm} from '../backend_wasm';\\n\\nimport {identity} from
'./Identity';\\nimport {CppType} from './types';\\n\\nlet wasmTranspose: (\\n   xId: number, xShape: Uint8Array,
xShapeLength: number, dtype: CppDType,\\n   outId: number, perm: Uint8Array, permLength: number) =>
void;\\n\\nfunction setup(backend: BackendWasm) {\\n   wasmTranspose = backend.wasm.cwrap(Transpose, null /*
void */, [\\n     'number', // xId\\n     'array', // x.shape\\n     'number', // x.shape.length\\n     'number', // dtype\\n
'number', // outId\\n     'array', // perm\\n     'number', // perm.length\\n   ]);\\n}\\n\\nexport function transpose(\\n   args:\\n
    {inputs: TransposeInputs, backend: BackendWasm, attrs: TransposeAttrs}):\\n   TensorInfo {\\n   const {inputs,
backend, attrs} = args;\\n
// Reduce any dimensions with size one. Lower-rank transpose kernel performs\\n // better due to simpler memory
access pattern.\\n   const [reducedShape, perm] = removeOneSizeDims(inputs.x.shape, attrs.perm);\\n\\n   let
permIsNoOp = true;\\n   for (let i = 0; i < perm.length; i++) {\\n     if (perm[i] !== i) {\\n       permIsNoOp = false;\\n
}\\n   }\\n\\n   const outShape = computeOutShape(inputs.x.shape, attrs.perm);\\n   const x = {\\n     dataId: inputs.x.dataId,\\n
shape: reducedShape,\\n     dtype: inputs.x.dtype\\n   };\\n\\n   if (permIsNoOp) {\\n     const cloned = identity({inputs,
backend});\\n     cloned.shape = outShape;\\n     return cloned;\\n   }\\n\\n   const out = backend.makeOutput(outShape,
x.dtype);\\n   const xId = backend.dataIdMap.get(x.dataId).id;\\n   const outId =
backend.dataIdMap.get(out.dataId).id;\\n   const permBytes = new Uint8Array(new Int32Array(perm).buffer);\\n
const xShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);\\n\\n   wasmTranspose(\\n     xId,
xShapeBytes, x.shape.length,
CppType[x.dtype], outId, permBytes,\\n     perm.length);\\n   return out;}\\n\\nfunction
computeOutShape(inShape: number[], perm: number[]): number[] {\\n   const outShape = new
Array(inShape.length);\\n   for (let i = 0; i < outShape.length; i++) {\\n     outShape[i] = inShape[perm[i]];\\n   }\\n
return outShape;}\\n\\nfunction removeOneSizeDims(\\n   shape: number[], perm: number[]): [number[], number[]]
{\\n   const newShape: number[] = [];\\n   const newPerm: number[] = [];\\n   for (let i = 0; i < shape.length; ++i) {\\n     if
(shape[i] !== 1) {\\n       newShape.push(shape[i]);\\n     }\\n     if (shape[perm[i]] !== 1) {\\n
newPerm.push(perm[i]);\\n     }\\n   }\\n   for (let i = 0; i < newPerm.length; ++i) {\\n     let minValIdx = -1;\\n     for (let j =
0; j < newPerm.length; ++j) {\\n       if (newPerm[j] >= i &&\\n         (minValIdx === -1 || newPerm[minValIdx] >
newPerm[j])) {\\n         minValIdx = j;\\n       }\\n     }\\n     newPerm[minValIdx] = i;\\n   }\\n   return [newShape,
newPerm];}\\n}\\n\\nexport const
transposeConfig: KernelConfig = {\\n   kernelName: Transpose,\\n   backendName: 'wasm',\\n   kernelFunc: transpose
as {} as KernelFunc,\\n   setupFunc: setup,\\n};\\n","**\\n * @license\\n * Copyright 2020 Google Inc. All Rights
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OR CONDITIONS OF ANY KIND, either express or implied.\\n * See the License for the specific language
governing permissions and\\n * limitations under the License.\\n *
=====\\n
*/\\n\\nimport {backend_util, TensorInfo, util} from '@tensorflow/tfjs-core';\\nimport {BackendWasm} from
'../backend_wasm';\\nimport
{transpose} from './Transpose';\\n\\n/**\\n * Compute permutation axes and do a transpose if necessary.\\n */\\n * Used
by reduction ops.\\n * @param x input TensorInfo\\n * @param axis reduction axes\\n * @param backend wasm
backend instance\\n */\\nexport function permuteAxesAndTranspose(\\n   x: TensorInfo, axis: number|number[],
backend: BackendWasm): {\\n   transposed: TensorInfo|null,\\n   axes: number[],\\n   originalAxes: number[],\\n
inputWasTransposed: boolean\\n } {\\n   const xShape = x.shape;\\n   const xRank = x.shape.length;\\n\\n   const
originalAxes = util.parseAxisParam(axis, xShape);\\n   let axes = originalAxes;\\n   const permutedAxes =
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backend_util.getAxesPermutation(axes, xRank);\n let xTransposed = null;\n let inputWasTransposed = false;\n if
(permutedAxes != null) {\n   const newShape: number[] = new Array(xRank);\n   for (let i = 0; i <
newShape.length; i++) {\n     newShape[i] = xShape[permutedAxes[i]];\n   }\n   axes =
backend_util.getInnerMostAxes(axes.length, xRank);\n
  xTransposed =\n    transpose({inputs: {x}, attrs: {perm: permutedAxes}, backend});\n\n  const xId =
backend.dataIdMap.get(x.dataId).id;\n  const transposedId = backend.dataIdMap.get(xTransposed.dataId).id;\n  if
(transposedId !== xId) {\n    inputWasTransposed = true;\n  }\n\n  return {transposed: xTransposed,
originalAxes, axes, inputWasTransposed};\n}\n"/**\n * @license\n * Copyright 2021 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file
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http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
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under the License.\n *
=====
*/\n\nimport {All, AllAttrs, AllInputs, backend_util, KernelConfig, KernelFunc, TensorInfo, util} from
'@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport
{permuteAxesAndTranspose} from './kernel_utils';\n\nlet wasmAll: (xId: number, reduceSize: number, outId:
number) => void;\n\nfunction setup(backend: BackendWasm): void {\n  wasmAll = backend.wasm.cwrap(All, null
/*void*/, ['number, number, number']);\n}\n\nfunction all(args: {backend: BackendWasm, inputs: AllInputs, attrs:
AllAttrs}): \n  TensorInfo {\n  const {backend, inputs, attrs} = args;\n  const {axis, keepDims} = attrs;\n  const {x}
= inputs;\n  const xId = backend.dataIdMap.get(x.dataId).id;\n  let inputId = xId;\n  let input = x;\n\n  const
{transposed, axes, originalAxes, inputWasTransposed} =\n    permuteAxesAndTranspose(x, axis, backend);\n\n  if
(inputWasTransposed) {\n    const transposedId
= backend.dataIdMap.get(transposed.dataId).id;\n    input = transposed;\n    inputId = transposedId;\n  }\n\n  const
inputRank = input.shape.length;\n  backend_util.assertAxesAreInnerMostDims('all', axes, inputRank);\n  const
[outShape, reduceShape] =\n    backend_util.computeOutAndReduceShapes(input.shape, axes);\n  const
reduceSize = util.sizeFromShape(reduceShape);\n\n  const out = backend.makeOutput(outShape, x.dtype);\n  if
(util.sizeFromShape(input.shape) !== 0) {\n    const outId = backend.dataIdMap.get(out.dataId).id;\n
wasmAll(inputId, reduceSize, outId);\n  }\n\n  if (inputWasTransposed) {\n    // dispose of the transposed tensor.\n
backend.disposeData(transposed.dataId);\n  }\n\n  if (keepDims) {\n    // reshape\n    const newShape =
backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n    out.shape = newShape;\n  }\n\n  return
out;\n}\n\nexport const allConfig: KernelConfig = {\n  kernelName: All,\n  backendName: 'wasm',\n  setupFunc:
setup,\n  kernelFunc:
all as {} as KernelFunc\n};\n"/**\n * @license\n * Copyright 2021 Google LLC. All Rights Reserved.\n *
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http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
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under the License.\n *
=====
*/\n\nimport {Any, AnyAttrs, AnyInputs, backend_util, KernelConfig, KernelFunc, TensorInfo, util} from
'@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport
{permuteAxesAndTranspose} from './kernel_utils';\n\nlet wasmAny:
(xId: number, reduceSize: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n
wasmAny = backend.wasm.cwrap(Any, null /*void*/, ['number, number, number']);\n}\n\nfunction any(args:

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*\n\nimport { AvgPool, AvgPoolAttrs, AvgPoolInputs, backend_util, KernelConfig, KernelFunc, Tensor4D } from
'@tensorflow/tfjs-core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nlet wasmAvgPool: (\n  xId:
number, batchSize: number, inputHeight: number, inputWidth: number,\n  filterHeight: number, filterWidth:
number, padTop: number, padRight: number,\n  padBottom: number, padLeft: number, strideHeight: number,\n  strideWidth: number, channels: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n
wasmAvgPool = backend.wasm.cwrap(AvgPool, null /* void */, [\n  'number', // xId\n  'number', // batchSize\n  'number', // inputHeight\n  'number', // inputWidth\n  'number', // filterHeight\n  'number', // filterWidth\n  'number', // padTop\n  'number', // padRight\n  'number', // padBottom\n  'number', // padLeft\n  'number', // strideHeight\n  'number', // strideWidth\n  'number', // channels\n  'number', // outId\n  ]);\n}\n\nfunction avgPool(\n  args: { inputs: AvgPoolInputs, backend: BackendWasm, attrs: AvgPoolAttrs }) {\n
const { inputs, attrs, backend } = args;\n\n  const x = inputs.x as Tensor4D;\n  const xId =
backend.dataIdMap.get(x.dataId).id;\n\n  const { filterSize, strides, pad, dimRoundingMode } = attrs;\n  const
convInfo = backend_util.computePool2DInfo(\n    x.shape, filterSize, strides, 1 /* dilations */, pad,
dimRoundingMode);\n\n  const filterHeight = convInfo.filterHeight;\n  const filterWidth = convInfo.filterWidth;\n
const padTop = convInfo.padInfo.top;\n  const padRight = convInfo.padInfo.right;\n  const padBottom =
convInfo.padInfo.bottom;\n  const padLeft = convInfo.padInfo.left;\n  const strideHeight = convInfo.strideHeight;\n
const strideWidth = convInfo.strideWidth;\n  const channels = convInfo.inChannels;\n\n  if (convInfo.dataFormat
!=='channelsLast') {\n
    throw new Error(\n      `wasm backend does not support dataFormat:~` +\n      `${convInfo.dataFormat}`. Please
use 'channelsLast'.`);\n  }\n\n  if (convInfo.dilationWidth !== 1 || convInfo.dilationHeight !== 1) {\n    throw new
Error(\n      `was backend only supports average pooling with dilation = [1, 1],` +\n      `got
[${convInfo.dilationHeight}, ${convInfo.dilationWidth}].`);\n  }\n\n  const out =
backend.makeOutput(convInfo.outShape, 'float32');\n  const outId = backend.dataIdMap.get(out.dataId).id;\n\n
wasmAvgPool(\n    xId, x.shape[0], x.shape[1], x.shape[2], filterHeight, filterWidth,\n    padTop, padRight,
padBottom, padLeft, strideHeight, strideWidth, channels,\n    outId);\n  return out;\n}\n\nexport const
avgPoolConfig: KernelConfig = {\n  kernelName: AvgPool,\n  backendName: 'wasm',\n  setupFunc: setup,\n
kernelFunc: avgPool as { } as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights
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BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the
License for the specific language governing permissions and\n * limitations under the License.\n */
=====
*\n\nimport { KernelConfig, KernelFunc, Reshape, ReshapeAttrs, ReshapeInputs, util } from '@tensorflow/tfjs-
core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nexport function reshape(\n  args: { inputs:
ReshapeInputs, attrs: ReshapeAttrs, backend: BackendWasm }) {\n  const { inputs, attrs } = args;\n  const { x } =
inputs;\n  const { shape } = attrs;\n\n  const xSize = util.sizeFromShape(x.shape);\n
const $shape = util.inferFromImplicitShape(shape, xSize);\n\n  util.assert(\n    xSize ===
util.sizeFromShape($shape),\n    () => `new shape: ${$shape}, old shape: ${x.shape}. New shape and old` +\n
`shape must have the same number of elements.`);\n\n  // Backend needs to track refCount for the dataId for reshape
op\n  args.backend.incRef(x.dataId);\n  return { dataId: x.dataId, shape: $shape, dtype: x.dtype };\n}\n\nexport const
reshapeConfig: KernelConfig = {\n  kernelName: Reshape,\n  backendName: 'wasm',\n  kernelFunc: reshape as { }
as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under
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/*\n\nimport { BatchMatMul, BatchMatMulAttrs, BatchMatMulInputs, KernelConfig, KernelFunc, util } from
'@tensorflow/tfjs-core';\n\nimport { BackendWasm } from './backend_wasm';\n\nimport { reshape } from
'./Reshape';\n\nlet wasmBatchMatMul: (\n  aId: number, aShape: Uint8Array, aShapeSize: number, bId: number,\n  bShape: Uint8Array, bShapeSize: number, transposeA: boolean,\n  transposeB: boolean, outId: number) =>
void;\n\nfunction setup(backend: BackendWasm) {\n  wasmBatchMatMul = backend.wasm.cwrap(BatchMatMul,
null /* void */, [\n    'number', // a_id\n    'array', // a_shape\n    'number', // a_shape.length\n    'number', // b_id\n    'array', // b_shape\n    'number', // b_shape.length\n    'number', // transpose_a\n    'number', // transpose_b\n    'number' // out_id\n  ]);\n\n  function batchMatMul(args: {\n    inputs: BatchMatMulInputs,\n    backend: BackendWasm,\n    attrs: BatchMatMulAttrs\n  }) {\n    const { inputs, backend, attrs } = args;\n    const { a, b } = inputs;\n    const { transposeA, transposeB } = attrs;\n\n    if (a.dtype !== 'float32' || b.dtype !== 'float32') {\n      throw new Error(\n        `BatchMatMul for non float32 tensors not yet supported.`);\n    }\n\n    const aRank = a.shape.length;\n    const bRank = b.shape.length;\n\n    const innerShapeA = transposeA ? a.shape[aRank - 2] : a.shape[aRank - 1];\n    const innerShapeB = transposeB ? b.shape[bRank - 1] : b.shape[bRank - 2];\n\n    const outerShapeA = transposeA ? a.shape[aRank - 1] : a.shape[aRank - 2];\n    const outerShapeB = transposeB ? b.shape[bRank - 2] : b.shape[bRank - 1];\n\n    const outerDimsA = a.shape.slice(0, -2);\n    const outerDimsB = b.shape.slice(0, -2);\n\n    const batchDimA = util.sizeFromShape(outerDimsA);\n    const batchDimB = util.sizeFromShape(outerDimsB);\n\n    const batchDimsCompatible =\n      batchDimA === batchDimB || batchDimA === 1 || batchDimB === 1;\n\n    util.assert(\n      aRank >= 2 && bRank >= 2 && batchDimsCompatible,\n      () => `Error in matMul: the input batch dimensions must either be the same or at least one input batch dimension must be 1. Got input batch dimensions of (${outerDimsA}) and (${outerDimsB}).`);\n\n    const outShapeOuterDims =\n      batchDimA > batchDimB ? a.shape.slice(0, -2) : b.shape.slice(0, -2);\n    const outShape =\n      outShapeOuterDims.concat([outerShapeA, outerShapeB]);\n\n    util.assert(\n      innerShapeA === innerShapeB,\n      () => `Error in matMul: inner shapes (${innerShapeA}) and (${innerShapeB}) of Tensors with shapes ${a.shape} and ${b.shape} and transposeA=${transposeA} and transposeB=${transposeB} must match.`);\n\n    const\n      a3dShape = transposeA ? [batchDimA, innerShapeA, outerShapeA] : [batchDimA, outerShapeA, innerShapeA];\n    const b3dShape = transposeB ? [batchDimB, outerShapeB, innerShapeB] : [batchDimB, innerShapeB, outerShapeB];\n\n    // The rest of the implementation is designed to operate on rank-3 tensors\n    const a3d = reshape({ inputs: { x: a }, backend, attrs: { shape: a3dShape } });\n    const b3d = reshape({ inputs: { x: b }, backend, attrs: { shape: b3dShape } });\n\n    const a3dId = backend.dataIdMap.get(a3d.dataId).id;\n    const b3dId = backend.dataIdMap.get(b3d.dataId).id;\n\n    const leftDim = transposeA ? a3d.shape[2] : a3d.shape[1];\n    const rightDim = transposeB ? b3d.shape[1] : b3d.shape[2];\n\n    const batchDim = Math.max(batchDimA, batchDimB);\n\n    const out = backend.makeOutput([batchDim, leftDim, rightDim], a3d.dtype);\n    const outId = backend.dataIdMap.get(out.dataId).id;\n\n    const aShapeBytes = new Uint8Array(new Int32Array(a3d.shape).buffer);\n\n    const bShapeBytes = new Uint8Array(new Int32Array(b3d.shape).buffer);\n\n    wasmBatchMatMul(\n      a3dId, aShapeBytes, a3d.shape.length, b3dId, bShapeBytes, b3d.shape.length, transposeA, transposeB, outId);\n\n    backend.disposeData(a3d.dataId);\n    backend.disposeData(b3d.dataId);\n\n    out.shape = outShape;\n\n    return out;\n  }\n\n  export const batchMatMulConfig: KernelConfig = {\n    kernelName: BatchMatMul,\n    backendName: 'wasm',\n    setupFunc: setup,\n    kernelFunc: batchMatMul as KernelFunc\n  };\n\n  /**\n   * @license\n   * Copyright 2020 Google LLC. All Rights Reserved.\n   * Licensed under the Apache License, Version 2.0 (the "License");\n   * you may not use this file except in compliance with the License.\n   * You may obtain a copy of the
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\n\n*/\nimport { backend_util, util } from '@tensorflow/tfjs-core';\nexport function concatImpl(inputs, outShape, dtype,\nsimplyConcat) {\n    const outVals = util.getArrayFromDType(dtype, util.sizeFromShape(outShape));\n    if\n(simpleConcat && dtype !== 'string') {\n        // Use built-in TypedArray.set() method for speed.\n        let offset =\n0;\n        inputs.forEach(input => {\n            const size = util.sizeFromShape(input.shape);\n            outVals.set(input.vals, offset);\n            offset += size;\n        });\n    } else {\n        let colOffset = 0;\n        inputs.forEach(input => {\n            const decodedData = dtype === 'string' ?\nbackend_util.fromUint8ToStringArray(input.vals) :\n            input.vals;\n\n            let tIdx = 0;\n            for (let row = 0; row < input.shape[0]; ++row) {\n                const resIdx = row *\noutShape[1] + colOffset;\n                for (let col = 0; col < input.shape[1]; ++col) {\n                    outVals[resIdx +\ncol] = decodedData[tIdx++];\n                }\n                colOffset += input.shape[1];\n            }\n            return\noutVals;\n        })\n    }\n}\n\nsourceMappingURL=data:application/json;base64,eyJ2ZXJzaW9uIjozLCJmaWxIIjoiQ29uY2F0X2ltcGwuanMiLCJzb3VyY2VSb290Ijoilwiwicz291cmNlcyI6WyJuLi8uLi8uLi8uLi8uLi8uLi90ZmpzLWJhY2t1bmQtY3B1L3NyYy9rZXRuZWxzL0NvbmlldH9pbXBsLnRzIl0sIm5hbWVzIjpjbXSuibWFwcGluc3MiOiJBQUFBQz7Ozs7Ozs7Ozs7Ozs7R0FIRztBQUVILE9BQU8sRUFBQyxZQUFZLEVBQXVDLEIBQUksRUFBQyxNQUFNLHVCCQUFIQixDQUFDO0FBRTIGLE1BQU0sVUFBVScxVQUFVLENBQ3RCLE1BQXFEBQVBUUsUUFBA0IsRUFDEKUSsS0FBZSxFQUFFLFIBQXFCO0IBQ3hdLE1BQU0sT0FTBTyxHQUFHLEIBQUksQ0FBQyxPqkFBaUIsQ0FBQyxLQUFLLEVBQUUsSUFBSSxDQUFDLGFBQWEsQ0FBQyxRQUFRLENBQUMsQ0FBQyxDQUFD00IBRTVFLEIBQUksWUFBWSxJQUFJLEtBQUssS0FBBSyxRQUFRLEVBQUU7UUFDdEMsa0RBQWtEO1FBQ2xELEIBQUksTUFBTSxHQUFHLENBQUMsQ0FBQztRQUNmLE1BQU0sQ0FBQyxPQUFPLENBQUMsS0FBBSyxDQUFDLEVBQUU7WUFDckIsTUFBTSxJQUFJLEdBQUcsSUFBSSxDQUFDLGFBQWEsQ0FBQyxLQUFLLENBQUMsS0FBBSyxDQUFDLENBQUM7WUFFNUMsT0FBc0IsQ0FBQyxHQUFHLENBQUMsS0FBBSyxDQUFDLEIBQWtCLEVBQUUsTUFBTSxDQUFDLENBQUM7WUFD0UQsTUFBTSxJQUFJLEIBQUksQ0FBQztRQUNqQixDQUFDLENBQUMsQ0FBQztLQUNKO1NBQU07UUFDTCxJQUFJLFNBQVMsR0FBRyxDQUFDLENBQUM7UUFFbEIsTUFBTSxDQUFDLE9BQU8sQ0FBQyxLQUFLLENBQUMsRUFBRtZTQUNyQixNQUFNLfdBQVCsR0FBRyxLQUFLLEtBQUssUUFBUSxDQUFDLENBQUM7Z0JBQ3BDLFIBQVksQ0FBQyxzQkFBc0IsQ0FBQyxLQUFLLENBQUMsSUFBb0IsQ0FBQyxDQUFDLENBQUM7Z0JBQ2pFLEtBQUssQ0FBQyxJQUFrQixDQUFD01IBRTdCLEIBQUksSUFBSSxHQUFHLENBQUMsQ0FBQztZQUViLEtBQUssSUFBSSxHQUFHLEdBQUcsQ0FBQyxLQUFFLEdBQUcsR0FBRyxLQUFLLENBQUMsS0FBBSyxDQUFDLENBQUMsQ0FBQyxFQUFFLEVBUUsR0FBRyxFQUFF02dCQUM3QyxNQUFNLE1BQU0sR0FBRyxHQUFHLEdBQUcsUUFBUSxDQUFDLENBQUMsQ0FBQyxHQUFHLFNBMVsQ0FBQztnQkFDN0MsS0FBBSyxJQUFJLEdBQUcsR0FBRyxDQUFDLEVBQUUsR0FBRyxHQUFHLEtBQUssQ0FBQyxLQUFLLENBQUMsQ0FBQyxDQUFDLEVBQUUsRUFBRShxQUFHLEVBQUU7b0JBQzdDLE9BQU8sQ0FBQyxNQUFNLEdBQUcsR0FBRyxDQUFDLEdBQUcsV0FBVyxDQUFDLEIBQUksRUFBRShxDQUFDLENBQUM7aUJBQzdDO2FBQ0Y7WUFFRCxTQUFTLEIBQUksS0FBBSyxDQUFDLEtBQUssQ0FBQyxDQUFDLENBQUMsQ0FBQztRQUM5QixDQUFDLENBQUMsQ0FBQztLQUNKO0IBRUQsT0FTBTyxPQUFPLENBQUM7QUFDakIsQ0FBQyIsInNvdXJjZXNDb250ZW50IjpbIi8qKlxuICogQGxpY2Vuc2VcbiAqlENvcHIyaWdodCAyMDIWIEdvbn2dsZSBMTEMuIEFsbcBSaWdodHMgUmVzZXJ2ZWQuXG4gKiBibMaWNlbNIZCB1bmRlcjB0aGUgQXBhY2h1IEExpY2Vuc2UsIFZlcnNpb24gMi4wICh0aGUgXCJMawNlbnNIXCIpOl1xuICogeW91IG1heSBub3QgdXNIHRoaXMgZmlsZSBleGNlcHQgaW4gY29tcGxpYW5jZSB3aXRoIHROZSBMaWNlibnNlLlxuICogWW91IG1heSBvYnRhaW4gYSBjb3B5IG9mIHROZSBMaWNlbnNlIGF0XG4gKlxuICogaHR0cDovL3d3dy5hcGFjaGUub3JnL2xpY2Vuc2VzL0xjQ0VOU0UtMi4wXG4gKlxuICogVW5sZXNZIHJlcXVpcmVkIGJ5IGFwcGxpY2FibGUgbGF3IG9yIGFnemVIZCB0byBpbjB3cm10aW5wNLCBzb2Z0d2FyZVxuICogZGlzdHJpYnV0Z
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*/\nimport { backend_util, buffer, Slice, slice_util, util } from '@tensorflow/tfjs-core';\nimport { assertNotComplex } from './cpu_util';\n\nexport function sliceImpl(vals, begin, size, shape, dtype) {\n  const isContinuous = slice_util.isSliceContinuous(shape, begin, size);\n  const length = util.sizeFromShape(size);\n  const xStrides = util.computeStrides(shape);\n  if (isContinuous) {\n    const flatOffset = slice_util.computeFlatOffset(begin, xStrides);\n    if (dtype === 'string') {\n      return vals.slice(flatOffset, flatOffset + length);\n    }\n    return vals.subarray(flatOffset, flatOffset + length);\n  }\n  const decodedData = dtype === 'string' ?\n    backend_util.fromUint8ToStringArray(vals) : vals;\n  const inBuf = buffer(shape, dtype, decodedData);\n  const outBuf = buffer(size, dtype);\n  for (let i = 0; i < outBuf.size; ++i) {\n    const outLoc = outBuf.indexToLoc(i);\n    const inLoc = outLoc.map((idx, j) => idx + begin[j]);\n    outBuf.set(inBuf.get(...inLoc), ...outLoc);\n  }\n  if (dtype === 'string') {\n    return backend_util.fromStringArrayToUint8(outBuf.values);\n  }\n  return outBuf.values;\n}\n\nexport function slice(args) {\n  const { inputs, backend, attrs } = args;\n  const { x } = inputs;\n  const { begin, size } = attrs;\n  assertNotComplex(x, 'slice');\n  const [$begin, $size] = slice_util.parseSliceParams(x, begin, size);\n  slice_util.assertParamsValid(x, $begin, $size);\n  const vals = backend.data.get(x.dataId).values;\n  const outVals = sliceImpl(vals, $begin, $size, x.shape, x.dtype);\n  return backend.makeTensorInfo($size, x.dtype, outVals);\n}\n\nexport const sliceConfig = {\n  kernelName: Slice,\n  backendName: 'cpu',\n  kernelFunc: slice\n};\n//#

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[illegible]

wgYXR0cnN9ID0gYXJncztcbiAgY29uc3Qge3h9ID0gaW5wdXRzO1xuICBjb25zdCB7YmVnaW4sIHNpemV9ID0gYXR0cnM7XG5cbiAgYXNzZXJ0Tm90Q29tcGxleCh4LCAnc2xpY2UnKTtcb1xuICBjb25zdCBbJGJlZ2luLCAkc2l6ZV0gPSBzbGljZV91dGlsLnBhcnNIU2xpY2VQYXJhbXMoecWgYmVnaW4sIHNpemUpO1xuICBzbGljZV91dGlsLmFzc2VydFBhcmFtc1ZhbGlkKHgsICRiZWdpbiwgJHNpemUpO1xuXG4gIGNvbnN0IHZhbHMgPSBiYWNRZW5kLmRhdGEuZ2V0KHguZGF0YUlkKS52YWx1ZXM7XG4gIGNvbnN0IG91dFZhbmHgPSBzbGljZUltcGwodmFscywgJGJlZ2luLCAkc2l6ZSwgeC5zaGFwZSwgeC5kdHlwZSk7XG4gIHJldHVybiBiYWNRZW5kLm1ha2VUZW5zb3JlbnZvKCRzaXplLCB4LmR0eXBILCBvdXRWYWxzKTtcbn1cblxuZXhwb3J0IGNvbnN0IHNsaWNlQ29uZmlnOiBLZXJuZWxD25maWcgPSB7XG4gIGtlcm5lbE55bWU6IFNsaWNlFxuICBiYWNRZW5kTmFtZTogJ2NwdScsXG4gIGtlcm5lbEZ1bmM6IHNsaWNlIGFzIHt9IGFzIetlcm5lbEZ1bmNcbn07XG4iXX0=","/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n

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outOffset += size[2];\n  }\n }\n\nfunction slice4d(\n  xVals: backend_util.TypedArray,\n  xStride1: number, xStride2: number,\n  xStride3: number, outVals: backend_util.TypedArray,\n  begin: [number,\n  number, number, number],\n  size: [number, number, number, number]): void {\n  let outOffset = 0;\n  const beginI = begin[0];\n  const beginJ = begin[1];\n  const beginK = begin[2];\n  const endI = beginI + size[0];\n  const endJ = beginJ + size[1];\n  const endK = beginK + size[2];\n  const beginL = begin[3];\n  for (let i = beginI; i < endI; i++)\n  {\n    for (let j = beginJ; j < endJ; j++) {\n      for (let k = beginK; k < endK; k++) {\n        const xOffset = i *\n        xStride1 + j * xStride2 + k * xStride3 + beginL;\n        outVals.set(xVals.subarray(xOffset, xOffset + size[3]),\n        outOffset);\n        outOffset += size[3];\n      }\n    }\n  }\n}\n\nexport const sliceConfig: KernelConfig = {\n  kernelName: Slice,\n  backendName: 'wasm',\n  kernelFunc: slice as {} as KernelFunc,\n};\n","/*\n * @license\n * Copyright 2021 Google LLC. All Rights Reserved.\n
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*\n\nimport {backend_util, BatchToSpaceND, BatchToSpaceNDAttrs, BatchToSpaceNDInputs, KernelConfig,\nKernelFunc} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport\n{reshape} from './Reshape';\nimport {slice} from './Slice';\nimport {transpose} from './Transpose';\n\nfunction\nbatchToSpaceND(args: {\n  inputs: BatchToSpaceNDInputs,\n  backend: BackendWasm,\n  attrs: BatchToSpaceNDAttrs\n}) {\n  const {inputs, backend, attrs} = args;\n  const\n  {x} = inputs;\n  const {blockShape, crops} = attrs;\n  const prod = blockShape.reduce((a, b) => a * b);\n  const\n  reshaped = backend_util.getReshaped(x.shape, blockShape, prod);\n  const permuted =\n  backend_util.getPermuted(reshaped.length, blockShape.length);\n  const reshapedPermuted =\n  backend_util.getReshapedPermuted(x.shape, blockShape, prod);\n  const sliceBeginCoords =\n  backend_util.getSliceBeginCoords(crops, blockShape.length);\n  const sliceSize =\n  backend_util.getSliceSize(reshapedPermuted, crops, blockShape.length);\n  const xReshaped = reshape({inputs:\n  {x}, backend, attrs: {shape: reshaped}});\n  const xTransposed =\n  transpose({inputs: {x: xReshaped}, backend,\n  attrs: {perm: permuted}});\n  const xTransposedReshaped = reshape(\n  {\n    inputs: {x: xTransposed}, backend,\n    attrs: {shape: reshapedPermuted}\n  });\n  const result\n  = slice({\n    inputs: {x: xTransposedReshaped},\n    backend,\n    attrs: {begin: sliceBeginCoords, size:\n    sliceSize}\n  });\n  backend.disposeData(xReshaped.dataId);\n  backend.disposeData(xTransposed.dataId);\n  backend.disposeData(xReshaped.dataId);\n  return result;\n}\n\nexport const batchToSpaceNDConfig:\nKernelConfig = {\n  kernelName: BatchToSpaceND,\n  backendName: 'wasm',\n  kernelFunc: batchToSpaceND as\n  {} as KernelFunc\n};\n","/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed\n * under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the\n * License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed\n * on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or\n * implied.\n * See the License for\n * the specific language governing permissions and\n * limitations under the License.\n *

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*\n\nimport {Cast, CastAttrs, CastInputs, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';\n\nimport\n{TensorInfo} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nexport function\ncast(\n  args: {inputs: CastInputs, attrs: CastAttrs, backend: BackendWasm};\n  TensorInfo {\n    const {inputs:\n    {x}, attrs: {dtype}, backend} = args;\n    const out = backend.makeOutput(x.shape, dtype);\n    const inVals =\n    backend.tensorArrayFromHeap(x);\n    const outVals = backend.tensorArrayFromHeap(out);\n    outVals.set(inVals);\n
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return out;\n\n\nexport const castConfig: KernelConfig = {\n  kernelName: Cast,\n  backendName: 'wasm',\n  kernelFunc: cast as {} as KernelFunc,\n};\n","/*\n * @license\n * Copyright 2021 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n\n=====\n*/\n\nimport {KernelConfig, Ceil} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from './unary_kernel';\n\nexport const ceilConfig: KernelConfig = createUnaryKernelConfig(Ceil);\n","/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n\n=====\n*/\n\nimport {ClipByValue, ClipByValueAttrs, ClipByValueInputs, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nlet wasmClip: (xId: number, min: number, max: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n  wasmClip = backend.wasm.cwrap(ClipByValue, null /* void */, [\n    'number', // x_id\n    'number', // min\n    'number', // max\n    'number' // out_id\n  ]);\n\n  function clip(args: {\n    inputs: ClipByValueInputs,\n    backend: BackendWasm,\n    attrs: ClipByValueAttrs\n  }) {\n    const {inputs, backend, attrs} = args;\n    const {x} = inputs;\n    const {clipValueMin, clipValueMax} = attrs;\n    const xId = backend.dataIdMap.get(x.dataId).id;\n    const out = backend.makeOutput(x.shape, x.dtype);\n    const outId = backend.dataIdMap.get(out.dataId).id;\n    wasmClip(xId, clipValueMin, clipValueMax, outId);\n    return out;\n  }\n\n  export const clipByValueConfig: KernelConfig = {\n    kernelName: ClipByValue,\n    backendName: 'wasm',\n    setupFunc: setup,\n    kernelFunc: clip as {} as KernelFunc\n  }; \n","/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n\n=====\n*/\n\nimport {backend_util, Concat, ConcatAttrs, ConcatInputs, KernelConfig, KernelFunc, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nimport {concatImplCPU} from '../kernel_utils/shared';\nimport {identity} from './Identity';\nimport {reshape} from './Reshape';\n\nexport function concat(\n  args: {\n    inputs: ConcatInputs,\n    backend: BackendWasm,\n    attrs: ConcatAttrs\n  }) {\n    const {inputs, backend} = args;\n    const axis = util.parseAxisParam(args.attrs.axis, inputs[0].shape)[0];\n    let outShape = backend_util.computeOutShape(inputs.map(t => t.shape), axis);\n    // Keep only non-empty tensors (ignore tensors with 0 in their shape).\n    const $inputs = inputs.filter(t => util.sizeFromShape(t.shape) > 0);\n    if ($inputs.length === 1) {\n      return identity({inputs: {x: $inputs[0]}, backend});\n    }\n    const out = backend.makeOutput(outShape, inputs[0].dtype);\n    if (util.sizeFromShape(outShape) === 0) {\n      return out;\n    }\n    const shapes = $inputs.map(t => t.shape);\n    backend_util.assertParamsConsistent(shapes, axis);\n    if ($inputs[0].dtype ===

```

```
(string) {\n    // Any concat of n-dimensional tensors across any axis can be reduced to\n    // a concatenation of two-dimensional tensors across the axis 1 by first\n    // partitioning the axes of the original tensors into those less than\n    the\n    // axis to be concatenated and the rest. Then reshape the tensors\n    // into a two-dimensional tensor by collapsing these two sets of axes and\n    // concatenate the resulting matrices across the axis 1, finally reshaping\n    // the result to have the proper shape.\n    const inputs2D = $inputs.map(t => {\n        const innerSize = util.sizeFromShape(t.shape.slice(axis));\n        const shape = [-1, innerSize];\n        return reshape({inputs: {x: t}, backend, attrs: {shape}});\n    });\n    const inputsValShapes = inputs2D.map(t => {\n        return {vals: backend.readSync(t.dataId), shape: t.shape};\n    });\n    // Concates 2d tensors along axis=1.\n    outShape =\n    backend_util.computeOutShape(inputs2D.map(t => t.shape), 1 /* axis */);\n    const simplyConcat =\n    inputs2D[0].shape[0] === 1;\n    const outVals = concatImplCPU(\n        inputsValShapes, outShape,\n        inputs[0].dtype,\n        simplyConcat) as string[];\n    const finalOutShape =\n    backend_util.computeOutShape($inputs.map(t => t.shape), axis);\n    out.shape = finalOutShape;\n    const outData = backend.dataIdMap.get(out.dataId);\n    outData.stringBytes =\n    backend_util.fromStringArrayToUint8(outVals);\n    inputs2D.forEach(t => backend.disposeData(t.dataId));\n}\nreturn out;\n}\nconst batchDim = util.sizeFromShape($inputs[0].shape.slice(0, axis));\nlet sumInnerDims = 0;\nconst innerDims =\n$inputs.map(input => {\n    const innerDim = util.sizeFromShape(input.shape.slice(axis));\n    sumInnerDims += innerDim;\n    return innerDim;\n});\nconst inVals = $inputs.map(input =>\nbackend.typedArrayFromHeap(input));\nconst outVals = backend.typedArrayFromHeap(out);\nfor (let b = 0; b < batchDim; b++) {\n    let outOffset = b * sumInnerDims;\n    for (let i = 0; i < inVals.length; i++) {\n        const innerDim = innerDims[i];\n        const inOffset = b * innerDim;\n        const vals = inVals[i].subarray(inOffset, inOffset + innerDim);\n        outVals.set(vals, outOffset);\n        outOffset += innerDim;\n    }\n}\nreturn out;\n}\nexport const concatConfig: KernelConfig = {\n    kernelName: Concat,\n    backendName: 'wasm',\n    kernelFunc: concat as {} as KernelFunc,\n};\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n\nimport {backend_util, Conv2D, Conv2DAttrs, Conv2DInputs, KernelConfig, KernelFunc, Tensor4D} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nlet wasmConv2d: (\n    xId: number, batchSize: number, inputHeight: number, inputWidth: number,\n    filterId: number, filterHeight: number, filterWidth: number, padTop: number,\n    padRight: number, padBottom: number, padLeft: number, isSamePad: number,\n    dilationHeight: number, dilationWidth: number, strideHeight: number,\n    strideWidth: number, inputChannels: number, outputChannels: number,\n    outId: number) => void;\nfunction setup(backend: BackendWasm) {\n    wasmConv2d = backend.wasm.cwrap(Conv2D, null /* void */, [\n        'number', // xId\n        'number', // batchSize\n        'number', // inputHeight\n        'number', // inputWidth\n        'number', // filterId\n        'number', // filterHeight\n        'number', // filterWidth\n        'number', // padTop\n        'number', // padRight\n        'number', // padBottom\n        'number', // padLeft\n        'number', // isSamePad\n        'number', // dilationHeight\n        'number', // dilationWidth\n        'number', // strideHeight\n        'number', // strideWidth\n        'number', // inputChannels\n        'number', // outputChannels\n        'number', // outId\n    ]);\n}\nfunction conv2d(\n    args: {inputs: Conv2DInputs, backend: BackendWasm, attrs: Conv2DAttrs}) {\n    const {inputs, attrs, backend} = args;\n    const {x, filter} = inputs;\n    const xId = backend.dataIdMap.get(x.dataId).id;\n    const filterId = backend.dataIdMap.get(filter.dataId).id;\n    const {strides, dilations, pad, dimRoundingMode, dataFormat} = attrs;\n    const $dataFormat =\n    backend_util.convertConv2DDataFormat(dataFormat);\n    const convInfo = backend_util.computeConv2DInfo(\n
```

```
(x as Tensor4D).shape, (filter as Tensor4D).shape, strides, dilations, pad, dimRoundingMode, false,
$dataFormat);\n\n const filterHeight = convInfo.filterHeight;\n const filterWidth = convInfo.filterWidth;\n const
padTop = convInfo.padInfo.top;\n const padRight = convInfo.padInfo.right;\n const padBottom =
convInfo.padInfo.bottom;\n const padLeft = convInfo.padInfo.left;\n const dilationHeight =
convInfo.dilationHeight;\n const dilationWidth = convInfo.dilationWidth;\n const strideHeight =
convInfo.strideHeight;\n const strideWidth = convInfo.strideWidth;\n const inputChannels
= convInfo.inChannels;\n const outputChannels = convInfo.outChannels;\n const isSamePad =
convInfo.padInfo.type === 'SAME' ? 1 : 0;\n\n if (convInfo.dataFormat !== 'channelsLast') {\n throw new
Error(\n      `wasm backend Conv2D does not support dataFormat:~` +\n      `${convInfo.dataFormat}`. Please use
'channelsLast'.);\n }\n\n const out = backend.makeOutput(convInfo.outShape, 'float32');\n const outId =
backend.dataIdMap.get(out.dataId).id;\n wasmConv2d(\n      xId, x.shape[0], x.shape[1], x.shape[2], filterId,
filterHeight,\n      filterWidth, padTop, padRight, padBottom, padLeft, isSamePad,\n      dilationHeight,\n      dilationWidth, strideHeight, strideWidth, inputChannels,\n      outputChannels, outId);\n return out;\n }\n\nexport
const conv2DConfig: KernelConfig = {\n kernelName: Conv2D,\n backendName: 'wasm',\n setupFunc: setup,\n
kernelFunc: conv2d as {} as KernelFunc\n};\n", "/*~*\n * @license\n * Copyright 2020 Google LLC. All Rights
Reserved.\n * Licensed
under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with
the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n
*\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is
distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n *\n
=====~\n
*/\n\nimport {backend_util, Conv2DBackpropInput, Conv2DBackpropInputAttrs, Conv2DBackpropInputInputs,
KernelConfig, KernelFunc, TensorInfo, util} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from
'./backend_wasm';\n\nlet wasmConv2DBackpropInput: (\n      dyId: number, filterId: number, batchSize: number,
filterHeight: number,\n      filterWidth: number,
inHeight: number, inWidth: number, inChannels: number,\n      outHeight: number, outWidth: number, outChannels:
number,\n      strideHeight: number, strideWidth: number, topPad: number, leftPad: number,\n      fltS0: number, fltS1:
number, fltS2: number, xBatchStride: number,\n      xRowStride: number, xColStride: number, xChannelStride:
number,\n      yBatchStride: number, yRowStride: number, yColStride: number,\n      yChannelStride: number, outId:
number) => void;\n\nfunction setup(backend: BackendWasm): void {\n      wasmConv2DBackpropInput =
backend.wasm.cwrap(Conv2DBackpropInput, null, [\n          'number', // dyId\n          'number', // filterId\n          'number', //
batchSize\n          'number', // filterHeight\n          'number', // filterWidth\n          'number', // inHeight\n          'number', //
inWidth\n          'number', // inChannels\n          'number', // outHeight\n          'number', // outWidth\n          'number', //
outChannels\n          'number', // strideHeight\n          'number', // strideWidth\n          'number', // topPad\n          'number', // leftPad\n          'number', // fltS0\n          'number', // fltS1\n          'number', // fltS2\n          'number', //
xBatchStride\n          'number', // xRowStride\n          'number', // xColStride\n          'number', // xChannelStride\n          'number', //
yBatchStride\n          'number', // yRowStride\n          'number', // yColStride\n          'number', // yChannelStride\n          'number', // outId\n      ]);\n\nfunction conv2DBackpropInput(args: {\n      backend: BackendWasm,\n      inputs:
Conv2DBackpropInputInputs,\n      attrs: Conv2DBackpropInputAttrs\n}): TensorInfo {\n      const {backend, inputs,
attrs} = args;\n      const {dy, filter} = inputs;\n      const {strides, pad, dataFormat, dimRoundingMode, inputShape} =
attrs;\n\n      const dilations = 1;\n      const $dataFormat = backend_util.convertConv2DDataFormat(dataFormat);\n      const convInfo = backend_util.computeConv2DInfo((\n          inputShape, filter.shape as [number, number, number,
number], strides,\n          dilations, pad, dimRoundingMode, false /* depthwise */, $dataFormat);\n      const {\n          batchSize,\n          filterHeight,\n          filterWidth,\n          inChannels,\n          inHeight,\n          inWidth,\n          outChannels,\n          outHeight,\n          outWidth,\n          strideHeight,\n          strideWidth\n      } = convInfo;\n\n      const topPad =
filterHeight - 1 - convInfo.padInfo.top;\n      const leftPad = filterWidth - 1 - convInfo.padInfo.left;\n\n      const
```

```
isChannelsLast = convInfo.dataFormat === 'channelsLast';\n const dxStrides =
util.computeStrides(convInfo.inShape);\n const dyStrides = util.computeStrides(dy.shape);\n const [fltS0, fltS1,
fltS2] = util.computeStrides(filter.shape);\n const xBatchStride = dxStrides[0];\n const xRowStride =
isChannelsLast ? dxStrides[1] : dxStrides[2];\n const xColStride = isChannelsLast ? dxStrides[2] : 1;\n const
xChannelStride = isChannelsLast ? 1 : dxStrides[1];\n const yBatchStride = dyStrides[0];\n const yRowStride =
isChannelsLast ? dyStrides[1] : dyStrides[2];\n const yColStride = isChannelsLast ? dyStrides[2] : 1;\n const
yChannelStride = isChannelsLast
? 1 : dyStrides[1];\n\n const out = backend.makeOutput(convInfo.inShape, 'float32');\n const outId =
backend.dataIdMap.get(out.dataId).id;\n const dyId = backend.dataIdMap.get(dy.dataId).id;\n const filterId =
backend.dataIdMap.get(filter.dataId).id;\n\n wasmConv2DBackpropInput(\n    dyId, filterId, batchSize,
filterHeight, filterWidth, inHeight, inWidth,\n    inChannels, outHeight, outWidth, outChannels, strideHeight,
strideWidth,\n    topPad, leftPad, fltS0, fltS1, fltS2, xBatchStride, xRowStride,\n    xColStride, xChannelStride,
yBatchStride, yRowStride, yColStride,\n    yChannelStride, outId);\n return out;\n}\n\nexport const
conv2DBackpropInputConfig: KernelConfig = {\n kernelName: Conv2DBackpropInput,\n backendName:
'wasm',\n setupFunc: setup,\n kernelFunc: conv2DBackpropInput as {} as KernelFunc\n};\n\n"/**\n * @license\n *
Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
\"License\");\n * you may not
use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
\n\n*/\n\nimport {Cos, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from
'./unary_kernel';\n\nexport const cosConfig: KernelConfig = createUnaryKernelConfig(Cos);\n\n"/**\n * @license\n *
Copyright 2021 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
\"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of
the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====
\n\n*/\n\nimport {Cosh, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from
'./unary_kernel';\n\nexport const coshConfig: KernelConfig = createUnaryKernelConfig(Cosh);\n\n"/**\n * @license\n *
Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version
2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless
required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an
\"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
=====
\n\n*/\n\nimport {CropAndResize, CropAndResizeAttrs, CropAndResizeInputs, KernelConfig, KernelFunc,
TensorInfo} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from './backend_wasm';\n\nimport {cast}
from './Cast';\n\n// Must match enum in CropAndResize.cc\nenum InterpolationMethod {\n bilinear = 0,\n nearest
= 1\n}\n\nlet wasmCropAndResize: (\n imagesId: number, boxesId: number, boxIndId: number, numBoxes:
number,\n imagesShape: Uint8Array, cropHeight: number, cropWidth: number,\n method: number,
extrapolationValue: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm):
```



```

void {\n  wasmCropAndResize = backend.wasm.cwrap(CropAndResize, null /*void*/, [\n  'number', //
imagesId\n  'number', // boxesId\n  'number', // boxIndId\n  'number', // numBoxes\n  'array', // images
shape\n  'number', // cropHeight\n  'number', // cropWidth\n  'number', // method\n  'number', // extrapolation
value\n  'number' // out id\n  ]);\n\nfunction cropAndResize(args: {\n  backend: BackendWasm,\n  inputs:
CropAndResizeInputs,\n  attrs: CropAndResizeAttrs\n}): TensorInfo {\n  const {backend, inputs, attrs} = args;\n
const {method, extrapolationValue, cropSize} = attrs;\n  const {image, boxes, boxInd} = inputs;\n\n  const
numBoxes = boxes.shape[0];\n\n  const [cropHeight, cropWidth] = cropSize as [number, number];\n  const
outShape = [numBoxes, cropHeight, cropWidth, image.shape[3]];\n\n  let imagesData =
backend.dataIdMap.get(image.dataId);\n  let castedData;\n  if (image.dtype !== 'float32') {\n    castedData =
cast({backend, inputs:
  {x: image}, attrs: {dtype: 'float32'}});\n    imagesData = backend.dataIdMap.get(castedData.dataId);\n  }\n\n  const
imagesId = imagesData.id;\n  const boxesId = backend.dataIdMap.get(boxes.dataId).id;\n  const boxIndId =
backend.dataIdMap.get(boxInd.dataId).id;\n\n  const out = backend.makeOutput(outShape, 'float32');\n  const outId
= backend.dataIdMap.get(out.dataId).id;\n\n  const imagesShapeBytes = new Uint8Array(new
Int32Array(image.shape).buffer);\n\n  wasmCropAndResize(\n    imagesId, boxesId, boxIndId, numBoxes,
imagesShapeBytes, cropHeight,\n    cropWidth,\n    InterpolationMethod[method as {}] as keyof typeof
InterpolationMethod,\n    extrapolationValue, outId);\n\n  if (castedData !== null) {\n
backend.disposeData(castedData.dataId);\n  }\n\n  return out;\n}\n\nexport const cropAndResizeConfig:
KernelConfig = {\n  kernelName: CropAndResize,\n  backendName: 'wasm',\n  setupFunc: setup,\n  kernelFunc:
cropAndResize as {} as KernelFunc\n};\n", "/*\n * @license\n
* Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
'License');\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an 'AS IS' BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====
\n
*\n\nimport {backend_util, KernelConfig, KernelFunc, Cumsum, CumsumAttrs, CumsumInputs, TensorInfo, util}
from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from './backend_wasm';\n\nimport {CppType} from
'./types';\n\nimport {transpose} from './Transpose';\n\nlet wasmCumsum: (xId: number, exclusive:
number, reverse: number,\n      finalDim: number, outId: number, dtype: CppDType) => void;\n\nfunction
setup(backend: BackendWasm) {\n  wasmCumsum = backend.wasm.cwrap(Cumsum, null /* void */, [\n  'number',
// x_id\n  'number', // exclusive\n  'number', // reverse\n  'number', // final_dim\n  'number', // out_id\n
'number' // dtype\n  ]);\n\n  export function cumsum(\n    args: {inputs: CumsumInputs, backend: BackendWasm,
attrs: CumsumAttrs});\n\n  TensorInfo {\n    const {inputs, backend, attrs} = args;\n    const {x} = inputs;\n    const {axis,
exclusive, reverse} = attrs;\n    const xRank = x.shape.length;\n    util.assert(x.dtype === 'float32' || x.dtype ===
'int32',\n      () => `cumsum does not support ${x.dtype} tensors in the WASM backend`);\n    // permute required axis
to inner most axis\n    const permutation = backend_util.getAxesPermutation([axis], xRank);\n    let permutedX = x;\n    if (permutation !== null) {\n      permutedX = transpose({inputs: {x}, attrs: {perm:
permutation}, backend});\n    }\n    const permutedAxis = backend_util.getInnerMostAxes(1, xRank)[0];\n    backend_util.assertAxesAreInnerMostDims('cumsum', [permutedAxis], xRank);\n    const permutedOut =
backend.makeOutput(permutedX.shape, permutedX.dtype);\n    const finalDim = permutedX.shape[permutedAxis];\n    const permutedXId = backend.dataIdMap.get(permutedX.dataId).id;\n    const permutedOutId =
backend.dataIdMap.get(permutedOut.dataId).id;\n    wasmCumsum(permutedXId, exclusive ? 1 : 0, reverse ? 1 : 0,
finalDim,\n      permutedOutId, CppDType[x.dtype]);\n\n    // transpose data back if permuted\n    let out =
permutedOut;\n    if (permutation !== null) {\n      const undoPermutation =
backend_util.getUndoAxesPermutation(permutation);\n      out = transpose(\n        {inputs: {x: permutedOut}, attrs:
{perm: undoPermutation}, backend});\n      backend.disposeData(permutedX.dataId);\n    }\n  }\n}

```

```

backend.disposeData(permutedOut.dataId);\n } \n return out;\n}\n\nexport const cumsumConfig: KernelConfig
= {\n kernelName: Cumsum,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: cumsum as { } as
KernelFunc\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *

```

```

===== \n
*/\n\nimport {DepthToSpace, DepthToSpaceAttrs, DepthToSpaceInputs, KernelConfig, KernelFunc, TensorInfo,
util} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm}
from './backend_wasm';\n\nlet wasmDepthToSpace: (\n xId: number, blockSize: number, channelsLast: number,
xStrides: Uint8Array,\n xStridesLength: number, outputShape: Uint8Array, outputStrides: Uint8Array,\n
outSize: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n
wasmDepthToSpace = backend.wasm.cwrap(DepthToSpace, null /*void*/, [\n 'number', // xId\n 'number', //
blockSize\n 'number', // channelsLast\n 'array', // xStrides\n 'number', // xStridesLength\n 'array', //
outputShape\n 'array', // outputStrides\n 'number', // outSize\n 'number', // outId\n ]);\n}\n\nexport function
depthToSpace(args: {\n backend: BackendWasm,\n inputs: DepthToSpaceInputs,\n attrs: DepthToSpaceAttrs\n}):
TensorInfo {\n const {backend, inputs, attrs} = args;\n const {x} = inputs;\n const {blockSize, dataFormat} =
attrs;\n\n const batchSize = x.shape[0];\n const inputHeight = (dataFormat === 'NHWC') ? x.shape[1]
: x.shape[2];\n const inputWidth = (dataFormat === 'NHWC') ? x.shape[2] : x.shape[3];\n const inputDepth =
(dataFormat === 'NHWC') ? x.shape[3] : x.shape[1];\n\n const outputHeight = inputHeight * blockSize;\n const
outputWidth = inputWidth * blockSize;\n const outputDepth = inputDepth / (blockSize * blockSize);\n\n const
outputShape = (dataFormat === 'NHWC') ?\n [batchSize, outputHeight, outputWidth, outputDepth] :\n
[batchSize, outputDepth, outputHeight, outputWidth];\n\n const out = backend.makeOutput(outputShape,
'float32');\n\n const xData = backend.dataIdMap.get(x.dataId);\n const xId = xData.id;\n const xStridesBytes =\n
new Uint8Array(new Int32Array(util.computeStrides(x.shape)).buffer);\n\n const outputShapeBytes = new
Uint8Array(new Int32Array(outputShape).buffer);\n const outStridesBytes =\n new Uint8Array(new
Int32Array(util.computeStrides(outputShape)).buffer);\n\n const outId = backend.dataIdMap.get(out.dataId).id;\n
const channelsLast
= dataFormat === 'NHWC' ? 1 : 0;\n\n wasmDepthToSpace(\n xId, blockSize, channelsLast, xStridesBytes,
x.shape.length - 1,\n outputShapeBytes, outStridesBytes, outputShape.length, outId);\n\n return
out;\n}\n\nexport const depthToSpaceConfig: KernelConfig = {\n kernelName: DepthToSpace,\n backendName:
'wasm',\n setupFunc: setup,\n kernelFunc: depthToSpace as { } as KernelFunc\n};\n", "/*\n * @license\n *
Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
\"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n
* limitations under the License.\n *

```

```

===== \n
*/\n\nimport {backend_util, DepthwiseConv2dNative, DepthwiseConv2dNativeAttrs,
DepthwiseConv2dNativeInputs, KernelConfig, KernelFunc, Tensor4D} from '@tensorflow/tfjs-core';\n\nimport
{BackendWasm} from './backend_wasm';\n\nlet wasmDepthwiseConv2d: (\n xId: number, batchSize: number,
inputHeight: number, inputWidth: number,\n filterId: number, filterHeight: number, filterWidth: number, padTop:
number,\n padRight: number, padBottom: number, padLeft: number, isSamePad: number,\n dilationHeight:

```

```

number, dilationWidth: number, strideHeight: number,\n  strideWidth: number, inputChannels: number,
outputChannels: number,\n  outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n
wasmDepthwiseConv2d =\n  backend.wasm.cwrap(DepthwiseConv2dNative, null /* void */, [\n    'number', //
xId\n    'number', // batchSize\n    'number',
// inputHeight\n    'number', // inputWidth\n    'number', // filterId\n    'number', // filterHeight\n
'number', // filterWidth\n    'number', // padTop\n    'number', // padRight\n    'number', // padBottom\n
'number', // padLeft\n    'number', // isSamePad\n    'number', // dilationHeight\n    'number', //
dilationWidth\n    'number', // strideHeight\n    'number', // strideWidth\n    'number', // inputChannels\n
'number', // outputChannels\n    'number', // outId\n  ]);\n\nfunction depthwiseConv2d(args: {\n  inputs:
DepthwiseConv2dNativeInputs,\n  backend: BackendWasm,\n  attrs: DepthwiseConv2dNativeAttrs\n}) {\n  const
{inputs, attrs, backend} = args;\n\n  const {x, filter} = inputs;\n  const xId = backend.dataIdMap.get(x.dataId).id;\n
const filterId = backend.dataIdMap.get(filter.dataId).id;\n\n  const {strides, dilations, pad, dimRoundingMode} =
attrs;\n\n  const $dilations = dilations
== null ? [1, 1] : dilations;\n\n  const convInfo = backend_util.computeConv2DInfo(\n    (x as Tensor4D).shape,
(filter as Tensor4D).shape, strides,\n    ($dilations as number | [number, number]), pad, dimRoundingMode,\n
true /* depthwise */);\n\n  const filterHeight = convInfo.filterHeight;\n  const filterWidth = convInfo.filterWidth;\n
const padTop = convInfo.padInfo.top;\n  const padRight = convInfo.padInfo.right;\n  const padBottom =
convInfo.padInfo.bottom;\n  const padLeft = convInfo.padInfo.left;\n  const dilationHeight =
convInfo.dilationHeight;\n  const dilationWidth = convInfo.dilationWidth;\n  const strideHeight =
convInfo.strideHeight;\n  const strideWidth = convInfo.strideWidth;\n  const inputChannels =
convInfo.inChannels;\n  const outputChannels = convInfo.outChannels;\n  const isSamePad = convInfo.padInfo.type
=== 'SAME' ? 1 : 0;\n\n  if (convInfo.dataFormat !== 'channelsLast') {\n    throw new Error(\n      `wasm backend
DepthwiseConv2dNative does not support
dataFormat: ` +\n      `${convInfo.dataFormat}`. Please use 'channelsLast'.`);\n  }\n\n  const out =
backend.makeOutput(convInfo.outShape, 'float32');\n  const outId = backend.dataIdMap.get(out.dataId).id;\n
wasmDepthwiseConv2d(\n    xId, x.shape[0], x.shape[1], x.shape[2], filterId, filterHeight,\n    filterWidth,
padTop, padRight, padBottom, padLeft, isSamePad,\n    dilationHeight, dilationWidth, strideHeight, strideWidth,
inputChannels,\n    outputChannels, outId);\n  return out;\n}\n\nexport const depthwiseConv2dNativeConfig:
KernelConfig = {\n  kernelName: DepthwiseConv2dNative,\n  backendName: 'wasm',\n  setupFunc: setup,\n
kernelFunc: depthwiseConv2d as {} as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2021 Google LLC. All
Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
http://www.apache.org/licenses/LICENSE-2.0\n
*\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is
distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n */\n\n
=====
*\nimport {Elu, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from
'./unary_kernel';\nexport const eluConfig: KernelConfig = createUnaryKernelConfig(Elu);\n"/**\n * @license\n *
Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
"License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n
*\n * Unless required by applicable law or agreed to in writing, software\n
*\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR
CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing
permissions and\n * limitations under the License.\n */\n\n
=====

```

```

*\nimport {Equal, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createBinaryKernelConfig} from
'./binary_kernel';\n\nconst supportsFullBroadcast = false;\n\nexport const equalConfig: KernelConfig =\ncreateBinaryKernelConfig(Equal, supportsFullBroadcast, 'bool');\n\n"/**\n * @license\n * Copyright 2019 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not
use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n
 * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR
CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing
permissions and\n * limitations under the License.\n *
=====
*\nimport {Exp, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from
'./unary_kernel';\n\nexport const expConfig: KernelConfig = createUnaryKernelConfig(Exp, 'float32');\n\n"/**\n *
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2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n
 * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License
for the specific language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {ExpandDims, ExpandDimsAttrs, ExpandDimsInputs, KernelConfig, KernelFunc, util} from
'@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport {reshape} from
'./Reshape';\n\nexport function expandDims(args: {\n  inputs: ExpandDimsInputs,\n  attrs: ExpandDimsAttrs,\n  backend: BackendWasm\n}) {\n  const {inputs, attrs, backend} = args;\n  const {input} = inputs;\n  const {dim} =
attrs;\n\n  const inputRank = input.shape.length;\n  const newShape = input.shape.slice();\n  let $dim = dim;\n  if
(dim < 0) {\n    // Negative value is counted from the tail of rank.\n    util.assert(\n      -(inputRank + 1) <= dim,\n      () => `Axis must be in the interval [${-(inputRank + 1)}, ${\n
    inputRank\n    }]\n    `);\n    $dim = inputRank + dim + 1;\n  }\n  newShape.splice($dim, 0, 1);\n\n  return
reshape({inputs: {x: input}, backend, attrs: {shape: newShape}});\n}\n\nexport const expandDimsConfig:
KernelConfig = {\n  kernelName: ExpandDims,\n  backendName: 'wasm',\n  kernelFunc: expandDims as {\n    as
KernelFunc,\n  };,\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
=====
*\n\nimport {KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';\n\nimport {Fill, FillAttrs} from
'@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nexport function fill(args: {attrs:
FillAttrs, backend: BackendWasm}) {\n  const {attrs: {shape, value, dtype}, backend} = args;\n  const out =
backend.makeOutput(shape, dtype);\n  const outVals = backendtypedArrayFromHeap(out);\n  outVals.fill(value as
number);\n  return out;\n}\n\nexport const fillConfig: KernelConfig = {\n  kernelName: Fill,\n  backendName:
'wasm',\n  kernelFunc: fill as {\n    as KernelFunc,\n  };,\n"/**\n * @license\n * Copyright 2019 Google LLC. All
Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to

```

to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *

```
=====\n
*\n\nimport {FlipLeftRight, FlipLeftRightInputs, KernelConfig, KernelFunc, TensorInfo} from '@tensorflow/tfjs-
core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nlet wasmFlipLeftRight: (\n  xId: number, batch:
number, imageHeight: number, imageWidth: number,\n  numChannels: number, outId: number) =>
void;\n\nfunction setup(backend: BackendWasm) {\n  wasmFlipLeftRight = backend.wasm.cwrap(FlipLeftRight,
null /* void */, [\n  'number', // xId\n  'number', // batch\n  'number', // imageHeight\n  'number', //
imageWidth\n  'number', // numChannels\n  'number', // outId\n  ]);\n}\n\nexport function flipLeftRight(\n
  args: {inputs: FlipLeftRightInputs, backend: BackendWasm}): TensorInfo {\n  const {inputs, backend} = args;\n
const {image} = inputs;\n\n  const out = backend.makeOutput(image.shape, image.dtype);\n  const imageId =
backend.dataIdMap.get(image.dataId).id;\n  const outId = backend.dataIdMap.get(out.dataId).id;\n\n  const [batch,
imageHeight, imageWidth, numChannels] = image.shape;\n\n  wasmFlipLeftRight(\n    imageId, batch,
imageHeight, imageWidth, numChannels, outId);\n  return out;\n}\n\nexport const flipLeftRightConfig:
KernelConfig = {\n  kernelName: FlipLeftRight,\n  backendName: 'wasm',\n  kernelFunc: flipLeftRight as { } as
KernelFunc,\n  setupFunc: setup\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n
* Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in
compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n
*\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is
distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n *
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http://www.apache.org/licenses/LICENSE-2.0\n
*\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is
distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n *
```

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=====\n
*\n\nimport {Floor, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from
'./unary_kernel';\n\nexport const floorConfig: KernelConfig = createUnaryKernelConfig(Floor);\n\n"/**\n *
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2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable
law or agreed to in writing, software\n * distributed
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```
under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF
ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n *
limitations under the License.\n *
```

```
=====\n
*\n\nimport {FloorDiv, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createBinaryKernelConfig} from
'./binary_kernel';\n\nconst supportsFullBroadcast = false;\n\nexport const floorDivConfig: KernelConfig =\n  createBinaryKernelConfig(FloorDiv, supportsFullBroadcast);\n\n"/**\n * @license\n * Copyright 2019 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not
use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n *
```

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CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing
permissions and\n * limitations under the License.\n *
```

```
=====\n
*\n\nimport {FusedBatchNorm, FusedBatchNormAttrs, FusedBatchNormInputs, KernelConfig, KernelFunc,
TensorInfo, util} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nlet
```

```

wasmBatchNorm: (\n  xId: number, meanId: number, varianceId: number, offsetId: number,\n  scaleId: number,
varianceEpsilon: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n
wasmBatchNorm = backend.wasm.cwrap(\n  FusedBatchNorm, null /* void */,\n  ['number', 'number',
'number', 'number', 'number', 'number', 'number']);\n}\n\nfunction fusedBatchNorm(args: {\n  backend:
BackendWasm,\n  inputs: FusedBatchNormInputs,\n  attrs: FusedBatchNormAttrs\n}): TensorInfo {\n  const {backend, inputs, attrs} = args;\n  const {varianceEpsilon}
= attrs;\n  const {x, mean, variance, offset, scale} = inputs;\n  const xId = backend.dataIdMap.get(x.dataId).id;\n
const meanId = backend.dataIdMap.get(mean.dataId).id;\n  const varianceId =
backend.dataIdMap.get(variance.dataId).id;\n  const offsetId = offset != null ?
backend.dataIdMap.get(offset.dataId).id : 0;\n  const scaleId = scale != null ?
backend.dataIdMap.get(scale.dataId).id : 0;\n\n  const out = backend.makeOutput(x.shape, x.dtype);\n  // Short-
circuit zero-sized tensors.\n  if (util.sizeFromShape(x.shape) === 0) {\n    return out;\n  }\n\n  const outId =
backend.dataIdMap.get(out.dataId).id;\n\n  wasmBatchNorm(\n    xId, meanId, varianceId, offsetId, scaleId,
varianceEpsilon, outId);\n  return out;\n}\n\nexport const fusedBatchNormConfig: KernelConfig = {\n  kernelName:
FusedBatchNorm,\n  backendName: 'wasm',\n  setupFunc: setup,\n  kernelFunc: fusedBatchNorm
as { } as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed
under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * \n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
=====
*\n\nimport {backend_util, FusedConv2D, FusedConv2DAttrs, FusedConv2DInputs, KernelConfig, KernelFunc,
Tensor4D} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport
{FusableActivation} from './types';\n\nlet
wasmFusedConv2d: (\n  xId: number, batchSize: number, inputHeight: number, inputWidth: number,\n  filterId:
number, filterHeight: number, filterWidth: number,\n  biasId: number, padTop: number, padRight: number,
padBottom: number,\n  padLeft: number, isSamePad: number, dilationHeight: number,\n  dilationWidth:
number, strideHeight: number, strideWidth: number,\n  inputChannels: number, outputChannels: number,
activation: number,\n  preluActivationWeightsId: number, leakyreluAlpha: number, outId: number) =>\n
void;\n\nfunction setup(backend: BackendWasm) {\n  wasmFusedConv2d = backend.wasm.cwrap(FusedConv2D,
null /* void */, [\n    'number', // xId\n    'number', // batchSize\n    'number', // inputHeight\n    'number', //
inputWidth\n    'number', // filterId\n    'number', // filterHeight\n    'number', // filterWidth\n    'number', // biasId\n
    'number', // padTop\n    'number', // padRight\n    'number', // padBottom\n    'number', // padLeft\n
    'number', // isSamePad\n    'number', // dilationHeight\n    'number', // dilationWidth\n    'number', //
strideHeight\n    'number', // strideWidth\n    'number', // inputChannels\n    'number', // outputChannels\n
    'number', // activation\n    'number', // preluActivationWeightsId\n    'number', // leakyreluAlpha\n    'number', //
outId\n  ]);\n\n  function fusedConv2d(args: {\n    inputs: FusedConv2DInputs,\n    backend: BackendWasm,\n    attrs:
FusedConv2DAttrs\n  }) {\n    const {inputs, attrs, backend} = args;\n    const {x, filter, bias, preluActivationWeights} =
inputs;\n    const {\n      strides,\n      pad,\n      dilations,\n      dataFormat,\n      dimRoundingMode,\n      activation,\n      leakyreluAlpha\n    } = attrs;\n    const convInfo = backend_util.computeConv2DInfo(\n      (x as Tensor4D).shape,
(filter as Tensor4D).shape, strides, dilations,\n      pad, dimRoundingMode);\n    const fusedActivation =\n      FusableActivation[activation as { } as keyof typeof FusableActivation];\n\n    if (fusedActivation == null) {\n      throw new Error(\n        `${activation} activation not yet supported for
FusedConv2D` +\n        `in the wasm backend.`);\n    }\n\n    const xId = backend.dataIdMap.get(x.dataId).id;\n    const
filterId = backend.dataIdMap.get(filter.dataId).id;\n\n    const outputChannels = convInfo.outChannels;\n\n    let biasId
= 0;\n    if (bias != null) {\n      const biasData = backend.dataIdMap.get(bias.dataId);\n      if (biasData.shape.length !==

```

[illegible]

```

dataFormat,\n  dimRoundingMode,\n  activation,\n  leakyreluAlpha\n } = attrs;\n\n const convInfo =
backend_util.computeConv2DInfo(\n  (x as Tensor4D).shape, (filter as Tensor4D).shape, strides, dilations,\n  pad, dimRoundingMode, true /* depthwise */);\n\n const fusedActivation =\n  FusableActivation[activation as { }
as keyof typeof FusableActivation];\n  if (fusedActivation == null) {\n    throw new Error(\n      `${activation}
activation not yet supported for FusedDepthwiseConv2D` +\n      `in the wasm backend.`);\n  }\n\n const xId =
backend.dataIdMap.get(x.dataId).id;\n  const filterId = backend.dataIdMap.get(filter.dataId).id;\n\n
const outputChannels = convInfo.outChannels;\n\n let biasId = 0;\n  if (bias != null) {\n    const biasData =
backend.dataIdMap.get(bias.dataId);\n    if (biasData.shape.length !== 1) {\n      throw new Error(\n
`FusedDepthwiseConv2D only supports rank-1 bias but got` +\n      `rank ${biasData.shape.length}`);\n    }\n
if (biasData.shape[0] !== outputChannels) {\n      throw new Error(\n      `FusedDepthwiseConv2D bias shape
(${biasData.shape}) does not` +\n      `match the number of output channels (${outputChannels})`);\n    }\n
biasId = biasData.id;\n  }\n\n const filterHeight = convInfo.filterHeight;\n  const filterWidth =
convInfo.filterWidth;\n  const padTop = convInfo.padInfo.top;\n  const padRight = convInfo.padInfo.right;\n  const
padBottom = convInfo.padInfo.bottom;\n  const padLeft = convInfo.padInfo.left;\n  const dilationHeight =
convInfo.dilationHeight;\n  const dilationWidth = convInfo.dilationWidth;\n  const strideHeight =
convInfo.strideHeight;\n
const strideWidth = convInfo.strideWidth;\n  const inputChannels = convInfo.inChannels;\n  const isSamePad =
convInfo.padInfo.type === 'SAME' ? 1 : 0;\n  const batchSize = convInfo.batchSize;\n  const inHeight =
convInfo.inHeight;\n  const inWidth = convInfo.inWidth;\n\n  if (dataFormat !== 'NHWC') {\n    throw new Error(\n
`wasm backend FusedDepthwiseConv2D does not support dataFormat:` +\n      `${dataFormat}`. Please use
'NHWC`);\n  }\n\n  const out = backend.makeOutput(convInfo.outShape, 'float32');\n  const outId =
backend.dataIdMap.get(out.dataId).id;\n  const preluActivationWeightsId = preluActivationWeights == null ?\n    0
:\n    backend.dataIdMap.get(preluActivationWeights.dataId).id;\n\n  wasmFusedDepthwiseConv2d(\n    xId,
batchSize, inHeight, inWidth, filterId, filterHeight, filterWidth,\n    biasId, padTop, padRight, padBottom, padLeft,
isSamePad, dilationHeight,\n    dilationWidth, strideHeight, strideWidth, inputChannels, outputChannels,\n
    fusedActivation, preluActivationWeightsId, leakyreluAlpha || 0, outId);\n\n  return out;\n}\n\nexport const
fusedDepthwiseConv2DConfig: KernelConfig = {\n  kernelName: FusedDepthwiseConv2D,\n  backendName:
'wasm',\n  setupFunc: setup,\n  kernelFunc: fusedDepthwiseConv2d as { } as KernelFunc\n};\n"/**\n * @license\n
* Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
"License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n */
=====
\n
*/\n\nimport { gather_util, GatherNd, GatherNdInputs, KernelConfig, TensorInfo } from '@tensorflow/tfjs-
core';\n\nimport { BackendWasm } from './backend_wasm';\n\nimport { CppDType } from './types';\n\nlet
wasmGatherNd: (\n  xId: number, dtype: CppDType, indicesId: number, numSlices: number,\n  sliceRank:
number, sliceSize: number, strides: Uint8Array, outId: number) =>\n  void;\n\nfunction setup(backend:
BackendWasm): void {\n  wasmGatherNd = backend.wasm.cwrap(GatherNd, null /*void*/, [\n    'number', // xId\n
'number', // dtype\n    'number', // indicesId\n    'number', // numSlices\n    'number', // sliceRank\n    'number', //
sliceSize\n    'array', // strides\n    'number' // outId\n  ]);\n\n  function gatherNd(args: { backend: BackendWasm,
inputs: GatherNdInputs }):\n    TensorInfo {\n    const { backend, inputs } = args;\n    const { params, indices } =
inputs;\n\n    const [resultShape, numSlices, sliceSize, strides] =\n      gather_util.prepareAndValidate(params,
indices);\n\n    const out = backend.makeOutput(resultShape, params.dtype);\n    if (numSlices === 0) {\n      return
out;\n    }\n\n    const indicesShape = indices.shape;\n    const sliceRank = indicesShape[indicesShape.length - 1];\n\n
const xData = backend.dataIdMap.get(params.dataId);\n    const xId = xData.id;\n    const indicesData =
backend.dataIdMap.get(indices.dataId);\n    const indicesId = indicesData.id;\n\n    const stridesBytes = new

```



```
UInt8Array(new Int32Array(strides).buffer);\n\n const outId = backend.dataIdMap.get(out.dataId).id;\n\nwasmGatherNd(\n    xId, CppDType[params.dtype], indicesId, numSlices, sliceRank, sliceSize,\n    stridesBytes, outId);\n\n return out;\n}\n\nexport const gatherNdConfig: KernelConfig = {\n kernelName: GatherNd,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: gatherNd\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n http://www.apache.org/licenses/LICENSE-2.0\n *\n Unless required by applicable law or agreed to in writing,\n software distributed under the License is distributed on an "AS IS" BASIS,\n WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n See the License for the specific language governing permissions and\n limitations under the License.\n */\n\n=====\n*/\nimport {backend_util, GatherV2, GatherV2Attrs, GatherV2Inputs, KernelConfig, KernelFunc, Tensor, TensorInfo, TypedArray, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nimport {reshape} from './Reshape';\nimport {CppType} from './types';\nlet wasmGather:\n(\n  xId: number, dtype: CppDType, xStrides: UInt8Array, stridesSize: number,\n  indicesId: number, batchSize: number, outStrides:\n  UInt8Array,\n  outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n  wasmGather = backend.wasm.cwrap('Gather', null /*void*/, [\n    'number', // xId\n    'number', // dtype\n    'array', // xStrides\n    'number', // stridesSize\n    'number', // indicesId\n    'number', // batchSize\n    'array', // outStrides\n    'number' // outId\n  ]);\n\n  function gatherV2(\n    args: {backend: BackendWasm, inputs: GatherV2Inputs, attrs: GatherV2Attrs}): \n    TensorInfo {\n    const {backend, inputs, attrs} = args;\n    const {x, indices} = inputs;\n    const {axis, batchDims} = attrs;\n\n    // Throw error when any index is out of bound.\n    const parsedAxis = util.parseAxisParam(axis, x.shape)[0];\n    const indicesVals = backend.readSync(indices.dataId) as TypedArray;\n    const axisDim = x.shape[parsedAxis];\n    for (let i = 0; i < indicesVals.length; ++i) {\n      const index = indicesVals[i];\n      util.assert(index <= axisDim - 1 && index >= 0,\n        () =>`\n          GatherV2: the index value ${index} is not in [0, ${axisDim - 1}]\n        `);\n    }\n\n    const shapeInfo = backend_util.segment_util.collectGatherOpShapeInfo(\n      x as Tensor, indices as Tensor, parsedAxis, batchDims);\n\n    const flattenX = reshape({\n      inputs: {x},\n      attrs: {\n        shape: [\n          shapeInfo.batchSize, shapeInfo.outerSize, shapeInfo.dimSize,\n          shapeInfo.sliceSize\n        ],\n        backend\n      }\n    });\n    const indicesSize = util.sizeFromShape(indices.shape);\n    const flattenIndex = reshape({\n      inputs: {x: indices},\n      attrs: {\n        shape: [shapeInfo.batchSize, indicesSize / shapeInfo.batchSize],\n        backend\n      }\n    });\n    const flattenOutputShape = [\n      shapeInfo.batchSize, shapeInfo.outerSize, indicesSize / shapeInfo.batchSize,\n      shapeInfo.sliceSize\n    ];\n\n    const out = backend.makeOutput(flattenOutputShape, x.dtype);\n    if (util.sizeFromShape(x.shape) === 0) {\n      return out;\n    }\n\n    const stridesSize = flattenX.shape.length - 1;\n\n    const xData = backend.dataIdMap.get(flattenX.dataId);\n    const xId = xData.id;\n\n    const indicesData = backend.dataIdMap.get(flattenIndex.dataId);\n    const indicesId = indicesData.id;\n\n    const outId = backend.dataIdMap.get(out.dataId).id;\n\n    const xStridesBytes = new UInt8Array(\n      new Int32Array(util.computeStrides(flattenX.shape)).buffer);\n    const outStridesBytes = new UInt8Array(\n      new Int32Array(util.computeStrides(flattenOutputShape)).buffer);\n\n    wasmGather(\n      xId, CppDType[x.dtype], xStridesBytes, stridesSize, indicesId,\n      shapeInfo.batchSize, outStridesBytes, outId);\n\n    backend.disposeData(flattenX.dataId);\n    backend.disposeData(flattenIndex.dataId);\n\n    // reshape\n    out.shape = shapeInfo.outputShape;\n\n    return out;\n  }\n\n  export const gatherV2Config: KernelConfig = {\n    kernelName: GatherV2,\n    backendName: 'wasm',\n    setupFunc: setup,\n    kernelFunc: gatherV2 as {} as KernelFunc\n  };\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n http://www.apache.org/licenses/LICENSE-2.0\n *\n Unless required by applicable law or agreed to in writing,
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```
=====\n\n*\nimport {Greater, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from\n './binary_kernel';\n\nconst supportsFullBroadcast = false;\nexport const greaterConfig: KernelConfig =\n createBinaryKernelConfig(Greater, supportsFullBroadcast, 'bool');\n\n", "/*\n * @license\n * Copyright 2019 Google\n LLC. All Rights
```

```
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```

```
=====\n\n*\nimport {GreaterEqual, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from\n './binary_kernel';\n\nconst supportsFullBroadcast = false;\nexport const greaterEqualConfig: KernelConfig =\n createBinaryKernelConfig(GreaterEqual, supportsFullBroadcast, 'bool');\n\n", "/*\n * @license\n * Copyright 2019\n Google
```

```
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not\n use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,\n software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n governing permissions and\n * limitations under the License.\n *
```

```
=====\n\n*\n\nimport {KernelConfig, KernelFunc, LeakyRelu, LeakyReluAttrs, LeakyReluInputs, TensorInfo, util} from\n '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nimport {CppType} from\n './types';\n\nlet wasmFunc: (\n  xId: number, dtype: number, leakyreluAlpha: number, outId: number) =>\n void;\n\nfunction
```

```
  setupFunc(backend: BackendWasm): void {\n    wasmFunc = backend.wasm.cwrap(LeakyRelu, null /* void */, [\n      'number', // x_id\n      'number', // dtype\n      'number', // leakyrelu_alpha\n      'number', // out_id\n    ]);\n\n    export\n    function leakyRelu(\n      args: {\n        inputs: LeakyReluInputs, attrs: LeakyReluAttrs, backend: BackendWasm\n      }):\n      TensorInfo {\n      const {inputs: {x}, attrs: {alpha}, backend} = args;\n      const xId =\n        backend.dataIdMap.get(x.dataId).id;\n      // According to TF API, LeakyRelu returns float32 when input is either\n      float32\n      // or int32.\n      const out = backend.makeOutput(x.shape, 'float32');\n      if (util.sizeFromShape(x.shape)\n        !== 0) {\n        const outId = backend.dataIdMap.get(out.dataId).id;\n        wasmFunc(xId, CCppType[x.dtype], alpha,\n          outId);\n      }\n      return out;\n    }\n\n    export const leakyReluConfig: KernelConfig = {\n      kernelName: LeakyRelu,\n      backendName: 'wasm',\n      setupFunc,\n      kernelFunc: leakyRelu as {\n        as KernelFunc\n      }\n    };\n\n    ", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\n License at\n *\n http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or\n agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n\n*\nimport {KernelConfig, Less} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from\n './binary_kernel';\n\nconst supportsFullBroadcast = false;\nexport const lessConfig: KernelConfig =\n
```

```

createBinaryKernelConfig(Less, supportsFullBroadcast, 'bool');\n", "/*\n * @license\n * Copyright
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you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
\n
*/\n\nimport { KernelConfig, LessEqual } from '@tensorflow/tfjs-core';\n\nimport { createBinaryKernelConfig } from
'./binary_kernel';\n\nconst supportsFullBroadcast = false;\n\nexport const lessEqualConfig: KernelConfig =\ncreateBinaryKernelConfig(LessEqual, supportsFullBroadcast, 'bool');\n\n", "/*\n * @license\n
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\"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
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agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====
\n
*/\n\nimport { KernelConfig, Log } from '@tensorflow/tfjs-core';\n\nimport { createUnaryKernelConfig } from
'./unary_kernel';\n\nexport const logConfig: KernelConfig = createUnaryKernelConfig(Log);\n\n", "/*\n * @license\n *
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Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may
obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by
applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\"
BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the
License for the specific language governing permissions and\n * limitations under the License.\n *
=====
\n
*/\n\nimport { KernelConfig, LogicalAnd } from '@tensorflow/tfjs-core';\n\nimport { createBinaryKernelConfig } from
'./binary_kernel';\n\nconst supportsFullBroadcast = false;\n\nexport const logicalAndConfig: KernelConfig =\ncreateBinaryKernelConfig(LogicalAnd, supportsFullBroadcast, 'bool');\n\n", "/*\n * @license\n * Copyright 2019
Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
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Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
=====
\n
*/\n\nimport { backend_util, KernelConfig, KernelFunc, Max, MaxAttrs, MaxInputs, TensorInfo, util } from
'@tensorflow/tfjs-core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nimport
{ permuteAxesAndTranspose } from './kernel_utils';\n\nimport { CppDType } from './types';\n\nlet wasmMax: (xId:
number, dtype: number, reduceSize: number, outId: number) =>\n  void;\n\nfunction
setup(backend: BackendWasm): void {\n  wasmMax = backend.wasm.cwrap(Max, null /*void*/, [\n    'number', //
x_id\n    'number', // dtype\n    'number', // reduce_size\n    'number', // out_id\n  ]);\n\n  function max(args:
{ backend: BackendWasm, inputs: MaxInputs, attrs: MaxAttrs }):\n    TensorInfo {\n    const { backend, inputs, attrs } =
args;\n    const { reductionIndices: axis, keepDims } = attrs;\n    const { x } = inputs;\n    const xId =
backend.dataIdMap.get(x.dataId).id;\n    let inputId = xId;\n    let input = x;\n\n    const { transposed, axes, originalAxes,
inputWasTransposed } =\n      permuteAxesAndTranspose(x, axis, backend);\n\n    if (inputWasTransposed) {\n

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const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n  input = transposed;\n  inputId =
transposedId;\n }\n\n const inputRank = input.shape.length;\n backend_util.assertAxesAreInnerMostDims('max',
axes, inputRank);\n const [outShape, reduceShape] =\nbackend_util.computeOutAndReduceShapes(input.shape,
axes);\n const reduceSize = util.sizeFromShape(reduceShape);\n\n const out = backend.makeOutput(outShape,
x.dtype);\n if (util.sizeFromShape(input.shape) !== 0) {\n  const outId = backend.dataIdMap.get(out.dataId).id;\n  wasmMax(inputId, CppDType[x.dtype], reduceSize, outId);\n }\n\n if (inputWasTransposed) {\n  // dispose of the
transposed tensor.\n  backend.disposeData(transposed.dataId);\n }\n\n if (keepDims) {\n  // reshape\n  const
newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n  out.shape = newShape;\n }\n\n
return out;\n }\n\n\nexport const maxConfig: KernelConfig = {\n  kernelName: Max,\n  backendName: 'wasm',\n
setupFunc: setup,\n  kernelFunc: max as { } as KernelFunc\n};\n\n", "/*\n * @license\n * Copyright 2019 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not
use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n
* http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *\n
=====\n
*\nimport {KernelConfig, Maximum} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from
'/binary_kernel';\nconst supportsFullBroadcast = false;\nexport const maximumConfig: KernelConfig =\ncreateBinaryKernelConfig(Maximum, supportsFullBroadcast);\n\n", "/*\n * @license\n * Copyright 2019 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not
use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n
* http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is
distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n *\n
=====\n
*\n\nimport {backend_util, KernelConfig, KernelFunc, MaxPool, MaxPoolAttrs, MaxPoolInputs, Tensor4D, util}
from '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\n\nlet wasmMaxPool: (\n  xId:
number, batchSize: number, inputHeight: number, inputWidth: number,\n  filterHeight: number, filterWidth:
number, padTop: number, padRight: number,\n  padBottom: number, padLeft: number, dilationHeight: number,\n
dilationWidth: number, strideHeight: number, strideWidth: number,\n  inputChannels: number, outputChannels:
number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n  wasmMaxPool =
backend.wasm.cwrap(MaxPool, null /* void */, [\n    'number', // xId\n    'number', // batchSize\n    'number', //
inputHeight\n    'number', // inputWidth\n    'number', // filterHeight\n    'number', // filterWidth\n    'number', //
padTop\n    'number', // padRight\n    'number', // padBottom\n    'number', // padLeft\n    'number', //
dilationHeight\n    'number', // dilationWidth\n    'number', // strideHeight\n    'number', // strideWidth\n    'number', //
inputChannels\n    'number', // outputChannels\n    'number', // outId\n  ]);\n\n  function maxPool(\n    args:
{inputs: MaxPoolInputs, backend: BackendWasm, attrs: MaxPoolAttrs}) {\n    const {inputs, attrs, backend} =
args;\n\n    const x = inputs.x as Tensor4D;\n    const xId = backend.dataIdMap.get(x.dataId).id;\n\n    // TF API
supports int32 input. CPU and WebGL backend also support int32\n    // input. WASM backend doesn't
support it because it uses xnnpack which only\n    // supports float32.\n    //\n    // Add the following assert only for the
WASM backend instead of at core op\n    // level.\n    //\n    // TODO: add support for int32 input.\n    util.assert(\n
x.dtype === 'float32',\n      () =>\n        `Error in MaxPool: only float32 input is supported. Got ${x.dtype}.`);\n\n
const {filterSize, strides, pad, dimRoundingMode} = attrs;\n    const convInfo = backend_util.computePool2DInfo(\n
x.shape, filterSize, strides, 1 /* dilations */, pad, dimRoundingMode);\n    const filterHeight =

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convInfo.filterHeight;\n const filterWidth = convInfo.filterWidth;\n const padTop = convInfo.padInfo.top;\n const
padRight = convInfo.padInfo.right;\n const padBottom = convInfo.padInfo.bottom;\n const padLeft =
convInfo.padInfo.left;\n const dilationHeight = convInfo.dilationHeight;\n const dilationWidth =
convInfo.dilationWidth;\n const strideHeight = convInfo.strideHeight;\n const strideWidth =
convInfo.strideWidth;\n
const inputChannels = convInfo.inChannels;\n const outputChannels = convInfo.outChannels;\n\n if
(convInfo.dataFormat !== 'channelsLast') {\n throw new Error(\n `wasm backend does not support
dataFormat:` +\n `${convInfo.dataFormat}`. Please use 'channelsLast'.`);\n }\n\n const out =
backend.makeOutput(convInfo.outShape, 'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n
wasmMaxPool(\n xId, x.shape[0], x.shape[1], x.shape[2], filterHeight, filterWidth,\n padTop, padRight,
padBottom, padLeft, dilationHeight, dilationWidth,\n strideHeight, strideWidth, inputChannels, outputChannels,
outId);\n return out;\n}\n\nexport const maxPoolConfig: KernelConfig = {\n kernelName: MaxPool,\n
backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: maxPool as { } as KernelFunc\n};\n"/**\n * @license\n
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http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*/\n\nimport { backend_util, KernelConfig, KernelFunc, Mean, MeanAttrs, MeanInputs, TensorInfo, util } from
'@tensorflow/tfjs-core';\n\nimport { BackendWasm } from './backend_wasm';\n\nimport { cast } from './Cast';\n\nimport
{ permuteAxesAndTranspose } from './kernel_utils';\n\nlet wasmMean: (xId: number, reduceSize: number, outId:
number) => void;\n\nfunction setup(backend: BackendWasm): void {\n wasmMean =\n
backend.wasm.cwrap(Mean,
null /*void*/, ['number, number, number']);\n}\n\nexport function mean(\n args: { backend: BackendWasm,
inputs: MeanInputs, attrs: MeanAttrs }):\n TensorInfo {\n const { backend, inputs, attrs } = args;\n const { axis,
keepDims } = attrs;\n const { x } = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n let inputId = xId;\n
let input = x;\n\n const { transposed, axes, originalAxes, inputWasTransposed } =\n
permuteAxesAndTranspose(x, axis, backend);\n\n let reductionAxes = axes;\n if (inputWasTransposed) {\n const
transposedId = backend.dataIdMap.get(transposed.dataId).id;\n if (transposedId !== xId) {\n // transpose was
not a no-op. We will need to dispose of this\n // once we are done.\n input = transposed;\n inputId =
transposedId;\n reductionAxes = backend_util.getInnerMostAxes(\n reductionAxes.length,
input.shape.length);\n }\n }\n\n backend_util.assertAxesAreInnerMostDims(\n 'mean', reductionAxes,
input.shape.length);\n
const [outShape, reduceShape] =\n backend_util.computeOutAndReduceShapes(input.shape, reductionAxes);\n
const reduceSize = util.sizeFromShape(reduceShape);\n let castedInput = input;\n if (input.dtype !== 'float32') {\n
castedInput =\n cast({ backend, inputs: { x: input }, attrs: { dtype: 'float32' }});\n inputId =
backend.dataIdMap.get(castedInput.dataId).id;\n }\n\n const out = backend.makeOutput(outShape, 'float32');\n if
(util.sizeFromShape(input.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n
wasmMean(inputId, reduceSize, outId);\n }\n\n if (inputWasTransposed) {\n // dispose of the transposed
tensor.\n backend.disposeData(transposed.dataId);\n }\n\n if (keepDims) {\n // reshape\n const newShape =
backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n out.shape = newShape;\n }\n\n if (input.dtype
!== 'float32') {\n backend.disposeData(castedInput.dataId);\n }\n\n return out;\n}\n\nexport
const meanConfig: KernelConfig = {\n kernelName: Mean,\n backendName: 'wasm',\n setupFunc: setup,\n
kernelFunc: mean as { } as KernelFunc\n};\n"/**\n * @license\n
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"License");\n * you may not use this file

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http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {backend_util, KernelConfig, KernelFunc, Min, MinAttrs, MinInputs, TensorInfo, util} from
'@tensorflow/tfjs-core';\n\nimport
{BackendWasm} from './backend_wasm';\n\nimport {permuteAxesAndTranspose} from './kernel_utils';\n\nimport
{CppType} from './types';\n\nlet wasmMin: (xId: number, dtype: number, reduceSize: number, outId: number)
=>\n void;\n\nfunction setup(backend: BackendWasm): void {\n  wasmMin = backend.wasm.cwrap(Min, null
/*void*/, [\n  'number', // x_id\n  'number', // dtype\n  'number', // reduce_size\n  'number', // out_id\n
]);\n}\n\nfunction min(args: {backend: BackendWasm, inputs: MinInputs, attrs: MinAttrs}): \n  TensorInfo {\n
const {backend, inputs, attrs} = args;\n  const {axis, keepDims} = attrs;\n  const {x} = inputs;\n  const xId =
backend.dataIdMap.get(x.dataId).id;\n  let inputId = xId;\n  let input = x;\n\n  const {transposed, axes, originalAxes,
inputWasTransposed} =\n    permuteAxesAndTranspose(x, axis, backend);\n\n  if (inputWasTransposed) {\n
const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n    if (transposedId !== xId)
{\n      // transpose was not a no-op. We will need to dispose of this\n      // once we are done.\n      input =
transposed;\n      inputId = transposedId;\n    }\n  }\n\n  const inputRank = input.shape.length;\n  backend_util.assertAxesAreInnerMostDims('min', axes, inputRank);\n  const [outShape, reduceShape] =\n  backend_util.computeOutAndReduceShapes(input.shape, axes);\n  const reduceSize =
util.sizeFromShape(reduceShape);\n\n  const out = backend.makeOutput(outShape, input.dtype);\n  if
(util.sizeFromShape(input.shape) !== 0) {\n    const outId = backend.dataIdMap.get(out.dataId).id;\n
wasmMin(inputId, CppDType[x.dtype], reduceSize, outId);\n  }\n\n  if (inputWasTransposed) {\n    // dispose of the
transposed tensor.\n    backend.disposeData(transposed.dataId);\n  }\n\n  if (keepDims) {\n    // reshape\n    const
newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n    out.shape = newShape;\n  }\n\n
return out;\n}\n\nexport const minConfig: KernelConfig
= {\n  kernelName: Min,\n  backendName: 'wasm',\n  setupFunc: setup,\n  kernelFunc: min as {} as
KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
=====
*\n\nimport {KernelConfig, Minimum} from '@tensorflow/tfjs-core';\n\nimport {createBinaryKernelConfig} from
'/binary_kernel';\n\nconst supportsFullBroadcast = false;\n\nexport
const minimumConfig: KernelConfig =\n  createBinaryKernelConfig(Minimum,
supportsFullBroadcast);\n\n"/**\n * @license\n * Copyright 2021 Google LLC. All Rights Reserved.\n * Licensed
under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
=====
*\n\nimport {KernelConfig, KernelFunc, MirrorPad, MirrorPadAttrs, MirrorPadInputs} from '@tensorflow/tfjs-

```

```

core';\n\nimport {BackendWasm} from './backend_wasm';\n\nimport
{CppType} from './types';\n\n// Must match enum in MirrorPad.cc\nenum MirrorPaddingMode {\n  reflect = 0,\n  symmetric = 1\n}\n\nlet wasmMirrorPad: (\n  xId: number, xShapeBytes: Uint8Array, xShapeLength: number,\n  xDtype: number,\n  prePaddingsBytes: Uint8Array, postPaddingsBytes: Uint8Array, mode: number,\n  outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n  wasmMirrorPad =
backend.wasm.cwrap(MirrorPad, null /* void */, [\n  'number', // xId\n  'array', // x.shape\n  'number', //
x.shape.length\n  'number', // x.dtype\n  'array', // pre-paddings\n  'array', // post-paddings\n  'number', //
mode\n  'number', // outId\n  ]);\n}\n\nfunction mirrorPad(args: {\n  inputs: MirrorPadInputs,\n  backend:
BackendWasm,\n  attrs: MirrorPadAttrs\n}) {\n  const {inputs: {x}, backend, attrs: {paddings, mode}} = args;\n\n  const outShape = paddings.map(\n    (p, i) => p[0] /* beforePad */ + x.shape[i] + p[1] /* afterPad */);\n  const xId =
backend.dataIdMap.get(x.dataId).id;\n\n  const out = backend.makeOutput(outShape, x.dtype);\n  const outId = backend.dataIdMap.get(out.dataId).id;\n\n  const xShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);\n\n  const prePaddingsFlat =
paddings.map(padTuple => padTuple[0]);\n  const postPaddingsFlat = paddings.map(padTuple => padTuple[1]);\n\n  const prePaddingsBytes =\n    new Uint8Array(new Int32Array(prePaddingsFlat).buffer);\n  const
postPaddingsBytes =\n    new Uint8Array(new Int32Array(postPaddingsFlat).buffer);\n\n  wasmMirrorPad(\n
xId, xShapeBytes, x.shape.length, CppDType[x.dtype], prePaddingsBytes,\n  postPaddingsBytes,
MirrorPaddingMode[mode], outId);\n  return out;\n}\n\nexport const mirrorPadConfig: KernelConfig = {\n
kernelName: MirrorPad,\n  backendName: 'wasm',\n  kernelFunc: mirrorPad as { } as KernelFunc,\n  setupFunc:
setup\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the
  \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n */\n\n
=====\n\n*/\n\nimport {KernelConfig, Multiply} from '@tensorflow/tfjs-core';\n\nimport {createBinaryKernelConfig} from
'./binary_kernel';\n\nconst supportsFullBroadcast = true;\n\nexport const multiplyConfig: KernelConfig =\n  createBinaryKernelConfig(Multiply, supportsFullBroadcast);\n\n"/**\n * @license\n * Copyright 2020 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
  \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n */\n\n
=====\n\n*/\n\nimport {KernelConfig, Neg} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from
'./unary_kernel';\n\nexport const negConfig: KernelConfig = createUnaryKernelConfig(Neg);\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
  \"License\");\n * you may not use this file except in compliance with the License.\n\n  * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless
required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an
  \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n\n  * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n\n
=====\n\n*/\n\nimport {BackendWasm} from './backend_wasm';\n\n// Analogous to `struct Result` in
`non_max_suppression_impl.h`\n\ninterface Result {\n  pSelectedIndices: number;\n  selectedSize: number;\n}

```

```
pSelectedScores: number;\n pValidOutputs: number;\n}\n\n/**\n * Parse the result of the c++ method, which has the
shape equivalent to\n * `Result`.\n */\nexport function parseResultStruct(\n  backend: BackendWasm, resOffset:
number): Result {\n  const result = new Int32Array(backend.wasm.HEAPU8.buffer,
resOffset, 4);\n  const pSelectedIndices = result[0];\n  const selectedSize = result[1];\n  const pSelectedScores =
result[2];\n  const pValidOutputs = result[3];\n  // Since the result was allocated on the heap, we have to delete it.\n  backend.wasm._free(resOffset);\n  return {pSelectedIndices, selectedSize, pSelectedScores,
pValidOutputs};\n}\n\n", /**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under
the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n
```

```
* =====\n\n*/\n\nimport { KernelConfig, KernelFunc, NonMaxSuppressionV3, NonMaxSuppressionV3Attrs,
NonMaxSuppressionV3Inputs, TensorInfo } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from
'./backend_wasm';\nimport { parseResultStruct } from './NonMaxSuppression_util';\n\nlet wasmFunc: (\n
boxesId: number, scoresId: number, maxOutputSize: number,\n iouThreshold: number, scoreThreshold: number)
=> number;\n\nfunction setup(backend: BackendWasm): void {\n  wasmFunc = backend.wasm.cwrap(\n
NonMaxSuppressionV3,\n   'number', // Result*\n   [\n     'number', // boxesId\n     'number', // scoresId\n     'number', // maxOutputSize\n     'number', // iouThreshold\n     'number', // scoreThreshold\n   ]);\n\n  function kernelFunc(args: {\n    backend: BackendWasm,\n    inputs: NonMaxSuppressionV3Inputs,\n    attrs:
NonMaxSuppressionV3Attrs\n  }): TensorInfo {\n    const { backend, inputs,
attrs } = args;\n    const { iouThreshold, maxOutputSize, scoreThreshold } = attrs;\n    const { boxes, scores } =
inputs;\n    const boxesId = backend.dataIdMap.get(boxes.dataId).id;\n    const scoresId =
backend.dataIdMap.get(scores.dataId).id;\n    const resOffset =\n      wasmFunc(boxesId, scoresId, maxOutputSize,
iouThreshold, scoreThreshold);\n    const { pSelectedIndices, selectedSize, pSelectedScores, pValidOutputs } =\n      parseResultStruct(backend, resOffset);\n    // Since we are not using scores for V3, we have to delete it from the
heap.\n    backend.wasm._free(pSelectedScores);\n    backend.wasm._free(pValidOutputs);\n    const
selectedIndicesTensor =\n      backend.makeOutput([selectedSize], 'int32', pSelectedIndices);\n    return
selectedIndicesTensor;\n  }\n\n  export const nonMaxSuppressionV3Config: KernelConfig = {\n    kernelName:
NonMaxSuppressionV3,\n    backendName: 'wasm',\n    setupFunc: setup,\n    kernelFunc: kernelFunc as { } as
KernelFunc,\n  };\n\n", /**\n * @license\n * Copyright 2020
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http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n
```

```
* =====\n\n*/\n\nimport { KernelConfig, KernelFunc, NonMaxSuppressionV4, NonMaxSuppressionV4Attrs,
NonMaxSuppressionV4Inputs, TensorInfo } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from
'./backend_wasm';\nimport { parseResultStruct } from './NonMaxSuppression_util';\n\nlet wasmFunc: (\n
boxesId: number, scoresId:
number, maxOutputSize: number,\n iouThreshold: number, scoreThreshold: number,\n padToMaxOutputSize:
boolean) => number;\n\nfunction setup(backend: BackendWasm): void {\n  wasmFunc = backend.wasm.cwrap(\n
NonMaxSuppressionV4,\n   'number', // Result*\n   [\n     'number', // boxesId\n     'number', // scoresId\n     'number', // maxOutputSize\n     'number', // iouThreshold\n     'number', // scoreThreshold\n     'bool', //

```



```

padToMaxOutputSize\n    ]);\n}\n\nfunction nonMaxSuppressionV4(args: {\n  backend: BackendWasm,\n  inputs: NonMaxSuppressionV4Inputs,\n  attrs: NonMaxSuppressionV4Attrs\n}): TensorInfo[] {\n  const {backend, inputs, attrs} = args;\n  const {iouThreshold, maxOutputSize, scoreThreshold, padToMaxOutputSize} =\n    attrs;\n  const {boxes, scores} = inputs;\n  const boxesId = backend.dataIdMap.get(boxes.dataId).id;\n  const scoresId = backend.dataIdMap.get(scores.dataId).id;\n  const resOffset = wasmFunc(\n    boxesId, scoresId, maxOutputSize, iouThreshold, scoreThreshold,\n    padToMaxOutputSize);\n  const {pSelectedIndices, selectedSize, pSelectedScores, pValidOutputs} =\n    parseResultStruct(backend, resOffset);\n  // Since we are not using scores for V4, we have to delete it from the heap.\n  backend.wasm._free(pSelectedScores);\n  const selectedIndicesTensor =\n    backend.makeOutput([selectedSize], 'int32', pSelectedIndices);\n  const validOutputsTensor = backend.makeOutput([], 'int32', pValidOutputs);\n  return [selectedIndicesTensor, validOutputsTensor];\n}\n\nexport const nonMaxSuppressionV4Config: KernelConfig = {\n  kernelName: NonMaxSuppressionV4,\n  backendName: 'wasm',\n  setupFunc: setup,\n  kernelFunc: nonMaxSuppressionV4 as {\n    as KernelFunc,\n  };,\n  "/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You

```

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```

=====
*/\n\nimport {KernelConfig, KernelFunc, NonMaxSuppressionV5, NonMaxSuppressionV5Attrs, NonMaxSuppressionV5Inputs, TensorInfo} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from './backend_wasm';\n\nimport {parseResultStruct} from './NonMaxSuppression_util';\n\nlet wasmFunc:\n  (boxesId: number, scoresId: number, maxOutputSize: number,\n    iouThreshold: number, scoreThreshold: number, softNmsSigma: number) =>\n    number;\n\nfunction setup(backend: BackendWasm): void {\n  wasmFunc = backend.wasm.cwrap(\n    NonMaxSuppressionV5,\n    'number', // Result*\n    [\n      'number', // boxesId\n      'number', // scoresId\n      'number', // maxOutputSize\n      'number', // iouThreshold\n      'number', // scoreThreshold\n      'number', // softNmsSigma\n    ]);\n}\n\nfunction kernelFunc(args: {\n  backend: BackendWasm,\n  inputs: NonMaxSuppressionV5Inputs,\n  attrs: NonMaxSuppressionV5Attrs\n}): TensorInfo[] {\n  const {backend, inputs, attrs} = args;\n  const {iouThreshold, maxOutputSize, scoreThreshold, softNmsSigma} =\n    attrs;\n  const {boxes, scores} = inputs;\n  const boxesId = backend.dataIdMap.get(boxes.dataId).id;\n  const scoresId = backend.dataIdMap.get(scores.dataId).id;\n  const resOffset = wasmFunc(\n    boxesId, scoresId, maxOutputSize, iouThreshold, scoreThreshold,\n    softNmsSigma);\n  const {pSelectedIndices, selectedSize, pSelectedScores, pValidOutputs} =\n    parseResultStruct(backend, resOffset);\n  // Since we are not using validOutputs for V5, we have to delete it from the\n  // heap.\n  backend.wasm._free(pValidOutputs);\n  const selectedIndicesTensor =\n    backend.makeOutput([selectedSize], 'int32', pSelectedIndices);\n  const selectedScoresTensor =\n    backend.makeOutput([selectedSize], 'float32', pSelectedScores);\n  return [selectedIndicesTensor, selectedScoresTensor];\n}\n\nexport const nonMaxSuppressionV5Config: KernelConfig = {\n  kernelName: NonMaxSuppressionV5,\n  backendName: 'wasm',\n  setupFunc: setup,\n  kernelFunc: kernelFunc as {\n    as KernelFunc,\n  };,\n  "/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *

```

```

=====\\n
*\\nimport {KernelConfig, NotEqual} from '@tensorflow/tfjs-core';\\n\\nimport {createBinaryKernelConfig} from
'./binary_kernel';\\nconst supportsFullBroadcast = false;\\nexport const notEqualConfig: KernelConfig =\\n
createBinaryKernelConfig(NotEqual, supportsFullBroadcast, 'bool');\\n"/**\\n * @license\\n * Copyright 2020
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may not use this file except in compliance with the License.\\n * You may obtain a copy of the License at\\n *\\n *
http://www.apache.org/licenses/LICENSE-2.0\\n *\\n * Unless required by applicable law or agreed to in writing,
software\\n * distributed under the
License is distributed on an "AS IS" BASIS,\\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY
KIND, either express or implied.\\n * See the License for the specific language governing permissions and\\n *
limitations under the License.\\n *
=====\\n
*\\n\\nimport {KernelConfig, KernelFunc, OneHot, OneHotAttrs, OneHotInputs} from '@tensorflow/tfjs-
core';\\n\\nimport {BackendWasm} from '../backend_wasm';\\n\\nlet wasmOneHot: (\\n  indicesId: number, depth:
number, onValue: number, offValue: number,\\n  outId: number) => void;\\n\\nfunction setup(backend:
BackendWasm) {\\n  wasmOneHot = backend.wasm.cwrap(OneHot, null /* void */, [\\n    'number', // indices_id\\n
'number', // depth,\\n    'number', // onValue\\n    'number', // offValue\\n    'number' // out_id\\n  ]);\\n}\\n\\nfunction
oneHot(\\n  args: {inputs: OneHotInputs, attrs: OneHotAttrs, backend: BackendWasm}) {\\n  const {inputs,
backend, attrs} = args;\\n  const {indices}
= inputs;\\n  const {depth, onValue, offValue} = attrs;\\n\\n  const out = backend.makeOutput([...indices.shape,
depth], 'int32');\\n  const outId = backend.dataIdMap.get(out.dataId).id;\\n\\n  const indicesData =
backend.dataIdMap.get(indices.dataId);\\n  const indicesId = indicesData.id;\\n\\n  wasmOneHot(indicesId, depth,
onValue, offValue, outId);\\n\\n  return out;\\n}\\n\\nexport const oneHotConfig: KernelConfig = {\\n  kernelName:
OneHot,\\n  backendName: 'wasm',\\n  setupFunc: setup,\\n  kernelFunc: oneHot as {} as KernelFunc,\\n};\\n"/**\\n *
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2.0 (the "License");\\n * you may not use this file except in compliance with the License.\\n * You may obtain a
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law or agreed to in writing, software\\n * distributed under the License is distributed on an "AS IS" BASIS,\\n *
WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\\n * See the License for the specific language
governing permissions and\\n * limitations under the License.\\n *
=====\\n
*\\n\\nimport {KernelConfig, KernelFunc, OnesLike, OnesLikeInputs} from '@tensorflow/tfjs-core';\\n\\nimport
{BackendWasm} from '../backend_wasm';\\n\\nfunction onesLike(args: {inputs: OnesLikeInputs, backend:
BackendWasm}) {\\n  const {inputs: {x}, backend} = args;\\n  const out = backend.makeOutput(x.shape, x.dtype);\\n
const outVals = backend.toArrayFromHeap(out);\\n  outVals.fill(1);\\n  return out;\\n}\\n\\nexport const
onesLikeConfig: KernelConfig = {\\n  kernelName: OnesLike,\\n  backendName: 'wasm',\\n  kernelFunc: onesLike as
{} as KernelFunc,\\n};\\n"/**\\n * @license\\n * Copyright 2020 Google LLC. All Rights Reserved.\\n * Licensed
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*\\n * Unless required by applicable law or agreed to in writing, software\\n * distributed under the License is
distributed on an "AS IS" BASIS,\\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
express or implied.\\n * See the License for the specific language governing permissions and\\n * limitations under
the License.\\n *
=====\\n
*\\n\\nimport {KernelConfig, KernelFunc, Pack, PackAttrs, PackInputs, TensorInfo, util} from '@tensorflow/tfjs-
core';\\nimport {BackendWasm} from '../backend_wasm';\\nimport {concat} from './Concat';\\nimport
{expandDims} from './ExpandDims';\\n\\nexport function pack(\\n  args: {inputs: PackInputs, backend:

```

```

BackendWasm, attrs: PackAttrs);\n
TensorInfo {\n const {inputs, backend, attrs} = args;\n const {axis} =
attrs;\n\n if (inputs.length === 1) {\n return expandDims(\n
{inputs: {input: inputs[0]}, backend, attrs: {dim: axis}});\n }\n\n const shape = inputs[0].shape;\n const dtype
= inputs[0].dtype;\n\n inputs.forEach(t => {\n util.assertShapesMatch(\n shape, t.shape,\n 'All tensors
passed to stack must have matching shapes');\n util.assert(\n dtype === t.dtype,\n () => 'All tensors passed
to stack must have matching dtypes');\n });\n\n const intermediateTensorInfos: TensorInfo[] = [];\n const
expandedTensors = inputs.map(t => {\n const expandedT =\n expandDims({inputs: {input: t}, backend, attrs:
{dim: axis}});\n intermediateTensorInfos.push(expandedT);\n return expandedT;\n });\n\n const result =
concat({inputs: expandedTensors, backend, attrs: {axis}});\n\n intermediateTensorInfos.forEach(t =>
backend.disposeData(t.dataId));\n\n return result;\n})\n\nexport const packConfig: KernelConfig = {\n kernelName:
Pack,\n backendName: 'wasm',\n kernelFunc: pack as {} as KernelFunc\n};\n", "/*\n
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2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a
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law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
======\n
*/\n\nimport {KernelConfig, KernelFunc, PadV2, PadV2Attrs, PadV2Inputs, util} from '@tensorflow/tfjs-
core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport {fill} from './Fill';\n\nimport {CppType}
from './types';\n\nlet wasmPadV2: (\n xId: number, xShapeBytes:
Uint8Array, xShapeLength: number, xDtype: number,\n prePaddingsBytes: Uint8Array, postPaddingsBytes:
Uint8Array,\n constantValue: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n
wasmPadV2 = backend.wasm.cwrap(PadV2, null /* void */, [\n 'number', // xId\n 'array', // x.shape\n
number', // x.shape.length\n 'number', // x.dtype\n 'array', // pre-paddings\n 'array', // post-paddings\n
number', // constantValue\n 'number', // outId\n ]);\n\nfunction pad(\n args: {inputs: PadV2Inputs, backend:
BackendWasm, attrs: PadV2Attrs}) {\n const {inputs: {x}, backend, attrs: {paddings, constantValue}} = args;\n\n
const outShape = paddings.map(\n (p, i) => p[0] /* beforePad */ + x.shape[i] + p[1] /* afterPad */);\n\n if
(util.sizeFromShape(x.shape) === 0) {\n // Short-circuit the computation, since x doesn't have value, only\n //
the shape is used to compute output shape to pad.\n return fill({\n
backend,\n attrs: {shape: outShape, value: constantValue, dtype: x.dtype}\n });\n }\n\n const xId =
backend.dataIdMap.get(x.dataId).id;\n const out = backend.makeOutput(outShape, x.dtype);\n const
outTensorData = backend.dataIdMap.get(out.dataId);\n const outId = outTensorData.id;\n\n const xShapeBytes =
new Uint8Array(new Int32Array(x.shape).buffer);\n\n const prePaddingsFlat = paddings.map(padTuple =>
padTuple[0]);\n const postPaddingsFlat = paddings.map(padTuple => padTuple[1]);\n const prePaddingsBytes =\n
new Uint8Array(new Int32Array(prePaddingsFlat).buffer);\n const postPaddingsBytes =\n new
Uint8Array(new Int32Array(postPaddingsFlat).buffer);\n\n wasmPadV2(\n xId, xShapeBytes, x.shape.length,
CppType[x.dtype], prePaddingsBytes,\n postPaddingsBytes, constantValue, outId);\n return out;\n})\n\nexport
const padV2Config: KernelConfig = {\n kernelName: PadV2,\n backendName: 'wasm',\n kernelFunc: pad as {} as
KernelFunc,\n setupFunc: setup\n};\n", "/*\n
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law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
======\n
*/\n\nimport {KernelConfig, Pow} from '@tensorflow/tfjs-core';\n\nimport {createBinaryKernelConfig} from

```

```
./binary_kernel';\nconst supportsFullBroadcast = false;\nextport const powConfig: KernelConfig =\ncreateBinaryKernelConfig(Pow, supportsFullBroadcast);\n"/>**\n *\n@license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version\n2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a\n copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable\n law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n the specific language governing permissions and\n * limitations under the License.\n *\n=====\n*\nimport { KernelConfig, KernelFunc, Prelu, PreluInputs } from '@tensorflow/tfjs-core';\nimport\n{ BackendWasm } from '../backend_wasm';\nimport { cast } from './Cast';\nlet wasmPrelu: (xId: number,\n weightsId: number, outId: number) => void;\nfunction setup(backend: BackendWasm) {\n  wasmPrelu = backend.wasm.cwrap(Prelu, null /* void */, [\n    'number', // x_id\n    'number', // weights_id\n    'number' // out_id\n  ]);\n  function prelu(args: { inputs: PreluInputs, backend: BackendWasm }) {\n    const\n      { inputs, backend } = args;\n    const { x, alpha } = inputs;\n    const xId = backend.dataIdMap.get(x.dataId).id;\n    const\n      weightsId = backend.dataIdMap.get(alpha.dataId).id;\n    let inputId = xId;\n    const input = x;\n    let castedInput =\n      input;\n    if (input.dtype !== 'float32') {\n      castedInput = cast({ backend, inputs: { x }, attrs: { dtype: 'float32' }});\n      inputId = backend.dataIdMap.get(castedInput.dataId).id;\n    }\n    const out = backend.makeOutput(x.shape,\n      'float32');\n    const outId = backend.dataIdMap.get(out.dataId).id;\n    wasmPrelu(inputId, weightsId, outId);\n    if\n      (input.dtype !== 'float32') {\n        backend.disposeData(castedInput.dataId);\n      }\n    return out;\n  }\n  \nextport const\n    preluConfig: KernelConfig = {\n      kernelName: Prelu,\n      backendName: 'wasm',\n      setupFunc: setup,\n      kernelFunc: prelu as { } as KernelFunc\n    };\n  /**\n   * @license\n   * Copyright 2020 Google\n   LLC. All Rights Reserved.\n   * Licensed under the Apache License, Version 2.0 (the \"License\");\n   * you may not\n   use this file except in compliance with the License.\n   * You may obtain a copy of the License at\n   *\n   http://www.apache.org/licenses/LICENSE-2.0\n   *\n   Unless required by applicable law or agreed to in writing,\n   software\n   * distributed under the License is distributed on an \"AS IS\" BASIS,\n   * WITHOUT WARRANTIES\n   OR CONDITIONS OF ANY KIND, either express or implied.\n   * See the License for the specific language\n   governing permissions and\n   * limitations under the License.\n   *\n   =====\n   *\n   import { backend_util, KernelConfig, KernelFunc, Prod, ProdAttrs, ProdInputs, TensorInfo, util } from\n   '@tensorflow/tfjs-core';\n   import { BackendWasm } from '../backend_wasm';\n   import\n   { permuteAxesAndTranspose }\n   from './kernel_utils';\n   import { CppDType } from './types';\n   let wasmProd: (\n     xId: number, reduceSize:\n     number,\n     dtype: number, outId: number ) => void;\n   function setup(backend: BackendWasm): void {\n     wasmProd = backend.wasm.cwrap(Prod, null /*void*/, [\n       'number',\n       'number',\n       'number',\n       'number'\n     ]);\n     function prod(args: {\n       backend: BackendWasm,\n       inputs: ProdInputs,\n       attrs: ProdAttrs\n     }): TensorInfo\n     {\n       const { backend, inputs, attrs } = args;\n       const { axis, keepDims } = attrs;\n       const { x } = inputs;\n       const xId =\n         backend.dataIdMap.get(x.dataId).id;\n       let inputId = xId;\n       let input = x;\n       const { transposed, axes, originalAxes,\n         inputWasTransposed } =\n         permuteAxesAndTranspose(x, axis, backend);\n       let reductionAxes = axes;\n       if\n         (inputWasTransposed) {\n           const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n           if (transposedId\n             !== xId) {\n               // transpose was not a no-op. We will need to dispose of this\n               // once\n               we are done.\n               input = transposed;\n               inputId = transposedId;\n               reductionAxes =\n                 backend_util.getInnerMostAxes(\n                   reductionAxes.length, input.shape.length);\n             }\n             backend_util.assertAxesAreInnerMostDims(\n               'prod', reductionAxes, input.shape.length);\n             const [outShape,\n               reduceShape] =\n                 backend_util.computeOutAndReduceShapes(input.shape, reductionAxes);\n             const reduceSize\n               = util.sizeFromShape(reduceShape);\n             const out = backend.makeOutput(outShape, input.dtype);\n             if\n               (util.sizeFromShape(input.shape) !== 0) {\n                 const outId = backend.dataIdMap.get(out.dataId).id;\n                 wasmProd(inputId, reduceSize, CppDType[out.dtype], outId);\n               }\n               if (inputWasTransposed) {\n                 // dispose of
```

the transposed tensor.\n backend.disposeData(transposed.dataId);\n }\n\n if (keepDims) {\n // reshape\n const newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n out.shape = newShape;\n }\n\n return out;\n}\n\nexport const prodConfig:

KernelConfig = {\n kernelName: Prod,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: prod as { } as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */

=====\n\n*/\n\nimport { KernelConfig, KernelFunc, Range, RangeAttrs, TensorInfo } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nimport { rangeImplCPU } from '../kernel_utils/shared';\n\nexport const range = (\n (args: { backend: BackendWasm, attrs: RangeAttrs }): TensorInfo => {\n const { backend, attrs } = args;\n const { start, stop, step, dtype } = attrs;\n const values = rangeImplCPU(start, stop, step, dtype);\n const out = backend.makeOutput([values.length], dtype);\n const outVals = backendtypedArrayFromHeap(out);\n outVals.set(values);\n return out;\n });\n\nexport const rangeConfig: KernelConfig = {\n kernelName: Range,\n backendName: 'wasm',\n kernelFunc: range as { } as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */

=====\n\n*/\n\nimport { KernelConfig, RealDiv } from '@tensorflow/tfjs-core';\nimport { createBinaryKernelConfig } from './binary_kernel';\n\nconst supportsFullBroadcast = true;\n\nexport const realDivConfig: KernelConfig = {\n createBinaryKernelConfig(RealDiv, supportsFullBroadcast);\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */

=====\n\n*/\n\nimport { KernelConfig, Relu } from '@tensorflow/tfjs-core';\nimport { createUnaryKernelConfig } from './unary_kernel';\n\nexport const reluConfig: KernelConfig = createUnaryKernelConfig(Relu);\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT

=====\n\n*/\n\nimport { KernelConfig, Relu } from '@tensorflow/tfjs-core';\nimport { createUnaryKernelConfig } from './unary_kernel';\n\nexport const reluConfig: KernelConfig = createUnaryKernelConfig(Relu);\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT

=====\n\n*/\n\nimport { KernelConfig, Relu } from '@tensorflow/tfjs-core';\nimport { createUnaryKernelConfig } from './unary_kernel';\n\nexport const reluConfig: KernelConfig = createUnaryKernelConfig(Relu);\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT

=====\n\n*/\n\nimport { KernelConfig, Relu } from '@tensorflow/tfjs-core';\nimport { createUnaryKernelConfig } from './unary_kernel';\n\nexport const reluConfig: KernelConfig = createUnaryKernelConfig(Relu);\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT

=====\n\n*/\n\nimport { KernelConfig, Relu } from '@tensorflow/tfjs-core';\nimport { createUnaryKernelConfig } from './unary_kernel';\n\nexport const reluConfig: KernelConfig = createUnaryKernelConfig(Relu);\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT

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=====\\n
*\\nimport {KernelConfig, Relu6} from '@tensorflow/tfjs-core';\\nimport {createUnaryKernelConfig} from
'./unary_kernel';\\nexport const relu6Config: KernelConfig = createUnaryKernelConfig(Relu6);\\n", "/*\\n *
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2.0 (the \"License\");\\n * you may not use this file except in compliance with the License.\\n * You may obtain a
copy of the License at\\n * http://www.apache.org/licenses/LICENSE-2.0\\n * Unless required by applicable
law or agreed to in writing, software\\n * distributed under the License is distributed on an \"AS IS\" BASIS,\\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\\n * See the License
for the specific language governing permissions and\\n * limitations under the License.\\n *
=====\\n
*\\nimport {KernelConfig, KernelFunc, ResizeBilinear, ResizeBilinearAttrs, ResizeBilinearInputs, TensorInfo,
util} from '@tensorflow/tfjs-core';\\nimport {BackendWasm} from './backend_wasm';\\nimport {cast} from
'./Cast';\\n\\nlet wasmResizeBilinear: (\\n  xId: number, batch: number, oldHeight: number, oldWidth: number,\\n
numChannels: number, newHeight: number, newWidth: number,\\n  alignCorners: number, halfPixelCenters:
number, outId: number) => void;\\n\\nfunction setup(backend: BackendWasm): void {\\n  wasmResizeBilinear =
backend.wasm.cwrap(ResizeBilinear, null /*void*/, [\\n    'number', // xId\\n    'number', // batch\\n    'number', //
oldHeight\\n    'number', // oldWidth\\n    'number', // numChannels\\n    'number', // newHeight\\n    'number', //
newWidth\\n    'number', // alignCorners\\n    'number',
// halfPixelCenters\\n    'number' // outId\\n  ]);\\n}\\n\\nfunction resizeBilinear(args: {\\n  backend: BackendWasm,\\n
inputs: ResizeBilinearInputs,\\n  attrs: ResizeBilinearAttrs\\n}): TensorInfo {\\n  const {backend, inputs, attrs} =
args;\\n\\n  const {images} = inputs;\\n  const {alignCorners, halfPixelCenters, size} = attrs;\\n  const [newHeight,
newWidth] = size;\\n\\n  const [batch, oldHeight, oldWidth, numChannels] = images.shape;\\n  const outShape =
[batch, newHeight, newWidth, numChannels];\\n\\n  let xData = backend.dataIdMap.get(images.dataId);\\n  let
castedData;\\n  if (xData.dtype !== 'float32') {\\n    castedData =\\n      cast({backend, inputs: {x: images}, attrs:
{dtype: 'float32'}});\\n    xData = backend.dataIdMap.get(castedData.dataId);\\n  }\\n  const xId = xData.id;\\n\\n  const
out = backend.makeOutput(outShape, 'float32');\\n  if (util.sizeFromShape(images.shape) === 0) {\\n    return out;\\n
}\\n  const outId = backend.dataIdMap.get(out.dataId).id;\\n  wasmResizeBilinear(\\n
xId, batch, oldHeight, oldWidth, numChannels, newHeight, newWidth,\\n    alignCorners ? 1 : 0,
halfPixelCenters ? 1 : 0, outId);\\n\\n  if (castedData !== null) {\\n    backend.disposeData(castedData.dataId);\\n  }\\n\\n
return out;\\n}\\n}\\n\\nexport const resizeBilinearConfig: KernelConfig = {\\n  kernelName: ResizeBilinear,\\n
backendName: 'wasm',\\n  setupFunc: setup,\\n  kernelFunc: resizeBilinear as {} as KernelFunc\\n};\\n", "/*\\n *
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law or agreed to in writing, software\\n * distributed under the License is distributed on an \"AS IS\" BASIS,\\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\\n * See the License for
the specific language
governing permissions and\\n * limitations under the License.\\n *
=====\\n
*\\nimport {KernelConfig, KernelFunc, Reverse, ReverseAttrs, ReverseInputs, TensorInfo, util} from
'@tensorflow/tfjs-core';\\nimport {BackendWasm} from './backend_wasm';\\nimport {identity} from
'./Identity';\\nimport {reshape} from './Reshape';\\n\\nlet wasmReverse: (\\n  xId: number, axes: Uint8Array,
axesLength: number, outShape: Uint8Array,\\n  outShapeLength: number, outId: number) => void;\\n\\nfunction
setup(backend: BackendWasm) {\\n  wasmReverse = backend.wasm.cwrap(Reverse, null, [\\n    'number', // x_id\\n
'array', // axes\\n    'number', // axes_length\\n    'array', // out_shape\\n    'number', // out_shape_length\\n
'number'
// out_id\\n  ]);\\n}\\n\\nexport function reverse(\\n  args: {inputs: ReverseInputs, backend: BackendWasm, attrs:
ReverseAttrs}\\n): TensorInfo {\\n  const {inputs, backend, attrs} = args;\\n  const

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{x} = inputs;\n const {dims} = attrs;\n\n const axes = util.parseAxisParam(dims, x.shape);\n\n if (x.shape.length\n === 0) {\n   return identity({inputs: {x}, backend});\n }\n\n const out = backend.makeOutput(x.shape, x.dtype);\n const xId = backend.dataIdMap.get(x.dataId).id;\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n const\n axesBytes = new Uint8Array(new Int32Array(axes).buffer);\n const outShapeBytes = new Uint8Array(new\n Int32Array(x.shape).buffer);\n\n wasmReverse(\n   xId, axesBytes, axes.length, outShapeBytes, x.shape.length,\n   outId);\n\n const reshaped =\n   reshape({inputs: {x: out}, attrs: {shape: x.shape}, backend});\n\n backend.disposeData(out.dataId);\n return reshaped;\n}\n\nexport const reverseConfig: KernelConfig = {\n  kernelName: Reverse,\n  backendName: 'wasm',\n  kernelFunc: reverse as { } as KernelFunc,\n  setupFunc:\n  setup\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the\n Apache License,
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=====\n\n*/\n\nimport {KernelConfig, KernelFunc, RotateWithOffset, RotateWithOffsetAttrs, RotateWithOffsetInputs,\n TensorInfo} from '@tensorflow/tfjs-core';\nimport {backend_util} from '@tensorflow/tfjs-core';\n\nimport\n {BackendWasm} from '../backend_wasm';\n\nlet wasmRotate: (\n   xId: number, batch: number, imageHeight:\n number, imageWidth: number,\n   numChannels: number, radians: number, centerX:\n number, centerY: number,\n   fillBytes: Uint8Array, fillLength: number, outId: number) => void;\n\nfunction\n setup(backend: BackendWasm) {\n   wasmRotate = backend.wasm.cwrap(RotateWithOffset, null /* void */, [\n 'number', // xId\n 'number', // batch\n 'number', // imageHeight\n 'number', // imageWidth\n 'number', //\n numChannels\n 'number', // radians\n 'number', // centerX\n 'number', // centerY\n 'array', // fillBytes\n 'number', // fillLength\n 'number', // outId\n ]);\n\n   export function rotateWithOffset(args: {\n inputs:\n RotateWithOffsetInputs,\n backend: BackendWasm,\n attrs: RotateWithOffsetAttrs\n }): TensorInfo {\n const\n {inputs, backend, attrs} = args;\n const {image} = inputs;\n const {radians, fillValue, center} = attrs;\n\n const out\n = backend.makeOutput(image.shape, image.dtype);\n const imageId = backend.dataIdMap.get(image.dataId).id;\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n const [batch,\n imageHeight, imageWidth, numChannels] = image.shape;\n\n const [centerX, centerY] =\n backend_util.getImageCenter(center, imageHeight, imageWidth);\n\n const fillIsBlack = fillValue === 0;\n const\n fullOpacityValue = 255;\n\n const fillValues = typeof fillValue === 'number' ?\n   [fillValue, fillValue, fillValue,\n fillIsBlack ? 0 : fullOpacityValue] :\n   [...fillValue, fullOpacityValue];\n\n const fillBytes = new Uint8Array(new\n Int32Array(fillValues).buffer);\n\n wasmRotate(\n   imageId, batch, imageHeight, imageWidth, numChannels,\n   radians, centerX,\n   centerY, fillBytes, fillValues.length, outId);\n\n return out;\n}\n\nexport const\n rotateWithOffsetConfig: KernelConfig = {\n  kernelName: RotateWithOffset,\n  backendName: 'wasm',\n  kernelFunc: rotateWithOffset as { } as KernelFunc,\n  setupFunc: setup\n};\n\n"/**\n * @license\n * Copyright 2021\n Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you\n may not use this
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```

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=====\n\n*/\n\nimport {KernelConfig, Round} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from\n '../unary_kernel';\n\nexport const roundConfig: KernelConfig = createUnaryKernelConfig(Round);\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version
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```
=====
*/nimport {KernelConfig, Rsqrt} from '@tensorflow/tfjs-core';nimport {createUnaryKernelConfig} from
'./unary_kernel';nexport const rsqrtConfig: KernelConfig = createUnaryKernelConfig(Rsqrt);n"/**n
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copy of the License atn * http://www.apache.org/licenses/LICENSE-2.0n * Unless required
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BASIS,n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.n * See the
License for the specific language governing permissions andn * limitations under the License.n *
```

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=====n
*/nnimport {KernelConfig, KernelFunc, scatter_util, ScatterNd, ScatterNdAttrs, ScatterNdInputs, TensorInfo, util}
from '@tensorflow/tfjs-core';nimport {BackendWasm} from '../backend_wasm';nimport {CppType} from
'./types';nnlet wasmScatterNd: (n indicesId: number, updatesId: number, dtype: CppDType, sliceRank:
number,n numUpdates: number, sliceSize: number, strides: Uint8Array,n outputSize: number, outId: number)
=> void;nfunction setup(backend: BackendWasm): void {n wasmScatterNd = backend.wasm.cwrap(ScatterNd,
null /*void*/, [n 'number', // indicesIdn 'number',
// updatesIdn 'number', // dtypen 'number', // sliceRankn 'number', // numUpdatesn 'number', //
sliceSizen 'array', // stridesn 'number', // outputSizen 'number' // outIdn ]);nnfunction scatterNd(n
args:n {backend: BackendWasm, inputs: ScatterNdInputs, attrs: ScatterNdAttrs}):n TensorInfo {n const
{backend, inputs, attrs} = args;n const {indices, updates} = inputs;n const {shape} = attrs;n const out =
backend.makeOutput(shape, updates.dtype);n if (util.sizeFromShape(shape) === 0) {n return out;n }nn const
{sliceRank, numUpdates, sliceSize, strides, outputSize} =n scatter_util.calculateShapes(updates, indices,
shape);nn const indicesData = backend.dataIdMap.get(indices.dataId);n const indicesId = indicesData.id;nn
const updatesData = backend.dataIdMap.get(updates.dataId);n const updatesId = updatesData.id;nn const
stridesBytes = new Uint8Array(new Int32Array(strides).buffer);nn const
outId = backend.dataIdMap.get(out.dataId).id;n wasmScatterNd(n indicesId, updatesId,
CppType[updates.dtype], sliceRank, numUpdates,n sliceSize, stridesBytes, outputSize, outId);nn return
out;n}nnexport const scatterNdConfig: KernelConfig = {n kernelName: ScatterNd,n backendName: 'wasm',n
setupFunc: setup,n kernelFunc: scatterNd as {} as KernelFuncn};n"/**n * @licensen * Copyright 2020
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http://www.apache.org/licenses/LICENSE-2.0n * Unless required by applicable law or agreed to in writing,
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OR CONDITIONS OF ANY KIND, either express or implied.n * See the License for the specific language
governing permissions andn * limitations
under the License.n *
```

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=====n
*/nnimport {KernelConfig, KernelFunc, Select, SelectInputs, util} from '@tensorflow/tfjs-core';nimport
{BackendWasm} from '../backend_wasm';nnlet wasmSelect: (n conditionId: number, tId: number, eId: number,
offset: number,n outId: number) => void;nfunction setup(backend: BackendWasm) {n wasmSelect =
backend.wasm.cwrap('SelectV2', null, [n 'number', // conditionIdn 'number', // tIdn 'number', // eIdn
'number', // offsetn 'number', // outIdn ]);nnfunction select(args: {inputs: SelectInputs, backend:
```



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BackendWasm}) {\n const {inputs, backend} = args;\n const {condition, t, e} = inputs;\n\n const conditionId =
backend.dataIdMap.get(condition.dataId).id;\n const tId = backend.dataIdMap.get(t.dataId).id;\n const eId =
backend.dataIdMap.get(e.dataId).id;\n const out = backend.makeOutput(t.shape, t.dtype);\n const outId =
backend.dataIdMap.get(out.dataId).id;\n\n
  const cRank = condition.shape.length;\n const tRank = t.shape.length;\n\n const offset = cRank === 0 || cRank > 1
|| tRank === 1 ?\n 1 :\n util.sizeFromShape(t.shape.slice(1));\n\n wasmSelect(conditionId, tId, eId, offset,
outId);\n return out;\n}\n\nexport const selectConfig: KernelConfig = {\n kernelName: Select,\n backendName:
'wasm',\n kernelFunc: select as { } as KernelFunc,\n setupFunc: setup\n};\n\n"/**\n * @license\n * Copyright 2019
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may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
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software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See
the License for the specific language governing permissions and\n * limitations under the License.\n *
=====
*/\n\nimport {KernelConfig, KernelFunc, Sigmoid, SigmoidInputs, TensorInfo, util} from '@tensorflow/tfjs-
core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nlet wasmFunc: (xId: number, outId: number) =>
void;\n\nfunction setup(backend: BackendWasm): void {\n wasmFunc = backend.wasm.cwrap(Sigmoid, null /*
void */, ['number', 'number']);\n}\n\nfunction sigmoid(args: {backend: BackendWasm, inputs: SigmoidInputs});\n
TensorInfo {\n const {backend, inputs: {x}} = args;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const out
= backend.makeOutput(x.shape, x.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n // Short-
circuit zero-sized tensors.\n if (util.sizeFromShape(out.shape) === 0) {\n return out;\n }\n\n wasmFunc(xId,
outId);\n return out;\n}\n\nexport const sigmoidConfig:
KernelConfig = {\n kernelName: 'Sigmoid',\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: sigmoid
as { } as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed
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* distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
=====
*/\n\nimport {KernelConfig, Sin} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from
'/unary_kernel';\n\nexport const
sinConfig: KernelConfig = createUnaryKernelConfig(Sin);\n\n"/**\n * @license\n * Copyright 2020 Google LLC.
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http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*/\n\nimport {KernelConfig, KernelFunc, Softmax, SoftmaxAttrs, SoftmaxInputs, TensorInfo, util} from
'@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nlet wasmFunc: (xId: number, outId:
number,
channels: number, batch: number) =>\n void;\n\nfunction setup(backend: BackendWasm): void {\n wasmFunc =
backend.wasm.cwrap(Softmax, null /* void */, [\n 'number', // xId\n 'number', // outId\n 'number', //
channels\n 'number' // batch\n ]);\n}\n\nfunction softmax(\n args: {backend: BackendWasm, inputs:

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SoftmaxInputs, attrs: SoftmaxAttrs});\n  TensorInfo {\n  const {backend, inputs: {logits}, attrs: {dim}} = args;\n  const xId = backend.dataIdMap.get(logits.dataId).id;\n  const out = backend.makeOutput(logits.shape,\n  logits.dtype);\n  const outId = backend.dataIdMap.get(out.dataId).id;\n  const channels = logits.shape[dim];\n  const batch = util.sizeFromShape(logits.shape) / channels;\n  // Short-circuit zero-sized tensors.\n  if\n  (util.sizeFromShape(out.shape) === 0) {\n    return out;\n  }\n  wasmFunc(xId, outId, channels, batch);\n  return\n  out;\n}\n\n\nexport const softmaxConfig: KernelConfig = {\n  kernelName: Softmax,\n  backendName: 'wasm',\n  setupFunc:\n    setup,\n  kernelFunc: softmax as {\n  } as KernelFunc\n};\n\n", "/*\n * @license\n * Copyright 2021 Google LLC. All\n  Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this\n  file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * \n  http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,\n  software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\n  OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n  governing permissions and\n * limitations under the License.\n *\n  =====\n\n  *\n  \nimport {backend_util, KernelConfig, KernelFunc, ReshapeAttrs, ReshapeInputs, SpaceToBatchND,\n  SpaceToBatchNDAttrs, SpaceToBatchNDInputs, TensorInfo, TransposeAttrs, TransposeInputs, util} from\n  '@tensorflow/tfjs-core';\n\nimport\n  {BackendWasm} from './backend_wasm';\n\nimport {padV2Config} from './PadV2';\nimport {reshape} from\n  './Reshape';\nimport {transpose} from './Transpose';\n\nfunction spaceToBatchND(args: {\n  inputs:\n  SpaceToBatchNDInputs,\n  backend: BackendWasm,\n  attrs: SpaceToBatchNDAttrs\n}) {\n  const {inputs,\n  backend, attrs} = args;\n  const {x} = inputs;\n  const {blockShape, paddings} = attrs;\n\n  const prod =\n  util.sizeFromShape(blockShape);\n\n  const completePaddings: Array<number, number> = [[0, 0]];\n  completePaddings.push(...(paddings as Array<number, number>));\n\n  for (let i = 1 + blockShape.length; i <\n  x.shape.length; ++i) {\n    completePaddings.push([0, 0]);\n  }\n\n  const paddedX = padV2Config.kernelFunc({\n  inputs: {x},\n  backend,\n  attrs: {paddings: completePaddings, constantValue: 0}\n}) as TensorInfo;\n\n  const\n  reshapedPaddedShape =\n    backend_util.getReshaped(paddedX.shape, blockShape, prod, false);\n\n  const\n  permutedReshapedPaddedPermutation\n  = backend_util.getPermuted(\n    reshapedPaddedShape.length, blockShape.length, false);\n\n  const flattenShape\n  =\n    backend_util.getReshapedPermuted(paddedX.shape, blockShape, prod, false);\n\n  const reshapeInputs:\n  ReshapeInputs = {x: paddedX};\n  const reshapeAttrs: ReshapeAttrs = {shape: reshapedPaddedShape};\n  const\n  paddedXReshaped =\n    reshape({inputs: reshapeInputs, backend, attrs: reshapeAttrs});\n\n  const transposeInputs:\n  TransposeInputs = {x: paddedXReshaped};\n  const transposeAttrs:\n    TransposeAttrs = {perm:\n  permutedReshapedPaddedPermutation};\n  const paddedXT =\n    transpose({inputs: transposeInputs, backend,\n  attrs: transposeAttrs});\n\n  const resultReshapeInputs: ReshapeInputs = {x: paddedXT};\n  const\n  resultReshapeAttrs: ReshapeAttrs = {shape: flattenShape};\n  const result = reshape(\n    {inputs:\n  resultReshapeInputs, backend, attrs: resultReshapeAttrs});\n\n  backend.disposeData(paddedX.dataId);\n  backend.disposeData(paddedXReshaped.dataId);\n\n  backend.disposeData(paddedXT.dataId);\n\n  return result;\n}\n\n\nexport const spaceToBatchNDConfig:\n  KernelConfig = {\n  kernelName: SpaceToBatchND,\n  backendName: 'wasm',\n  kernelFunc: spaceToBatchND as\n  {\n  } as KernelFunc\n};\n\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed\n  under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the\n  License.\n * You may obtain a copy of the License at\n * \n * \n  http://www.apache.org/licenses/LICENSE-2.0\n * \n * \n  Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed\n  on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or\n  implied.\n * See the License for the specific language governing permissions and\n * limitations under the\n  License.\n *\n  =====\n\n  \n

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*\n\nimport { KernelConfig, KernelFunc, SplitV,
SplitVAttrs, SplitVInputs, util } from '@tensorflow/tfjs-core';\nimport { backend_util } from '@tensorflow/tfjs-
core';\n\nimport { BackendWasm } from './backend_wasm';\n\nimport { slice } from './Slice';\n\nexport function
splitV(\n  args: { inputs: SplitVInputs, attrs: SplitVAttrs, backend: BackendWasm }) {\n  const { inputs, attrs,
backend } = args;\n  const { x } = inputs;\n  const { numOrSizeSplits, axis } = attrs;\n  const $axis =
util.parseAxisParam(axis, x.shape)[0];\n  const splitSizes = backend_util.prepareSplitSize(x, numOrSizeSplits,
$axis);\n  const begin = new Array(x.shape.length).fill(0);\n  const size = x.shape.slice();\n  return splitSizes.map(s
=> {\n    const xSliceSize = [...size];\n    xSliceSize[$axis] = s;\n    const xSlice =\n      slice({ inputs: { x }, attrs:
{ begin, size: xSliceSize }, backend });\n    begin[$axis] += s;\n    return xSlice;\n  });\n}\n\nexport const
splitVConfig: KernelConfig = {\n  kernelName: SplitV,\n  backendName: 'wasm',\n  kernelFunc: splitV as
  {} as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed
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on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
=====
*\n\nimport { KernelConfig, Sqrt } from '@tensorflow/tfjs-core';\nimport { createUnaryKernelConfig } from
'./unary_kernel';\nexport const sqrtConfig: KernelConfig = createUnaryKernelConfig(Sqrt);\n\n"/**\n * @license\n
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
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=====
*\n\nimport { KernelConfig, Square } from '@tensorflow/tfjs-core';\nimport { createUnaryKernelConfig } from
'./unary_kernel';\nexport const squareConfig: KernelConfig = createUnaryKernelConfig(Square);\n\n"/**\n *
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WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific
language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport { KernelConfig, SquaredDifference } from '@tensorflow/tfjs-core';\nimport { createBinaryKernelConfig }
from './binary_kernel';\nconst supportsFullBroadcast = true;\nexport const squaredDifferenceConfig: KernelConfig
=\n  createBinaryKernelConfig(SquaredDifference, supportsFullBroadcast);\n\n"/**\n * @license\n * Copyright
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language governing permissions and\n * limitations under the License.\n *
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*\n\nimport { KernelConfig, KernelFunc, Step, StepAttrs, StepInputs, TensorInfo } from '@tensorflow/tfjs-
core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nimport { CppDType } from './types';\n\nlet wasmStep:
(xId: number, alpha: number, dtype: number, outId: number) =>\n  void;\n\nfunction setup(backend:
BackendWasm): void {\n  wasmStep = backend.wasm.cwrap(Step, null /*void*/, [\n
  'number', // x_id\n  'number', // alpha\n  'number', // dtype\n  'number', // out_id\n  ]);\n}\n\nfunction step(\n
args: { backend: BackendWasm, inputs: StepInputs, attrs: StepAttrs }):\n  TensorInfo {\n  const { backend, inputs,
attrs } = args;\n  const { alpha } = attrs;\n  const { x } = inputs;\n  const xId = backend.dataIdMap.get(x.dataId).id;\n
const out = backend.makeOutput(x.shape, x.dtype);\n  const outId = backend.dataIdMap.get(out.dataId).id;\n
wasmStep(xId, alpha, CppDType[x.dtype], outId);\n  return out;\n}\n\nexport const stepConfig: KernelConfig = {\n
kernelName: Step,\n  backendName: 'wasm',\n  setupFunc: setup,\n  kernelFunc: step as { } as
KernelFunc\n};\n", "/*\n * @license\n * Copyright 2021 Google LLC. All Rights Reserved.\n * Licensed under the
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express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n *

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*\n\nimport { KernelConfig, KernelFunc, slice_util, StridedSlice, StridedSliceAttrs, StridedSliceInputs, TensorInfo,
util } from '@tensorflow/tfjs-core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nimport { reshape } from
'./Reshape';\n\nimport { slice } from './Slice';\n\nlet wasmStridedSlice: (\n  xId: number, xStridesBytes: Uint8Array,
xRank: number,\n  beginBytes: Uint8Array, endBytes: Uint8Array, stridesBytes: Uint8Array,\n  outShapeBytes:
Uint8Array, outStridesBytes: Uint8Array,\n  outShapeLength: number, outId: number) => void;\n\nfunction
setup(backend: BackendWasm):
  void {\n  wasmStridedSlice = backend.wasm.cwrap(StridedSlice, null /*void*/, [\n  'number', // xId\n  'array', //
xStrides\n  'number', // xRank\n  'array', // beginBytes\n  'array', // endBytes\n  'array', // stridesBytes\n
  'array', // outShapeBytes\n  'array', // outStridesBytes\n  'number', // outShapeLength\n  'number', // outId\n
  ]);\n}\n\nexport function stridedSlice(args: {\n  backend: BackendWasm,\n  inputs: StridedSliceInputs,\n  attrs:
StridedSliceAttrs\n}): TensorInfo {\n  const { backend, inputs, attrs } = args;\n  const { x } = inputs;\n  const {\n
begin,\n  end,\n  strides,\n  beginMask,\n  endMask,\n  ellipsisMask,\n  newAxisMask,\n
shrinkAxisMask\n } = attrs;\n  const {\n  finalShapeSparse,\n  finalShape,\n  isIdentity,\n  sliceDim0,\n
isSimpleSlice,\n  begin: $begin,\n  end: $end,\n  strides: $strides\n } =\n    slice_util.sliceInfo(\n      x.shape,
begin, end, strides, beginMask, endMask,
ellipsisMask,\n      newAxisMask, shrinkAxisMask);\n  let result;\n  if (isIdentity) {\n    // Optimization #1,
slice is a no-op plus reshape\n    result = reshape({ inputs: { x }, backend, attrs: { shape: finalShape } });\n  } else if
(sliceDim0 || isSimpleSlice) {\n    // Optimization #2, slice is memory contiguous (only occurs in dim 0)\n    util.assert(\n
      x.shape.length >= 1,\n      () => `Input must have rank at least 1, got: ${x.shape.length}`);\n    const size = slice_util.computeOutShape($begin, $end, $strides);\n    // To tolerate begin[0] > end[0] (a 0-output
slice), we min(begin, end).\n    const sliced = slice({ inputs: { x }, backend, attrs: { begin: $begin, size } });\n    result
=\n      reshape({ inputs: { x: sliced }, backend, attrs: { shape: finalShape } });\n    backend.disposeData(sliced.dataId);\n  } else {\n    const out = backend.makeOutput(finalShapeSparse,
'float32');\n    const xId = backend.dataIdMap.get(x.dataId).id;\n    const xStridesBytes =\n      new Uint8Array(new Int32Array(util.computeStrides(x.shape)).buffer);\n    const beginBytes = new
Uint8Array(new Int32Array($begin).buffer);\n    const endBytes = new Uint8Array(new
Int32Array($end).buffer);\n    const stridesBytes = new Uint8Array(new Int32Array($strides).buffer);\n    const
outputShapeBytes =\n      new Uint8Array(new Int32Array(finalShapeSparse).buffer);\n    const outStridesBytes =
new Uint8Array(\n      new Int32Array(util.computeStrides(finalShapeSparse)).buffer);\n    const outId =
backend.dataIdMap.get(out.dataId).id;\n    wasmStridedSlice(\n      xId, xStridesBytes, x.shape.length,

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beginBytes, endBytes, stridesBytes,\n    outputShapeBytes, outStridesBytes, finalShapeSparse.length, outId);\n\nresult = reshape({inputs: {x: out}, backend, attrs: {shape: finalShape}});\n\n    backend.disposeData(out.dataId);\n\n}\n\nreturn result;\n\n\nexport const stridedSliceConfig: KernelConfig = {\n  kernelName: StridedSlice,\n  backendName: 'wasm',\n  setupFunc:\n    setup,\n  kernelFunc: stridedSlice as {} as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *\n *=====\n\n*/\n\nimport {KernelConfig, Sub} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from\n  './binary_kernel';\nconst supportsFullBroadcast = true;\nexport const subConfig: KernelConfig =\n  createBinaryKernelConfig(Sub,\n    supportsFullBroadcast);\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *\n *=====\n\n*/\n\nimport {backend_util, KernelConfig, KernelFunc, Sum, SumAttrs, SumInputs, TensorInfo, util} from\n  '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nimport\n  {permuteAxesAndTranspose} from './kernel_utils';\nimport\n  {CppType} from './types';\n\nlet wasmSum: (xId: number, reduceSize: number, dtype: number, outId: number)\n  =>\n    void;\n\nfunction setup(backend: BackendWasm): void {\n  wasmSum = backend.wasm.cwrap(Sum, null\n    /*void*/, [\n      'number', // input_id\n      'number', // reduce_size\n      'number', // dtype\n      'number', // out_id\n    ]);\n\n  function sum(args: {backend: BackendWasm, inputs: SumInputs, attrs: SumAttrs}):\n    TensorInfo {\n    const {backend, inputs, attrs} = args;\n    const {axis, keepDims} = attrs;\n    const {x} = inputs;\n    const xId =\n      backend.dataIdMap.get(x.dataId).id;\n    let inputId = xId;\n    let input = x;\n\n    const {transposed, axes, originalAxes,\n      inputWasTransposed} =\n      permuteAxesAndTranspose(x, axis, backend);\n\n    let reductionAxes = axes;\n    if\n      (inputWasTransposed) {\n      const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n      if (transposedId\n        !== xId) {\n        // transpose was not a no-op. We will need to dispose of this\n\n        // once we are done.\n        input = transposed;\n        inputId = transposedId;\n        reductionAxes =\n          backend_util.getInnerMostAxes(\n            reductionAxes.length, input.shape.length);\n      }\n\n      backend_util.assertAxesAreInnerMostDims(\n        'sum', reductionAxes, input.shape.length);\n      const [outShape,\n        reduceShape] =\n        backend_util.computeOutAndReduceShapes(input.shape, reductionAxes);\n      const reduceSize\n        = util.sizeFromShape(reduceShape);\n\n      const out = backend.makeOutput(outShape, input.dtype);\n      if\n        (util.sizeFromShape(input.shape) !== 0) {\n        const outId = backend.dataIdMap.get(out.dataId).id;\n        wasmSum(inputId, reduceSize, CCppType[out.dtype], outId);\n      }\n\n      if (inputWasTransposed) {\n        // dispose of\n        the transposed tensor.\n        backend.disposeData(transposed.dataId);\n      }\n\n      if (keepDims) {\n        // reshape\n        const\n        newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n        out.shape = newShape;\n      }\n\n      return out;\n    }\n\n  }\n\n  export\n    const sumConfig: KernelConfig = {\n      kernelName: Sum,\n      backendName: 'wasm',\n      setupFunc: setup,\n      kernelFunc: sum as {} as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2021 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file

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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
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=====
*\nimport {KernelConfig, Tan} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from
'./unary_kernel';\nexport const
tanConfig: KernelConfig = createUnaryKernelConfig(Tan);\n", "/*\n * @license\n * Copyright 2019 Google LLC.
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
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=====
*\nimport {KernelConfig, Tanh} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from
'./unary_kernel';\nexport const tanhConfig: KernelConfig = createUnaryKernelConfig(Tanh);\n", "/*\n * @license\n * Copyright
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
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=====
*\nimport {KernelConfig, KernelFunc, Tile, TileAttrs, TileInputs} from '@tensorflow/tfjs-core';\nimport
{BackendWasm} from './backend_wasm';\nimport {CppType} from './types';\nlet wasmTile: (\n  xId:
number, xShape: Uint8Array, xShapeSize: number, newShape: Uint8Array,\n  newShapeSize: number,
dtype: number, outId: number) => void;\nfunction setup(backend: BackendWasm) {\n  wasmTile =
backend.wasm.cwrap(Tile, null /* void */, [\n    'number', // x_id\n    'array', // x_shape\n    'number', //
x_shape.length\n    'array', // new_shape\n    'number', // new_shape.length\n    'number' // out_id\n  ]);\n}\nfunction tile(\n  args: {inputs: TileInputs, backend: BackendWasm, attrs: TileAttrs}) {\n  const {inputs,
backend, attrs} = args;\n  const {x} = inputs;\n  const xId = backend.dataIdMap.get(x.dataId).id;\n  const {reps} =
attrs;\n  const newShape: number[] = new Array(x.shape.length);\n  for (let i = 0; i < newShape.length; i++) {\n
newShape[i] = x.shape[i] * reps[i];\n  }\n  const xShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);\n
const newShapeBytes = new Uint8Array(new Int32Array(newShape).buffer);\n  const out =
backend.makeOutput(newShape, x.dtype);\n  const outId = backend.dataIdMap.get(out.dataId).id;\n  wasmTile(\n
xId, xShapeBytes,\n  x.shape.length, newShapeBytes, newShape.length,\n  CCppType[out.dtype], outId);\n  return out;\n}\n\nexport
const tileConfig: KernelConfig = {\n  kernelName: Tile,\n  backendName: 'wasm',\n  setupFunc: setup,\n
kernelFunc: tile as {} as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *

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=====\\n
*\\n\\nimport
{KernelConfig, KernelFunc, TensorInfo, TopK, TopKAttrs, TopKInputs} from '@tensorflow/tfjs-core';\\n\\nimport
{BackendWasm} from '../backend_wasm';\\nimport {CppType} from './types';\\n\\nlet wasmTopK: (\\n  xId:
number, xShapeBytes: Uint8Array, xShapeLength: number,\\n  xDtype: CCppType, k: number, sorted: boolean,
outValuesId: number,\\n  outIndicesId: number) => void;\\n\\nfunction setup(backend: BackendWasm) {\\n
wasmTopK = backend.wasm.cwrap(TopK, null /* void */, [\\n  'number', // xId\\n  'array', // x.shape\\n  'number',
// x.shape.length\\n  'number', // x.dtype\\n  'number', // k\\n  'bool', // sorted\\n  'number', // outValuesId\\n
'number', // outIndicesId\\n  ]);\\n}\\n\\nexport const topk: (args: {inputs: TopKInputs, backend: BackendWasm,
attrs: TopKAttrs}) =>\\n  TensorInfo[] | TensorInfo = ({inputs, backend, attrs}) => {\\n  const {x} = inputs;\\n
const {k, sorted} = attrs;\\n\\n  const xId = backend.dataIdMap.get(x.dataId).id;\\n
const xShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);\\n  const outputShape =
x.shape.slice();\\n  outputShape[outputShape.length - 1] = k;\\n  const outValues =
backend.makeOutput(outputShape, x.dtype);\\n  const outValuesId =
backend.dataIdMap.get(outValues.dataId).id;\\n  const outIndices = backend.makeOutput(outputShape,
'int32');\\n  const outIndicesId = backend.dataIdMap.get(outIndices.dataId).id;\\n\\n  wasmTopK(\\n
xId, xShapeBytes, x.shape.length, CCppType[x.dtype], k, sorted,\\n  outValuesId, outIndicesId);\\n\\n
return [outValues, outIndices];\\n  };\\n}\\n\\nexport const topKConfig: KernelConfig = {\\n  kernelName: TopK,\\n
backendName: 'wasm',\\n  setupFunc: setup,\\n  kernelFunc: topk as {} as KernelFunc,\\n};\\n", "/*\\n * @license\\n *
Copyright 2021 Google LLC. All Rights Reserved.\\n * Licensed under the Apache License, Version 2.0 (the
'License');\\n * you may not use
this file except in compliance with the License.\\n * You may obtain a copy of the License at\\n *
http://www.apache.org/licenses/LICENSE-2.0\\n * Unless required by applicable law or agreed to in writing,
software\\n * distributed under the License is distributed on an 'AS IS' BASIS,\\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\\n * See the License for the specific language
governing permissions and\\n * limitations under the License.\\n *
=====\\n
*\\n\\nimport {KernelConfig, KernelFunc, TensorInfo, Transform, TransformAttrs, TransformInputs, util} from
 '@tensorflow/tfjs-core';\\n\\nimport {BackendWasm} from '../backend_wasm';\\n\\nlet wasmTransform: (\\n  imageId:
number, transformsId: number, isBatchTransform: boolean,\\n  batch: number, outHeight: number, outWidth:
number, numChannels: number,\\n  imageWidth: number, imageHeight: number, strides: Uint8Array,\\n
stridesLength:
number, interpolationModeId: number, fillModeId: number,\\n  fillValue: number, outId: number) =>
void;\\n\\nfunction setup(backend: BackendWasm): void {\\n  wasmTransform = backend.wasm.cwrap(Transform,
null /*void*/, [\\n  'number', // imageId\\n  'number', // transformsId\\n  'bool', // isBatchTransform\\n  'number',
// batch\\n  'number', // outHeight\\n  'number', // outWidth\\n  'number', // numChannels\\n  'number', //
imageWidth\\n  'number', // imageHeight\\n  'array', // strides\\n  'number', // stridesLength\\n  'number', //
interpolationModeId\\n  'number', // fillModeId\\n  'number', // fillValue\\n  'number' // outId\\n
]);\\n}\\n\\nfunction transform(\\n  args: {\\n    backend: BackendWasm, inputs: TransformInputs, attrs:
TransformAttrs});\\n  TensorInfo {\\n    const {backend, inputs, attrs} = args;\\n    const {image, transforms} = inputs;\\n
const {interpolation, fillMode, fillValue, outputShape} = attrs;\\n\\n    const [batch, imageHeight, imageWidth,
numChannels] = image.shape;\\n    const [outHeight, outWidth] =\\n      outputShape != null ? outputShape :
[imageHeight, imageWidth];\\n    const outShape =\\n      [batch, outHeight, outWidth,\\n      numChannels] as
[number, number, number, number];\\n    const strides =\\n      new Uint8Array(new
Int32Array(util.computeStrides(image.shape)).buffer);\\n\\n    const out = backend.makeOutput(outShape,
image.dtype);\\n    const outId = backend.dataIdMap.get(out.dataId).id;\\n\\n    const imageData =
backend.dataIdMap.get(image.dataId);\\n    const imageId = imageData.id;\\n\\n    const transformsData =
backend.dataIdMap.get(transforms.dataId);\\n    const transformsId = transformsData.id;\\n\\n    const

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interpolationModeId = interpolation === 'nearest' ? 1 : 2;\n let fillModeId;\n switch (fillMode) {\n case
'constant':\n fillModeId = 1;\n break;\n case 'reflect':\n fillModeId = 2;\n break;\n case 'wrap':\n
fillModeId = 3;\n break;\n case 'nearest':\n fillModeId = 4;\n
break;\n default:\n fillModeId = 1;\n break;\n }\n\n wasmTransform(\n imageId, transformsId,
(transforms.shape[0] > 1), batch, outHeight,\n outWidth, numChannels, imageWidth, imageHeight, strides,\n
image.shape.length - 1, interpolationModeId, fillModeId, fillValue,\n outId);\n\n return out;\n}\n\nexport const
transformConfig: KernelConfig = {\n kernelName: Transform,\n backendName: 'wasm',\n setupFunc: setup,\n
kernelFunc: transform as { } as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS
OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions
and\n * limitations under the License.\n */
=====
*\n\nimport { KernelConfig, KernelFunc, TensorInfo, Unpack, UnpackAttrs, UnpackInputs } from
'@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nimport { slice } from
'./Slice';\n\nfunction unpack(\n args: { inputs: UnpackInputs, backend: BackendWasm, attrs: UnpackAttrs }):\n
TensorInfo[] {\n const { inputs, backend, attrs } = args;\n const { value } = inputs;\n let { axis } =
attrs;\n if (axis <
0) {\n axis += value.shape.length;\n }\n\n const numOutputs = value.shape[axis];\n const rank =
value.shape.length;\n const outShape: number[] = new Array(rank - 1);\n let outIndex = 0;\n for (let i = 0; i < rank;
i++) {\n if (i !== axis) {\n outShape[outIndex++] = value.shape[i];\n }\n }\n\n const outs: TensorInfo[] =
new Array(numOutputs);\n const begin = new Array(rank).fill(0);\n const size = value.shape.slice();\n size[axis] =
1;\n for (let i = 0; i < outs.length; i++) {\n begin[axis] = i;\n outs[i] = slice({ inputs: { x: value },
attrs: { begin,
size }, backend });\n }\n\n return outs.map(({ dataId, dtype }) => ({ dataId, dtype, shape: outShape }));\n}\n\nexport
const unpackConfig: KernelConfig = {\n kernelName: Unpack,\n backendName: 'wasm',\n kernelFunc: unpack as
{ } as KernelFunc,\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed
under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express
or implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n */
=====
*\n\nimport { KernelConfig, KernelFunc, ZerosLike, ZerosLikeInputs } from '@tensorflow/tfjs-core';\nimport
{ BackendWasm } from '../backend_wasm';\n\nfunction zerosLike(args: { inputs: ZerosLikeInputs, backend:
BackendWasm }) {\n const { inputs: { x }, backend } = args;\n const out = backend.makeOutput(x.shape, x.dtype);\n
const outVals = backend.toArrayFromHeap(out);\n outVals.fill(0);\n return out;\n}\n\nexport const
zerosLikeConfig: KernelConfig = {\n kernelName: ZerosLike,\n backendName: 'wasm',\n kernelFunc: zerosLike
as { } as KernelFunc,\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed
under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a
copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n */
=====
*\n\n//

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We explicitly import the modular kernels so they get registered in the\n// global registry when we compile the library. A modular build would replace\n// the contents of this file and import only the kernels that are needed.\nimport {KernelConfig, registerKernel} from '@tensorflow/tfjs-core';\n\nimport {fusedMatMulConfig} from './kernels/_FusedMatMul';\nimport {absConfig} from './kernels/Abs';\nimport {addConfig} from './kernels/Add';\nimport {addNConfig} from './kernels/AddN';\nimport {allConfig} from './kernels/All';\nimport {anyConfig} from './kernels/Any';\nimport {argMaxConfig} from './kernels/ArgMax';\nimport {avgPoolConfig} from './kernels/AvgPool';\nimport {batchMatMulConfig} from './kernels/BatchMatMul';\nimport {batchToSpaceNDConfig} from './kernels/BatchToSpaceND';\nimport {castConfig} from './kernels/Cast';\nimport {ceilConfig} from './kernels/Ceil';\nimport {clipByValueConfig} from './kernels/ClipByValue';\nimport {concatConfig} from './kernels/Concat';\nimport {conv2DConfig} from './kernels/Conv2D';\nimport {conv2DBackpropInputConfig} from './kernels/Conv2DBackpropInput';\nimport {cosConfig} from './kernels/Cos';\nimport {coshConfig} from './kernels/Cosh';\nimport {cropAndResizeConfig} from './kernels/CropAndResize';\nimport {cumsumConfig} from './kernels/Cumsum';\nimport {depthToSpaceConfig} from './kernels/DepthToSpace';\nimport {depthwiseConv2dNativeConfig} from './kernels/DepthwiseConv2dNative';\nimport {eluConfig} from './kernels/Elu';\nimport {equalConfig} from './kernels/Equal';\nimport {expConfig} from './kernels/Exp';\nimport {expandDimsConfig} from './kernels/ExpandDims';\nimport {fillConfig} from './kernels/Fill';\nimport {flipLeftRightConfig} from './kernels/FlipLeftRight';\nimport {floorConfig} from './kernels/Floor';\nimport {floorDivConfig} from './kernels/FloorDiv';\nimport {fusedBatchNormConfig} from './kernels/FusedBatchNorm';\nimport {fusedConv2DConfig} from './kernels/FusedConv2D';\nimport {fusedDepthwiseConv2DConfig} from './kernels/FusedDepthwiseConv2D';\nimport {gatherNdConfig} from './kernels/GatherNd';\nimport {gatherV2Config} from './kernels/GatherV2';\nimport {greaterConfig} from './kernels/Greater';\nimport {greaterEqualConfig} from './kernels/GreaterEqual';\nimport {identityConfig} from './kernels/Identity';\nimport {leakyReluConfig} from './kernels/LeakyRelu';\nimport {lessConfig} from './kernels/Less';\nimport {lessEqualConfig} from './kernels/LessEqual';\nimport {logConfig} from './kernels/Log';\nimport {logicalAndConfig} from './kernels/LogicalAnd';\nimport {maxConfig} from './kernels/Max';\nimport {maximumConfig} from './kernels/Maximum';\nimport {maxPoolConfig} from './kernels/MaxPool';\nimport {meanConfig} from './kernels/Mean';\nimport {minConfig} from './kernels/Min';\nimport {minimumConfig} from './kernels/Minimum';\nimport {mirrorPadConfig} from './kernels/MirrorPad';\nimport {multiplyConfig} from './kernels/Multiply';\nimport {negConfig} from './kernels/Neg';\nimport {nonMaxSuppressionV3Config} from './kernels/NonMaxSuppressionV3';\nimport {nonMaxSuppressionV4Config} from './kernels/NonMaxSuppressionV4';\nimport {nonMaxSuppressionV5Config} from './kernels/NonMaxSuppressionV5';\nimport {notEqualConfig} from './kernels/NotEqual';\nimport {oneHotConfig} from './kernels/OneHot';\nimport {onesLikeConfig} from './kernels/OnesLike';\nimport {packConfig} from './kernels/Pack';\nimport {padV2Config} from './kernels/PadV2';\nimport {powConfig} from './kernels/Pow';\nimport {preluConfig} from './kernels/Prelu';\nimport {prodConfig} from './kernels/Prod';\nimport {rangeConfig} from './kernels/Range';\nimport {realDivConfig} from './kernels/RealDiv';\nimport {reluConfig} from './kernels/Relu';\nimport {relu6Config} from './kernels/Relu6';\nimport {reshapeConfig} from './kernels/Reshape';\nimport {resizeBilinearConfig} from './kernels/ResizeBilinear';\nimport {reverseConfig} from './kernels/Reverse';\nimport {rotateWithOffsetConfig} from './kernels/RotateWithOffset';\nimport {roundConfig} from './kernels/Round';\nimport {rsqrtConfig} from './kernels/Rsqrt';\nimport {scatterNdConfig} from './kernels/ScatterNd';\nimport {selectConfig} from './kernels/Select';\nimport {sigmoidConfig} from './kernels/Sigmoid';\nimport {sinConfig} from './kernels/Sin';\nimport {sliceConfig} from './kernels/Slice';\nimport {softmaxConfig} from './kernels/Softmax';\nimport {spaceToBatchNDConfig} from './kernels/SpaceToBatchND';\nimport {splitVConfig} from './kernels/SplitV';\nimport {sqrtConfig} from './kernels/Sqrt';\nimport

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{squareConfig} from './kernels/Square';\nimport {squaredDifferenceConfig} from\n./kernels/SquaredDifference';\nimport {stepConfig} from './kernels/Step';\nimport {stridedSliceConfig} from\n./kernels/StridedSlice';\nimport {subConfig} from './kernels/Sub';\nimport {sumConfig} from\n./kernels/Sum';\nimport {tanConfig} from './kernels/Tan';\nimport {tanhConfig} from './kernels/Tanh';\nimport\n{tileConfig} from './kernels/Tile';\nimport {topKConfig} from './kernels/TopK';\nimport {transformConfig} from\n./kernels/Transform';\nimport {transposeConfig} from './kernels/Transpose';\nimport {unpackConfig} from\n./kernels/Unpack';\nimport {zerosLikeConfig} from './kernels/ZerosLike';\n\n// List all kernel configs here\nconst\nkernelConfigs: KernelConfig[] = [\n  absConfig,\n  addConfig,\n  addNConfig,\n  allConfig,\n  anyConfig,\n  argMaxConfig,\n  avgPoolConfig,\n  batchMatMulConfig,\n  batchToSpaceNDConfig,\n  castConfig,\n  ceilConfig,\n  clipByValueConfig,\n  concatConfig,\n  conv2DConfig,\n  conv2DBackpropInputConfig,\n  cosConfig,\n  coshConfig,\n  cropAndResizeConfig,\n  cumsumConfig,\n  depthToSpaceConfig,\n  depthwiseConv2dNativeConfig,\n  eluConfig,\n  equalConfig,\n  expConfig,\n  expandDimsConfig,\n  fillConfig,\n  flipLeftRightConfig,\n  floorConfig,\n  floorDivConfig,\n  fusedMatMulConfig,\n  fusedBatchNormConfig,\n  fusedConv2DConfig,\n  fusedDepthwiseConv2DConfig,\n  gatherNdConfig,\n  gatherV2Config,\n  greaterConfig,\n  greaterEqualConfig,\n  identityConfig,\n  leakyReluConfig,\n  lessConfig,\n  lessEqualConfig,\n  logConfig,\n  logicalAndConfig,\n  maxConfig,\n  maximumConfig,\n  maxPoolConfig,\n  meanConfig,\n  minConfig,\n  minimumConfig,\n  mirrorPadConfig,\n  multiplyConfig,\n  negConfig,\n  nonMaxSuppressionV3Config,\n  nonMaxSuppressionV4Config,\n  nonMaxSuppressionV5Config,\n  notEqualConfig,\n  oneHotConfig,\n  onesLikeConfig,\n  packConfig,\n  padV2Config,\n  powConfig,\n  preluConfig,\n  prodConfig,\n  rangeConfig,\n  realDivConfig,\n  reluConfig,\n  relu6Config,\n  reshapeConfig,\n  resizeBilinearConfig,\n  reverseConfig,\n  rotateWithOffsetConfig,\n  rsqrtConfig,\n  roundConfig,\n  scatterNdConfig,\n  selectConfig,\n  sigmoidConfig,\n  sinConfig,\n  sliceConfig,\n  softmaxConfig,\n  spaceToBatchNDConfig,\n  splitVConfig,\n  sqrtConfig,\n  squareConfig,\n  squaredDifferenceConfig,\n  stepConfig,\n  stridedSliceConfig,\n  subConfig,\n  sumConfig,\n  tanConfig,\n  tanhConfig,\n  tileConfig,\n  topKConfig,\n  transformConfig,\n  transposeConfig,\n  unpackConfig,\n  zerosLikeConfig\n];\n\nfor (const kernelConfig of kernelConfigs) {\n  registerKernel(kernelConfig);\n}\n\n/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version\n 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a\n copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable\n law\n or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n the specific language governing permissions and\n * limitations under the License.\n */\n\n=====\n\n*\nimport {env} from '@tensorflow/tfjs-core';\nconst ENV = env();\n\n**\n * True if SIMD is supported.\n\n*/\n// From: https://github.com/GoogleChromeLabs/wasm-feature-detect\nENV.registerFlag(\n  // This typed array\n passed in to WebAssembly.validate is WebAssembly binary\n  // code. In this case it is a small program that\n contains SIMD\n  // instructions.\n  'WASM_HAS_SIMD_SUPPORT', async () => WebAssembly.validate(new\n Uint8Array([\n    0, 97, 115, 109, 1, 0, 0, 0, 1, 4, 1, 96, 0, 0, 3,\n    2, 1, 0, 10, 9, 1, 7, 0, 65, 0, 253, 15, 26,\n    11\n  ])));\n\n**\n * True if threads are supported.\n\n*/\n// From: https://github.com/GoogleChromeLabs/wasm-feature-\ndetect\nENV.registerFlag('WASM_HAS_MULTITHREAD_SUPPORT', async () => {\n  // TODO(annxingyuan):\n Enable node support once this is resolved:\n  // https://github.com/tensorflow/tfjs/issues/3830\n  if\n (ENV.get('IS_NODE')) {\n    return false;\n  }\n  try {\n    // Test for transferability of SABs (needed for Firefox)\n    // https://groups.google.com/forum/#!msg/mozilla.dev.platform/IHkBZIHETpA/dwsMNchWEQAJ\n    new\n MessageChannel().port1.postMessage(new SharedArrayBuffer(1));\n    // This typed array is a WebAssembly\n program containing threaded\n    // instructions.\n    return WebAssembly.validate(new Uint8Array([\n      0, 97,\n      115, 109, 1, 0, 0, 0, 1, 4, 1, 96, 0, 0, 3, 2, 1, 0, 5,\n      4, 1, 3, 1, 1, 10, 11, 1, 9, 0, 65, 0, 254, 16, 2, 0, 26,
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11\n  });\n } catch (e) {\n   return false;\n }\n});\n", "\nvar WasmBackendModuleThreadedSimd = (function() {\nvar _scriptId = typeof document !== 'undefined'\n&& document.currentScript ? document.currentScript.src : undefined;\n  if (typeof __filename !== 'undefined')\n    _scriptId = _scriptId || __filename;\n  return (\nfunction(WasmBackendModuleThreadedSimd) {\nWasmBackendModuleThreadedSimd = WasmBackendModuleThreadedSimd || {};\nfunction\nGROWABLE_HEAP_I8(){if(wasmMemory.buffer!=buffer){updateGlobalBufferAndViews(wasmMemory.buffer)}\nreturn HEAP8}function\nGROWABLE_HEAP_U8(){if(wasmMemory.buffer!=buffer){updateGlobalBufferAndViews(wasmMemory.buffer)}\nreturn HEAPU8}function\nGROWABLE_HEAP_I32(){if(wasmMemory.buffer!=buffer){updateGlobalBufferAndViews(wasmMemory.buffer)}\nreturn HEAP32}function\nGROWABLE_HEAP_U32(){if(wasmMemory.buffer!=buffer){updateGlobalBufferAndViews(wasmMemory.buffer)}\nreturn HEAPU32}function\nGROWABLE_HEAP_F64(){if(wasmMemory.buffer!=buffer){updateGlobalBufferAndViews(wasmMemory.buffer)}\nreturn HEAPF64}var Module=typeof\nWasmBackendModuleThreadedSimd!="undefined"?WasmBackendModuleThreadedSimd:{};var\nreadyPromiseResolve,readyPromiseReject;Module["ready"]=new\nPromise(function(resolve,reject){readyPromiseResolve=resolve;readyPromiseReject=reject});var\nmoduleOverrides={};var key;for(key in\nModule){if(Module.hasOwnProperty(key)){moduleOverrides[key]=Module[key]}}var arguments_=[];var\nthisProgram=\\.this.program\\;;var quit_=function(status,toThrow){throw toThrow};var\nENVIRONMENT_IS_WEB=false;var ENVIRONMENT_IS_WORKER=false;var\nENVIRONMENT_IS_NODE=false;var ENVIRONMENT_IS_SHELL=false;ENVIRONMENT_IS_WEB=typeof\nwindow==="object";ENVIRONMENT_IS_WORKER=typeof\nimportScripts==="function";ENVIRONMENT_IS_NODE=typeof process==="object"&&typeof\nprocess.versions==="object"&&typeof\nprocess.versions.node==="string";ENVIRONMENT_IS_SHELL=!ENVIRONMENT_IS_WEB&&!ENVIRONM\nENT_IS_NODE&&!ENVIRONMENT_IS_WORKER;var\nENVIRONMENT_IS_PTHREAD=Module["ENVIRONMENT_IS_PTHREAD"]||false;if(ENVIRONMENT_IS_P\nTHREAD){buffer=Module["buffer"]}var scriptDirectory="";function\nlocateFile(path){if(Module["locateFile"]){return Module["locateFile"](path,scriptDirectory)}return\nscriptDirectory+path}var read_,readAsync,readBinary,setWindowTitle;var nodeFS;var\nnodePath;if(ENVIRONMENT_IS_NODE){if(ENVIRONMENT_IS_WORKER){scriptDirectory=require("path").\ndirname(scriptDirectory)+"\\"}else{scriptDirectory=__dirname+"\\"}read_=function\nshell_read(filename,binary){if(!nodeFS)nodeFS=require("fs");if(!nodePath)nodePath=require("path");filename=n\nodePath["normalize"](filename);return\nnodeFS["readFileSync"](filename,binary?null:"utf8");}readBinary=function readBinary(filename){var\nret=read_(filename,true);if(!ret.buffer){ret=new Uint8Array(ret)}assert(ret.buffer);return\nret};if(process["argv"].length>1){thisProgram=process["argv"][1].replace(/\\/g,"\\")}arguments_=process["arg\nv"].slice(2);process["on"]("uncaughtException",function(ex){if(!(ex instanceof ExitStatus)){throw\nex}});process["on"]("unhandledRejection",abort);quit_=function(status){process["exit"](status)};Module["insp\nect"]=function(){return"[Emscripten\nModule object]";}\nvar\nnodeWorkerThreads;try{nodeWorkerThreads=require("worker_threads")}catch(e){console.error("The\n\"worker_threads\" module is not supported in this node.js build - perhaps a newer version is needed?");throw\n e}global.Worker=nodeWorkerThreads.Worker}else if(ENVIRONMENT_IS_SHELL){if(typeof\nread!="undefined"){read_=function shell_read(f){return read(f)}}readBinary=function readBinary(f){var\n data;if(typeof readbuffer==="function"){return new

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Uint8Array(readbuffer(f))}data=read(f,"binary");assert(typeof data==="object");return data};if(typeof
scriptArgs!="undefined"){arguments_=scriptArgs}else if(typeof
arguments!="undefined"){arguments_=arguments}if(typeof
quit==="function"){quit_=function(status){quit(status)}}if(typeof print!="undefined"){if(typeof
console==="undefined")console={};console.log=print;console.warn=console.error=typeof
printErr!="undefined"?printErr:print}}else
if(ENVIRONMENT_IS_WEB||ENVIRONMENT_IS_WORKER){if(ENVIRONMENT_IS_WORKER){scriptDire
ctory=self.location.href}else
if(typeof
document!="undefined"&&document.currentScript){scriptDirectory=document.currentScript.src}if(typeof
_scriptDir != "undefined" &&
_scriptDir){scriptDirectory=_scriptDir}if(scriptDirectory.indexOf("blob:")!==0){scriptDirectory=scriptDirectory.s
ubstr(0,scriptDirectory.lastIndexOf("/")+1)}else{scriptDirectory=""}if(ENVIRONMENT_IS_NODE){read_=fun
ction
shell_read(filename,binary){if(!nodeFS)nodeFS=require("fs");if(!nodePath)nodePath=require("path");filename=n
odePath["normalize"](filename);return
nodeFS["readFileSync"](filename,binary?null:"utf8");}readBinary=function readBinary(filename){var
ret=read_(filename,true);if(!ret.buffer){ret=new Uint8Array(ret)}assert(ret.buffer);return
ret}}else{read_=function(url){var xhr=new XMLHttpRequest;xhr.open("GET",url,false);xhr.send(null);return
xhr.responseText};if(ENVIRONMENT_IS_WORKER){readBinary=function(url){var xhr=new
XMLHttpRequest;xhr.open("GET",url,false);xhr.responseType="arraybuffer";xhr.send(null);return
new Uint8Array(xhr.response)}}readAsync=function(url,onload,onerror){var xhr=new
XMLHttpRequest;xhr.open("GET",url,true);xhr.responseType="arraybuffer";xhr.onload=function(){if(xhr.status
===200||xhr.status===0&&xhr.response){onload(xhr.response);return}onerror();}xhr.onerror=onerror;xhr.send(null)}
}setWindowTitle=function(title){document.title=title}}else{}if(ENVIRONMENT_IS_NODE){if(typeof
performance==="undefined"){global.performance=require("perf_hooks").performance}}var
out=Module["print"]||console.log.bind(console);var err=Module["printErr"]||console.warn.bind(console);for(key
in
moduleOverrides){if(moduleOverrides.hasOwnProperty(key)){Module[key]=moduleOverrides[key]}}moduleOverr
ides=null;if(Module["arguments"]){arguments_=Module["arguments"];}if(Module["thisProgram"]){thisProgram=
Module["thisProgram"];}if(Module["quit"]){quit_=Module["quit"];}function
warnOnce(text){if(!warnOnce.shown)warnOnce.shown={};if(!warnOnce.shown[text]){warnOnce.shown[text]=1;er
r(text)}}var
Atomics_load=Atomics.load;var Atomics_store=Atomics.store;var
Atomics_compareExchange=Atomics.compareExchange;var
wasmBinary;if(Module["wasmBinary"]){wasmBinary=Module["wasmBinary"];}var
noExitRuntime=Module["noExitRuntime"]||true;if(typeof WebAssembly!="object"){abort("no native wasm
support detected")}var wasmMemory;var wasmModule;var ABORT=false;var EXITSTATUS;function
assert(condition,text){if(!condition){abort("Assertion failed: "+text)}}function getCFunc(ident){var
func=Module["_"+ident];assert(func,"Cannot call unknown function "+ident+" , make sure it is exported");return
func}function ccall(ident,returnType,argTypes,args,opts){var toC={"string":function(str){var
ret=0;if(str===null&&str===undefined&&str===0){var
len=(str.length<2)+1;ret=stackAlloc(len);stringToUTF8(str,ret,len)}return ret},"array":function(arr){var
ret=stackAlloc(arr.length);writeArrayToMemory(arr,ret);return ret}};function
convertReturnValue(ret){if(returnType==="string")return
UTF8ToString(ret);if(returnType==="boolean")return Boolean(ret);return ret}var func=getCFunc(ident);var
cArgs=[];var stack=0;if(args){for(var i=0;i<args.length;i++){var
converter=toC[argTypes[i]];if(converter){if(stack===0)stack=stackSave();cArgs[i]=converter(args[i])}else{cArgs[i]

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]=args[i]} }var ret=func.apply(null,cArgs);ret=convertReturnValue(ret);if(stack!==0)stackRestore(stack);return
ret}function cwrap(ident,returnType,argTypes,opts){argTypes=argTypes||[];var
numericArgs=argTypes.every(function(type){return type==="number"});var
numericRet=returnType!=="string";if(numericRet&&numericArgs&&!opts){return getCFunc(ident)}return
function(){return ccall(ident,returnType,argTypes,arguments,opts)} }function
UTF8ArrayToString(heap,idx,maxBytesToRead){var endIdx=idx+maxBytesToRead;var
str="";while(!(idx>=endIdx)){var u0=heap[idx++];if(!u0)return
str;if(!(u0&128)){str+=String.fromCharCode(u0);continue}var
u1=heap[idx++]&63;if((u0&224)==192){str+=String.fromCharCode((u0&31)<<6|u1);continue}var
u2=heap[idx++]&63;if((u0&240)==224){u0=(u0&15)<<12|u1<<6|u2}else{u0=(u0&7)<<18|u1<<12|u2<<6|heap[id
x++]&63}if(u0<65536){str+=String.fromCharCode(u0)}else{var ch=u0-
65536;str+=String.fromCharCode(55296|ch>>10,56320|ch&1023)} }return str}function
UTF8ToString(ptr,maxBytesToRead){return
ptr?UTF8ArrayToString(GROWABLE_HEAP_U8(),ptr,maxBytesToRead):""}function
stringToUTF8Array(str,heap,outIdx,maxBytesToWrite){if(!(maxBytesToWrite>0))return 0;var startIdx=outIdx;var
endIdx=outIdx+maxBytesToWrite-1;for(var i=0;i<str.length;++i){var
u=str.charCodeAt(i);if(u>=55296&&u<=57343){var
u1=str.charCodeAt(++i);u=65536+((u&1023)<<10|u1&1023)}if(u<=127){if(outIdx>=endIdx)break;heap[outIdx++]
=u}else if(u<=2047){if(outIdx+1>=endIdx)break;heap[outIdx++]=192|u>>6;heap[outIdx++]=128|u&63}else
if(u<=65535){if(outIdx+2>=endIdx)break;heap[outIdx++]=224|u>>12;heap[outIdx++]=128|u>>6&63;heap[outIdx
++]=128|u&63}else{if(outIdx+3>=endIdx)break;heap[outIdx++]=240|u>>18;heap[outIdx++]=128|u>>12&63;heap[
outIdx++]=128|u>>6&63;heap[outIdx++]=128|u&63} }heap[outIdx]=0;return
outIdx-startIdx}function stringToUTF8(str,outPtr,maxBytesToWrite){return
stringToUTF8Array(str,GROWABLE_HEAP_U8(),outPtr,maxBytesToWrite)}function lengthBytesUTF8(str){var
len=0;for(var i=0;i<str.length;++i){var
u=str.charCodeAt(i);if(u>=55296&&u<=57343)u=65536+((u&1023)<<10|str.charCodeAt(++i)&1023);if(u<=127)+
+len;else if(u<=2047)len+=2;else if(u<=65535)len+=3;else len+=4}return len}function
writeArrayToMemory(array,buffer){GROWABLE_HEAP_I8().set(array,buffer)}function
alignUp(x,multiple){if(x%multiple>0){x+=multiple-x%multiple}return x}var
buffer,HEAP8,HEAPU8,HEAP16,HEAPU16,HEAP32,HEAPU32,HEAPF32,HEAPF64;function
updateGlobalBufferAndViews(buf){buffer=buf;Module["HEAP8"]=HEAP8=new
Int8Array(buf);Module["HEAP16"]=HEAP16=new Int16Array(buf);Module["HEAP32"]=HEAP32=new
Int32Array(buf);Module["HEAPU8"]=HEAPU8=new Uint8Array(buf);Module["HEAPU16"]=HEAPU16=new
Uint16Array(buf);Module["HEAPU32"]=HEAPU32=new
Uint32Array(buf);Module["HEAPF32"]=HEAPF32=new
Float32Array(buf);Module["HEAPF64"]=HEAPF64=new Float64Array(buf)}var
INITIAL_MEMORY=Module["INITIAL_MEMORY"]||16777216;if(ENVIRONMENT_IS_PTHREAD){wasmmM
emory=Module["wasmMemory"];buffer=Module["buffer"]}else{if(Module["wasmMemory"]){wasmMemory=
Module["wasmMemory"]}else{wasmMemory=new
WebAssembly.Memory({\"initial\":INITIAL_MEMORY/65536,\"maximum\":2147483648/65536,\"shared\":true});
if(!(wasmMemory.buffer instanceof SharedArrayBuffer)){err(\"requested a shared WebAssembly.Memory but the
returned buffer is not a SharedArrayBuffer, indicating that while the browser has SharedArrayBuffer it does not
have WebAssembly threads support - you may need to set a
flag\");if(ENVIRONMENT_IS_NODE){console.log(\"(on node you may need: --experimental-wasm-threads --
experimental-wasm-bulk-memory and also use a recent version)\")}throw Error(\"bad
memory\")}} }if(wasmMemory){buffer=wasmMemory.buffer}INITIAL_MEMORY=buffer.byteLength;updateGlob
alBufferAndViews(buffer);var

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wasmTable;var __ATPRERUN__=[];var __ATINIT__=[];var __ATMAIN__=[];var __ATEXIT__=[];var
__ATPOSTRUN__=[];var runtimeInitialized=false;var
runtimeExited=false;if(!ENVIRONMENT_IS_PTHREAD)__ATINIT__.push({func:function(){__wasm_call_ctors()}});function preRun(){if(ENVIRONMENT_IS_PTHREAD)return;if(Module["preRun"]){if(typeof
Module["preRun"]=="function")Module["preRun"]=Module["preRun"];while(Module["preRun"].length){a
ddOnPreRun(Module["preRun"].shift())}callRuntimeCallbacks(__ATPRERUN__)}function
initRuntime(){runtimeInitialized=true;if(ENVIRONMENT_IS_PTHREAD)return;callRuntimeCallbacks(__ATINIT
__)function
preMain(){if(ENVIRONMENT_IS_PTHREAD)return;callRuntimeCallbacks(__ATMAIN__)}function
exitRuntime(){if(ENVIRONMENT_IS_PTHREAD)return;runtimeExited=true}function
postRun(){if(ENVIRONMENT_IS_PTHREAD)return;if(Module["postRun"]){if(typeof
Module["postRun"]=="function")Module["postRun"]=Module["postRun"];while(Module["postRun"].lengt
h){addOnPostRun(Module["postRun"].shift())}callRuntimeCallbacks(__ATPOSTRUN__)}function
addOnPreRun(cb){__ATPRERUN__.unshift(cb)}function addOnPostRun(cb){__ATPOSTRUN__.unshift(cb)}var
runDependencies=0;var runDependencyWatcher=null;var dependenciesFulfilled=null;function
addRunDependency(id){assert(!ENVIRONMENT_IS_PTHREAD,"addRunDependency cannot be used in a
pthread
worker");runDependencies++;if(Module["monitorRunDependencies"]){Module["monitorRunDependencies"](ru
nDependencies)}}function removeRunDependency(id){runDependencies--
;if(Module["monitorRunDependencies"]){Module["monitorRunDependencies"](runDependencies)}if(runDepend
encies==0){if(runDependencyWatcher!==null){clearInterval(runDependencyWatcher);runDependencyWatcher=null}
if(dependenciesFulfilled){var
callback=dependenciesFulfilled;dependenciesFulfilled=null;callback()}}Module["preloadedImages"]={};Module
["preloadedAudios"]={};function
abort(what){if(Module["onAbort"]){Module["onAbort"](what)}if(ENVIRONMENT_IS_PTHREAD)console.err
or("\nPthread
aborting at "+(new Error).stack);what+="\n";err(what);ABORT=true;EXITSTATUS=1;what="\nabort("+what+").
Build with -s ASSERTIONS=1 for more info.";var e=new
WebAssembly.RuntimeError(what);readyPromiseReject(e);throw e}function hasPrefix(str,prefix){return
String.prototype.startsWith?str.startsWith(prefix):str.indexOf(prefix)===0}var
dataURIPrefix="data:application/octet-stream;base64,";function isDataURI(filename){return
hasPrefix(filename,dataURIPrefix)}var fileURIPrefix="file://";function isFileURI(filename){return
hasPrefix(filename,fileURIPrefix)}var wasmBinaryFile="tfjs-backend-wasm-threaded-
simd.wasm";if(!isDataURI(wasmBinaryFile)){wasmBinaryFile=locateFile(wasmBinaryFile)}function
getBinary(file){try{if(file===wasmBinaryFile&&wasmBinary){return new
Uint8Array(wasmBinary)}if(readBinary){return readBinary(file)}else{throw"both async and sync fetching of the
wasm failed"}}catch(err){abort(err)}}function
getBinaryPromise(){if(!wasmBinary&&(ENVIRONMENT_IS_WEB||ENVIRONMENT_IS_WORKER)){if(typeof
fetch==="function"&&!isFileURI(wasmBinaryFile)){return fetch(wasmBinaryFile,{credentials:"same-
origin"}).then(function(response){if(!response["ok"]){throw"failed to load wasm binary file at
"+wasmBinaryFile+""}return response["arrayBuffer"]()}).catch(function(){return
getBinary(wasmBinaryFile)})}else{if(readAsync){return new
Promise(function(resolve,reject){readAsync(wasmBinaryFile,function(response){resolve(new
Uint8Array(response)),reject}))})}return Promise.resolve().then(function(){return
getBinary(wasmBinaryFile)})}function createWasm(){var info={"a":asmLibraryArg};function
receiveInstance(instance,module){var
exports=instance.exports;Module["asm"]=exports;wasmTable=Module["asm"]["I"];wasmModule=module;if(!E
NVIRONMENT_IS_PTHREAD){var

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numWorkersToLoad=PThread.unusedWorkers.length;PThread.unusedWorkers.forEach(function(w){PThread.load
WasmModuleToWorker(w,function(){if(!--numWorkersToLoad)removeRunDependency("\wasm-
instantiate\");}})}if(!ENVIRONMENT_IS_PTHREAD){addRunDependency("\wasm-instantiate\");function
receiveInstantiatedSource(output){receiveInstance(output["instance"],output["module"]);}function
instantiateArrayBuffer(receiver){return getBinaryPromise().then(function(binary){return
WebAssembly.instantiate(binary,info)).then(receiver,function(reason){err("\failed to asynchronously prepare
wasm: "+reason);abort(reason)})}function instantiateAsync(){if(!wasmBinary&&typeof
WebAssembly.instantiateStreaming===\function\&&!isDataURI(wasmBinaryFile)&&!isFileURI(wasmBinaryFil
e)&&typeof fetch===\function\){return fetch(wasmBinaryFile,{credentials:\same-
origin\}).then(function(response){var result=WebAssembly.instantiateStreaming(response,info);return
result.then(receiveInstantiatedSource,function(reason){err("\wasm streaming compile failed: "+reason);err("\falling
back to ArrayBuffer instantiation\");return instantiateArrayBuffer(receiveInstantiatedSource)})})}else{return
instantiateArrayBuffer(receiveInstantiatedSource)})if(Module["instantiateWasm"]){try{var
exports=Module["instantiateWasm"](info,receiveInstance);return exports}catch(e){err("\Module.instantiateWasm
callback failed with error: "+e);return false}}instantiateAsync().catch(readPromiseReject);return{}}var
ASM_CONSTS={10520:function(){throw\Canceled!\"},10538:function($0,$1){setTimeout(function(){__emscript
en_do_dispatch_to_thread($0,$1),0})}};function initPthreadsJS(){PThread.initRuntime()}function
callRuntimeCallbacks(callbacks){while(callbacks.length>0){var callback=callbacks.shift();if(typeof
callback===\function\){callback(Module);continue}var func=callback.func;if(typeof
func===\number\){if(callback.arg===undefined){wasmTable.get(func)()}else{wasmTable.get(func)(callback.arg)
}}else{func(callback.arg===undefined?null:callback.arg)}}}var
ERRNO_CODES={EPERM:63,ENOENT:44,ESRCH:71,EINTR:27,EIO:29,ENXIO:60,E2BIG:1,ENOEXEC:45,E
BADF:8,ECHILD:12,EAGAIN:6,EWOULDBLOCK:6,ENOMEM:48,EACCES:2,EFAULT:21,ENOTBLK:105,EB
USY:10,EEXIST:20,EXDEV:75,ENODEV:43,ENOTDIR:54,EISDIR:31,EINVAL:28,ENFILE:41,EMFILE:33,EN
OTTY:59,ETXTBSY:74,EFBIG:22,ENOSPC:51,ESPIPE:70,EROFS:69,EMLINK:34,EPIPE:64,EDOM:18,ERAN
GE:68,ENOMSG:49,EIDRM:24,ECHRNA:106,EL2NSYNC:156,EL3HLT:107,EL3RST:108,ELNRNG:109,EUNA
TCH:110,ENOSCSI:111,EL2HLT:112,EDEADLK:16,ENOLCK:46,EBADE:113,EBADR:114,EXFULL:115,ENO
A:104,EBADRQC:103,EBADSLT:102,EDEADLOCK:16,EBFONT:101,ENOSTR:100,ENODATA:116,ETIME:
117,ENOSR:118,ENONET:119,ENOPKG:120,EREMOTE:121,ENOLINK:47,EADV:122,ESRMNT:123,ECOMM
:124,EPROTO:65,EMULTIHOP:36,EDOTDOT:125,EBADMSG:9,ENOTUNIQ:126,EBADFD:127,EREMCHG:1
28,ELIBACC:129,ELIBBAD:130,ELIBSCN:131,ELIBMAX:132,ELIBEXEC:133,ENOSYS:52,ENOTEMPTY:55,
ENAMETOOLONG:37,ELOOP:32,EOPNOTSUPP:138,EPFNOSUPPORT:139,ECONNRESET:15,ENOBUFS:42,
EAFNOSUPPORT:5,EPROTOTYPE:67,ENOTSOK:57,ENOPROTOOPT:50,ESHUTDOWN:140,ECONNREFU
SED:14,EADDRINUSE:3,ECONNABORTED:13,ENETUNREACH:40,ENETDOWN:38,ETIMEDOUT:73,EHOST
DOWN:142,EHOSTUNREACH:23,EINPROGRESS:26,EALREADY:7,EDESTADDRREQ:17,EMSGSIZE:35,E
PROTONOSUPPORT:66,ESOCKTNOSUPPORT:137,EADDRNOTAVAIL:4,ENETRESET:39,EISCONN:30,EN
OTCONN:53,ETOOMANYREFS:141,EUSERS:136,EDQUOT:19,ESTALE:72,ENOTSUP:138,ENOMEDIUM:14
8,EILSEQ:25,E_OVERFLOW:61,ECANCELED:11,ENOTRECOVERABLE:56,EOWNERDEAD:62,ESTRPIPE:13
5};function
__emscripten_futex_wake(addr,count){if(addr<=0||addr>GROWABLE_HEAP_I8().length||addr&3!=0||count<0)retu
rn-28;if(count==0)return 0;if(count>=2147483647)count=Infinity;var
mainThreadWaitAddress=Atomics.load(GROWABLE_HEAP_I32(),__emscripten_main_thread_futex>>2);var
mainThreadWoken=0;if(mainThreadWaitAddress==addr){var
loadedAddr=Atomics.compareExchange(GROWABLE_HEAP_I32(),__emscripten_main_thread_futex>>2,mainTh
readWaitAddress,0);if(loadedAddr==mainThreadWaitAddress){--count;mainThreadWoken=1;if(count<=0)return
1}}var ret=Atomics.notify(GROWABLE_HEAP_I32(),addr>>2,count);if(ret>=0)return
ret+mainThreadWoken;throw\Atomics.notify returned an unexpected value

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\'+ret}Module[\'_emscripten_futex_wake\']=_emscripten_futex_wake;function
killThread(pthread_ptr){if(ENVIRONMENT_IS_PTHREAD)throw\'Internal Error! killThread() can only ever be
called from main application thread!\';if(!pthread_ptr)throw\'Internal Error! Null pthread_ptr in
killThread!\';GROWABLE_HEAP_I32()[pthread_ptr+12>>2]=0;var
pthread=PThread.threads[pthread_ptr];pthread.worker.terminate();PThread.freeThreadData(pthread);PThread.runni
ngWorkers.splice(PThread.runningWorkers.indexOf(pthread.worker),1);pthread.worker pthread=undefined}functio
n cancelThread(pthread_ptr){if(ENVIRONMENT_IS_PTHREAD)throw\'Internal Error! cancelThread() can only
ever be called from main application thread!\';if(!pthread_ptr)throw\'Internal Error! Null pthread_ptr in
cancelThread!\';var
pthread=PThread.threads[pthread_ptr];pthread.worker.postMessage({\'cmd\':\'cancel\'})}function
cleanupThread(pthread_ptr){if(ENVIRONMENT_IS_PTHREAD)throw\'Internal Error! cleanupThread() can only
ever be called from main
application thread!\';if(!pthread_ptr)throw\'Internal Error! Null pthread_ptr in cleanupThread!\';var
pthread=PThread.threads[pthread_ptr];if(pthread){GROWABLE_HEAP_I32()[pthread_ptr+12>>2]=0;var
worker=pthread.worker;PThread.returnWorkerToPool(worker)}}var
PThread={unusedWorkers:[],runningWorkers:[],initMainThreadBlock:function(){var pthreadPoolSize=8;for(var
i=0;i<pthreadPoolSize;++i){PThread.allocateUnusedWorker()}},initRuntime:function(){var
tb=_malloc(228);for(var
i=0;i<228/4;++i)GROWABLE_HEAP_U32()[tb/4+i]=0;GROWABLE_HEAP_I32()[tb+12>>2]=tb;var
headPtr=tb+152;GROWABLE_HEAP_I32()[headPtr>>2]=headPtr;var tlsMemory=_malloc(512);for(var
i=0;i<128;++i)GROWABLE_HEAP_U32()[tlsMemory/4+i]=0;Atomics.store(GROWABLE_HEAP_U32(),tb+100
>>2,tlsMemory);Atomics.store(GROWABLE_HEAP_U32(),tb+40>>2,tb);__emscripten_thread_init(tb,!ENVIRON
MENT_IS_WORKER,1);__emscripten_register_main_browser_thread_id(tb);initWorker:function(){},threads:{},t
hreadExitHandlers:[],setThreadStatus:function(){},runExitHandlers:function(){while(PThread.threadExitHandlers.l
ength>0){PThread.threadExitHandlers.pop()()}if(ENVIRONMENT_IS_PTHREAD&&_pthread_self())__pthread
_tsd_run_dtors(),runExitHandlersAndDeinitThread:function(tb,exitCode){Atomics.store(GROWABLE_HEAP_U
32(),tb+56>>2,1);Atomics.store(GROWABLE_HEAP_U32(),tb+60>>2,0);PThread.runExitHandlers();Atomics.stor
e(GROWABLE_HEAP_U32(),tb+4>>2,exitCode);Atomics.store(GROWABLE_HEAP_U32(),tb+0>>2,1);_emscri
pten_futex_wake(tb+0,2147483647);__emscripten_thread_init(0,0,0)},threadExit:function(exitCode){var
tb=_pthread_self();if(tb){PThread.runExitHandlersAndDeinitThread(tb,exitCode);if(ENVIRONMENT_IS_PTHRE
AD){postMessage({\'cmd\':\'exit\'})}}},threadCancel:function(){PThread.runExitHandlersAndDeinitThread(_pthr
ead_self(),-1);postMessage({\'cmd\':\'cancelDone\'})},terminateAllThreads:function(){for(var t in
PThread.threads){var
pthread=PThread.threads[t];if(pthread&&pthread.worker){PThread.returnWorkerToPool(pthread.worker)}}PThre
ad.threads={};for(var
i=0;i<PThread.unusedWorkers.length;++i){var
worker=PThread.unusedWorkers[i];worker.terminate()}PThread.unusedWorkers=[];for(var
i=0;i<PThread.runningWorkers.length;++i){var worker=PThread.runningWorkers[i];var
pthread=worker pthread;PThread.freeThreadData(pthread);worker.terminate()}PThread.runningWorkers=[]},freeTh
readData:function(pthread){if(!pthread)return;if(pthread.threadInfoStruct){var
tlsMemory=GROWABLE_HEAP_I32()[pthread.threadInfoStruct+100>>2];GROWABLE_HEAP_I32()[pthread.thr
eadInfoStruct+100>>2]=0;_free(tlsMemory);_free(pthread.threadInfoStruct)}pthread.threadInfoStruct=0;if(pthread.
allocatedOwnStack&&pthread.stackBase)_free(pthread.stackBase);pthread.stackBase=0;if(pthread.worker)pthread.
worker pthread=null},returnWorkerToPool:function(worker){PThread.runWithoutMainThreadQueuedCalls(funcio
n){delete
PThread.threads[worker pthread.threadInfoStruct];PThread.unusedWorkers.push(worker);PThread.runningWorker
s.splice(PThread.runningWorkers.indexOf(worker),1);PThread.freeThreadData(worker pthread);worker pthread=un
defined}}},runWithoutMainThreadQueuedCalls:function(func){GROWABLE_HEAP_I32()[__emscripten_allow_m

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ain_runtime_queued_calls>>2]=0;try{func()}finally{GROWABLE_HEAP_I32()[_emscripten_allow_main_runti
me_queued_calls>>2]=1}}},receiveObjectTransfer:function(data){},loadWasmModuleToWorker:function(worker,o
nFinishedLoading){worker.onmessage=function(e){var
  d=e["data"];var
  cmd=d["cmd"];if(worker.pthread)PThread.currentProxiedOperationCallerThread=worker.pthread.threadInfoStruct;
  if(d["targetThread"]&&d["targetThread"]!="_pthread_self"){var
  thread=PThread.pthreads[d.targetThread];if(thread){thread.worker.postMessage(e.data,d["transferList"]);}else{con
sole.error('Internal error! Worker sent a message \''+cmd+'\' to target pthread '+d["targetThread"]+', but that
  thread no longer
  exists!')}PThread.currentProxiedOperationCallerThread=undefined;return}if(cmd===\'processQueuedMainThread
  Work\'){_emscripten_main_thread_process_queued_calls()}else
  if(cmd===\'spawnThread\'){spawnThread(e.data)}else
  if(cmd===\'cleanupThread\'){cleanupThread(d["thread"]);}else
  if(cmd===\'killThread\'){killThread(d["thread"]);}else
  if(cmd===\'cancelThread\'){cancelThread(d["thread"]);}else
  if(cmd===\'loaded\'){worker.loaded=true;if(onFinishedLoading)onFinishedLoading(worker);if(worker.runPthread)
    {worker.runPthread();delete worker.runPthread}}else if(cmd===\'print\'){out("Thread \"+d["threadId"]+"\":
    \''+d["text"]\')}else if(cmd===\'printErr\'){err("Thread \"+d["threadId"]+"\": \''+d["text"]\')}else
  if(cmd===\'alert\'){alert("Thread \"+d["threadId"]+"\": \''+d["text"]\')}else if(cmd===\'exit\'){var
  detached=worker.pthread&&Atomics.load(GROWABLE_HEAP_U32(),worker.pthread.threadInfoStruct+64>>2);if
  (detached){PThread.returnWorkerToPool(worker)}}else
  if(cmd===\'exitProcess\'){try{exit(d["returnCode"])}catch(e){if(e instanceof ExitStatus)return;throw e}}else
  if(cmd===\'cancelDone\'){PThread.returnWorkerToPool(worker)}else
  if(cmd===\'objectTransfer\'){PThread.receiveObjectTransfer(e.data)}else
    if(e.data.target===\'setimmediate\'){worker.postMessage(e.data)}else{err("worker sent an unknown command
    \''+cmd\')}PThread.currentProxiedOperationCallerThread=undefined};worker.onerror=function(e){err("pthread sent
    an error! \''+e.filename+'\':"'+e.lineno+'':
    \''+e.message\');if(ENVIRONMENT_IS_NODE){worker.on("message",function(data){worker.onmessage({data:d
    ata}});worker.on("error",function(data){worker.onerror(data)});worker.on("exit",function(data){})}worker.post
    Message({"cmd":\'load\',\'urlOrBlob\':Module["mainScriptUrlOrBlob"]||_scriptDir,"wasmMemory\':wasmMe
    memory,\':wasmModule\':wasmModule}}),allocateUnusedWorker:function(){var pthreadMainJs=locateFile("tfjs-
    backend-wasm-threaded-simd.worker.js");PThread.unusedWorkers.push(new
    Worker(pthreadMainJs)),getNewWorker:function(){if(PThread.unusedWorkers.length==0){PThread.allocateUnus
    edWorker();PThread.loadWasmModuleToWorker(PThread.unusedWorkers[0])}if(PThread.unusedWorkers.length>
    0)return
    PThread.unusedWorkers.pop();else return null},busySpinWait:function(msecs){var
    t=performance.now()+msecs;while(performance.now()<t){}};function
    establishStackSpace(stackTop,stackMax){_emscripten_stack_set_limits(stackTop,stackMax);stackRestore(stackTop
    )}Module["establishStackSpace"]=establishStackSpace;function getNoExitRuntime(){return
    noExitRuntime}Module["getNoExitRuntime"]=getNoExitRuntime;function invokeEntryPoint(ptr,arg){return
    wasmTable.get(ptr)(arg)}Module["invokeEntryPoint"]=invokeEntryPoint;function
    __assert_fail(condition,filename,line,func){abort("Assertion failed: \''+UTF8ToString(condition)+'\", at:
    \''+[filename?UTF8ToString(filename):\'unknown filename\'],line,func?UTF8ToString(func):\'unknown
    function\')}function __call_main(argc,argv){var returnCode=_main(argc,argv)}var
    _emscripten_get_now;if(ENVIRONMENT_IS_NODE){_emscripten_get_now=function(){var
    t=process["hrtime"]();return t[0]*1e3+t[1]/1e6}}else
    if(ENVIRONMENT_IS_PTHREAD){_emscripten_get_now=function(){return

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performance.now()-Module[\"__performance_now_clock_drift\"]}}else if(typeof
dateNow!=\"undefined\"){_emscripten_get_now=dateNow}else _emscripten_get_now=function(){return
performance.now()};function setErrNo(value){GROWABLE_HEAP_I32()[__errno_location()>>2]=value;return
value}function _atexit(func,arg){if(ENVIRONMENT_IS_PTHREAD)return
_emscripten_proxy_to_main_thread_js(1,1,func,arg)}function
__emscripten_notify_thread_queue(targetThreadId,mainThreadId){if(targetThreadId==mainThreadId){postMessag
e({\"cmd\\\": \"processQueuedMainThreadWork\"})}else
if(ENVIRONMENT_IS_PTHREAD){postMessage({\"targetThread\\\":targetThreadId,\"cmd\\\": \"processThreadQueue
e\\\"})}else{var pthread=PThread.pthreads[targetThreadId];var
worker=pthread.&&pthread.worker;if(!worker){return}worker.postMessage({\"cmd\\\": \"processThreadQueue\\\"})}ret
urn 1}function _abort(){abort()}function _emscripten_asm_const_int(code,sigPtr,argbuf){var
args=readAsmConstArgs(sigPtr,argbuf);return ASM_CONSTS[code].apply(null,args)}function
_emscripten_conditional_set_current_thread_status(expectedStatus,newStatus){function
_emscripten_futex_wait(addr,val,timeout){if(addr<=0||addr>GROWABLE_HEAP_I8().length||addr&3!=0)return-
28;if(!ENVIRONMENT_IS_WEB){var
ret=Atomics.wait(GROWABLE_HEAP_I32(),addr>>2,val,timeout);if(ret===\"timed-out\")return-
73;if(ret===\"not-equal\")return-6;if(ret===\"ok\")return 0;throw\"Atomics.wait returned an unexpected value
\\\"+ret}else{if(Atomics.load(GROWABLE_HEAP_I32(),addr>>2)!=val){return-6}var
tNow=performance.now();var tEnd=tNow+timeout;var
lastAddr=Atomics.exchange(GROWABLE_HEAP_I32(),__emscripten_main_thread_futex>>2,addr);while(1){tNo
w=performance.now();if(tNow>tEnd){lastAddr=Atomics.exchange(GROWABLE_HEAP_I32(),__emscripten_mai
n_thread_futex>>2,0);return-
73}lastAddr=Atomics.exchange(GROWABLE_HEAP_I32(),__emscripten_main_thread_futex>>2,0);if(lastAddr==
0){break}_emscripten_main_thread_process_queued_calls();if(Atomics.load(GROWABLE_HEAP_I32(),addr>>2)!
=val){return-
6}lastAddr=Atomics.exchange(GROWABLE_HEAP_I32(),__emscripten_main_thread_futex>>2,addr)}return
0}}function
_emscripten_memcpy_big(dest,src,num){GROWABLE_HEAP_U8().copyWithin(dest,src,src+num)}function
_emscripten_num_logical_cores(){if(ENVIRONMENT_IS_NODE)return require(\"os\").cpus().length;return
navigator[\"hardwareConcurrency\"]}}function _emscripten_proxy_to_main_thread_js(index,sync){var
numCallArgs=arguments.length-2;var stack=stackSave();var serializedNumCallArgs=numCallArgs;var
args=stackAlloc(serializedNumCallArgs*8);var b=args>>3;for(var i=0;i<numCallArgs;i++){var
arg=arguments[2+i];GROWABLE_HEAP_F64()[b+i]=arg}var
ret=_emscripten_run_in_main_runtime_thread_js(index,serializedNumCallArgs,args,sync);stackRestore(stack);retur
n ret}var _emscripten_receive_on_main_thread_js_callArgs=[];var readAsmConstArgsArray=[];function
readAsmConstArgs(sigPtr,buf){readAsmConstArgsArray.length=0;var
ch;buf>>=2;while(ch=GROWABLE_HEAP_U8()[sigPtr++){var
double=ch<105;if(double&&buf&1)buf++;readAsmConstArgsArray.push(double?GROWABLE_HEAP_F64()[buf
++>>1]:GROWABLE_HEAP_I32()[buf]);++buf}return
readAsmConstArgsArray}function
_emscripten_receive_on_main_thread_js(index,numCallArgs,args){_emscripten_receive_on_main_thread_js_callA
rgs.length=numCallArgs;var b=args>>3;for(var
i=0;i<numCallArgs;i++){_emscripten_receive_on_main_thread_js_callArgs[i]=GROWABLE_HEAP_F64()[b+i]}v
ar isEmAsmConst=index<0;var func=!isEmAsmConst?proxiedFunctionTable[index]:ASM_CONSTS[-index-
1];return func.apply(null,_emscripten_receive_on_main_thread_js_callArgs)}function
_emscripten_get_heap_size(){return GROWABLE_HEAP_U8().length}function
emscripten_realloc_buffer(size){try{wasmmemory.grow(size-
buffer.byteLength+65535>>>16);updateGlobalBufferAndViews(wasmmemory.buffer);return

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1 }catch(e){ } }function _emscripten_resize_heap(requestedSize){ var
oldSize=_emscripten_get_heap_size();if(requestedSize<=oldSize){return false} var
maxHeapSize=2147483648;if(requestedSize>maxHeapSize){return false}for(var
cutDown=1;cutDown<=4;cutDown*=2){ var
overGrownHeapSize=oldSize*(1+.2/cutDown);overGrownHeapSize=Math.min(overGrownHeapSize,requestedSize
+100663296);var
newSize=Math.min(maxHeapSize,alignUp(Math.max(requestedSize,overGrownHeapSize),65536));var
replacement=_emscripten_realloc_buffer(newSize);if(replacement){return true} }return false}var
JSEvents={ inEventHandler:0,removeAllEventListeners:function(){ for(var i=JSEvents.eventHandlers.length-
1;i>=0;--
i){ JSEvents._removeHandler(i)}JSEvents.eventHandlers=[];JSEvents.deferredCalls=[]},registerRemoveEventListen
ers:function(){ if(!JSEvents.removeEventListenersRegistered){ __ATEXIT__.push(JSEvents.removeAllEventListene
rs);JSEvents.removeEventListenersRegistered=true} },deferredCalls:[],deferCall:function(targetFunction,precedence
,argsList){ function arraysHaveEqualContent(arrA,arrB){ if(arrA.length!=arrB.length)return false;for(var i in
arrA){ if(arrA[i]!=arrB[i])return false}return true}for(var i in JSEvents.deferredCalls){ var
call=JSEvents.deferredCalls[i];if(call.targetFunction==targetFunction&&arraysHaveEqualContent(call.argsList,args
List)){ return } }JSEvents.deferredCalls.push({ targetFunction:targetFunction,precedence:precedence,argsList:argsList
});JSEvents.deferredCalls.sort(function(x,y){ return
x.precedence<y.precedence})),removeDeferredCalls:function(targetFunction){ for(var
i=0;i<JSEvents.deferredCalls.length;++i){ if(JSEvents.deferredCalls[i].targetFunction==targetFunction){ JSEvents.d
eferredCalls.splice(i,1);--i} },canPerformEventHandlerRequests:function(){ return
JSEvents.inEventHandler&&JSEvents.currentEventHandler.allowsDeferredCalls },runDeferredCalls:function(){ if(!J
SEvents.canPerformEventHandlerRequests()){ return}for(var i=0;i<JSEvents.deferredCalls.length;++i){ var
call=JSEvents.deferredCalls[i];JSEvents.deferredCalls.splice(i,1);--
i;call.targetFunction.apply(null,call.argsList) },eventHandlers:[],removeAllHandlersOnTarget:function(target,event
TypeString){ for(var
i=0;i<JSEvents.eventHandlers.length;++i){ if(JSEvents.eventHandlers[i].target==target&&(!eventTypeString||event
TypeString==JSEvents.eventHandlers[i].eventTypeString)){ JSEvents._removeHandler(i--
)}} },_removeHandler:function(i){ var
h=JSEvents.eventHandlers[i];h.target.removeEventListener(h.eventTypeString,h.eventListenerFunc,h.useCapture);J
SEvents.eventHandlers.splice(i,1)},registerOrRemoveHandler:function(eventHandler){ var jsEventHandler=function
jsEventHandler(event){ ++JSEvents.inEventHandler;JSEvents.currentEventHandler=eventHandler;JSEvents.runDef
erredCalls();eventHandler.handlerFunc(event);JSEvents.runDeferredCalls();--
JSEvents.inEventHandler};if(eventHandler.callbackfunc){ eventHandler.eventListenerFunc=jsEventHandler;eventH
andler.target.addEventListener(eventHandler.eventTypeString,jsEventHandler,eventHandler.useCapture);JSEvents.e
ventHandlers.push(eventHandler);JSEvents.registerRemoveEventListeners()}else{ for(var
i=0;i<JSEvents.eventHandlers.length;++i){ if(JSEvents.eventHandlers[i].target==eventHandler.target&&JSEvents.e
ventHandlers[i].eventTypeString==eventHandler.eventTypeString){ JSEvents._removeHandler(i--
)}} },queueEventHandlerOnThread_iiii:function(targetThread,eventHandlerFunc,eventTypeId,eventData,userData)
{ var
stackTop=stackSave();var
varargs=stackAlloc(12);GROWABLE_HEAP_I32()[varargs>>2]=eventTypeId;GROWABLE_HEAP_I32()[varargs
+4>>2]=eventData;GROWABLE_HEAP_I32()[varargs+8>>2]=userData;__emscripten_call_on_thread(0,targetThr
ead,637534208,eventHandlerFunc,eventData,varargs);stackRestore(stackTop)},getTargetThreadForEventCallback:f
unction(targetThread){ switch(targetThread){ case 1:return 0;case 2:return
PThread.currentProxiedOperationCallerThread;default:return
targetThread} },getNodeNameForTarget:function(target){ if(!target)return\"\";if(target==window)return\"#window\";
if(target==screen)return\"#screen\";return

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target&&target.nodeName?target.nodeName:""},fullscreenEnabled:function(){return
document.fullscreenEnabled||document.webkitFullscreenEnabled}};function stringToNewUTF8(jsString){ var
length=lengthBytesUTF8(jsString)+1;var cString=_malloc(length);stringToUTF8(jsString,cString,length);return
cString}function
_emsripten_set_offscreencanvas_size_on_target_thread_js(targetThread,targetCanvas,width,height){ var
stackTop=stackSave();var varargs=stackAlloc(12);var
targetCanvasPtr=0;if(targetCanvas){ targetCanvasPtr=stringToNewUTF8(targetCanvas)}GROWABLE_HEAP_I32(
)[varargs>>2]=targetCanvasPtr;GROWABLE_HEAP_I32()[varargs+4>>2]=width;GROWABLE_HEAP_I32()[var
args+8>>2]=height;__emsripten_call_on_thread(0,targetThread,657457152,0,targetCanvasPtr,varargs);stackRestor
e(stackTop)}function
_emsripten_set_offscreencanvas_size_on_target_thread(targetThread,targetCanvas,width,height){ targetCanvas=tar
getCanvas?UTF8ToString(targetCanvas):"";_emsripten_set_offscreencanvas_size_on_target_thread_js(targetThr
ead,targetCanvas,width,height)}function maybeCStringToJsString(cString){ return
cString>2?UTF8ToString(cString):cString}var specialHTMLTargets=[0,typeof
document!=="undefined"?document:0,typeof window!=="undefined"?window:0];function
findEventTarget(target){ target=maybeCStringToJsString(target);var
domElement=specialHTMLTargets[target]||(typeof
document!=="undefined"?document.querySelector(target):undefined);return domElement}function
findCanvasEventTarget(target){ return findEventTarget(target)}function
_emsripten_set_canvas_element_size_calling_thread(target,width,height){ var
canvas=findCanvasEventTarget(target);if(!canvas)return-
4;if(canvas.canvasSharedPtr){ GROWABLE_HEAP_I32()[canvas.canvasSharedPtr>>2]=width;GROWABLE_HEA
P_I32()[canvas.canvasSharedPtr+4>>2]=height}if(canvas.offscreenCanvas||!canvas.controlTransferredOffscreen){ if
(canvas.offscreenCanvas)canvas=canvas.offscreenCanvas;var
autoResizeViewport=false;if(canvas.GLctxObject&&canvas.GLctxObject.GLctx){ var
prevViewport=canvas.GLctxObject.GLctx.getParameter(2978);autoResizeViewport=prevViewport[0]===0&&prev
Viewport[1]===0&&prevViewport[2]===canvas.width&&prevViewport[3]===canvas.height}canvas.width=width;
canvas.height=height;if(autoResizeViewport){ canvas.GLctxObject.GLctx.viewport(0,0,width,height)}}else
if(canvas.canvasSharedPtr){ var
targetThread=GROWABLE_HEAP_I32()[canvas.canvasSharedPtr+8>>2];_emsripten_set_offscreencanvas_size_o
n_target_thread(targetThread,target,width,height);return 1}else{return-4}return 0}function
_emsripten_set_canvas_element_size_main_thread(target,width,height){ if(ENVIRONMENT_IS_PTHREAD)retur
n _emsripten_proxy_to_main_thread_js(2,1,target,width,height);return
_emsripten_set_canvas_element_size_calling_thread(target,width,height)}function
_emsripten_set_canvas_element_size(target,width,height){ var
canvas=findCanvasEventTarget(target);if(canvas){ return
_emsripten_set_canvas_element_size_calling_thread(target,width,height)}else{return
_emsripten_set_canvas_element_size_main_thread(target,width,height)}}function
_emsripten_set_current_thread_status(newStatus){ }function
_emsripten_set_thread_name(threadId,name){ }function __webgl_enable_ANGLE_instanced_arrays(ctx){ var
ext=ctx.getExtension("ANGLE_instanced_arrays");if(ext){ ctx["vertexAttribDivisor"]=function(index,divisor){ ex
t["vertexAttribDivisorANGLE"](index,divisor)};ctx["drawArraysInstanced"]=function(mode,first,count,primcou
nt){ ext["drawArraysInstancedANGLE"](mode,first,count,primcount)};ctx["drawElementsInstanced"]=function(
mode,count,type,indices,primcount){ ext["drawElementsInstancedANGLE"](mode,count,type,indices,primcount)};
return
1}}function __webgl_enable_OES_vertex_array_object(ctx){ var
ext=ctx.getExtension("OES_vertex_array_object");if(ext){ ctx["createVertexArray"]=function(){ return
ext["createVertexArrayOES"]();};ctx["deleteVertexArray"]=function(vao){ ext["deleteVertexArrayOES"](vao)};

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ctx[\"bindVertexArray\"]=function(vao){ext[\"bindVertexArrayOES\"](vao)};ctx[\"isVertexArray\"]=function(vao)
{return ext[\"isVertexArrayOES\"](vao)};return 1}}function __webgl_enable_WEBGL_draw_buffers(ctx){var
ext=ctx.getExtension(\"WEBGL_draw_buffers\");if(ext){ctx[\"drawBuffers\"]=function(n,bufs){ext[\"drawBuffers
WEBGL\"](n,bufs)};return
1}}function
__webgl_enable_WEBGL_multi_draw(ctx){return!!(ctx.multiDrawWebgl=ctx.getExtension(\"WEBGL_multi_dra
w\"))}var
GL={counter:1,buffers:[],programs:[],framebuffers:[],renderbuffers:[],textures:[],uniforms:[],shaders:[],vaos:[],cont
exts:{},offscreenCanvases:{},timerQueriesEXT:[],programInfos:{},stringCache:{},unpackAlignment:4,recordError:
function recordError(errorCode){if(!GL.lastError){GL.lastError=errorCode}},getNewId:function(table){var
ret=GL.counter++;for(var i=table.length;i<ret;i++){table[i]=null}return
ret},getSource:function(shader,count,string,length){var source=\"\";for(var i=0;i<count;++i){var
len=length?GROWABLE_HEAP_I32()[length+i*4>>2]:-
1;source+=UTF8ToString(GROWABLE_HEAP_I32()[string+i*4>>2],len<0?undefined:len)}return
source},createContext:function(canvas,webGLContextAttributes){var
ctx=canvas.getContext(\"webgl\",webGLContextAttributes);if(!ctx)return 0;var
handle=GL.registerContext(ctx,webGLContextAttributes);return
handle},registerContext:function(ctx,webGLContextAttributes){var
handle=_malloc(8);GROWABLE_HEAP_I32()[handle+4>>2]=_pthread_self();var
context={handle:handle,attributes:webGLContextAttributes,version:webGLContextAttributes.majorVersion,GLctx:
ctx};if(ctx.canvas)ctx.canvas.GLctxObject=context;GL.contexts[handle]=context;if(typeof
webGLContextAttributes.enableExtensionsByDefault===\"undefined\"||webGLContextAttributes.enableExtensions
ByDefault){GL.initExtensions(context)}return
handle},makeContextCurrent:function(contextHandle){GL.currentContext=GL.contexts[contextHandle];Module.ctx
=GLctx=GL.currentContext&&GL.currentContext.GLctx;return!(contextHandle&&!GLctx)},getContext:function(c
ontextHandle){return
GL.contexts[contextHandle]},deleteContext:function(contextHandle){if(GL.currentContext===GL.contexts[context
Handle])GL.currentContext=null;if(typeof
JSEvents===\"object\")JSEvents.removeAllHandlersOnTarget(GL.contexts[contextHandle].GLctx.canvas);if(GL.co
ntexts[contextHandle]&&GL.contexts[contextHandle].GLctx.canvas)GL.contexts[contextHandle].GLctx.canvas.GL
ctxObject=undefined;_free(GL.contexts[contextHandle].handle);GL.contexts[contextHandle]=null},initExtensions:f
unction(context){if(!context)context=GL.currentContext;if(context.initExtensionsDone)return;context.initExtension
sDone=true;var
GLctx=context.GLctx;__webgl_enable_ANGLE_instanced_arrays(GLctx);__webgl_enable_OES_vertex_array_obj
ect(GLctx);__webgl_enable_WEBGL_draw_buffers(GLctx);GLctx.disjointTimerQueryExt=GLctx.getExtension(\"
EXT_disjoint_timer_query\");__webgl_enable_WEBGL_multi_draw(GLctx);var
exts=GLctx.getSupportedExtensions()||[];exts.forEach(function(ext){if(ext.indexOf(\"lose_context\")<0&&ext.inde
xOf(\"debug\")<0){GLctx.getExtension(ext)}}),populateUniformTable:function(program){var
p=GL.programs[program];var
ptable=GL.programInfos[program]={uniforms:{},maxUniformLength:0,maxAttributeLength:-
1,maxUniformBlockNameLength:-1};var utable=ptable.uniforms;var
numUniforms=GLctx.getProgramParameter(p,35718);for(var i=0;i<numUniforms;++i){var
u=GLctx.getActiveUniform(p,i);var
name=u.name;ptable.maxUniformLength=Math.max(ptable.maxUniformLength,name.length+1);if(name.slice(-
1)===\"\\\"){name=name.slice(0,name.lastIndexOf(\"\\\"))}var loc=GLctx.getUniformLocation(p,name);if(loc){var
id=GL.getNewId(GL.uniforms);utable[name]=[u.size,id];GL.uniforms[id]=loc;for(var j=1;j<u.size;++j){var
n=name+\"\\\"+j+\"\\\"\";loc=GLctx.getUniformLocation(p,n);id=GL.getNewId(GL.uniforms);GL.uniforms[id]=loc}}
}};var __emscripten_webgl_power_preferences=[\"default\",\"low-power\",\"high-performance\"];function

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_emsripten_webgl_do_create_context(target,attributes){ var a=attributes>>2;var
powerPreference=GROWABLE_HEAP_I32()[a+(24>>2)];var
contextAttributes={"alpha\":"!!GROWABLE_HEAP_I32()[a+(0>>2)],"depth\":"!!GROWABLE_HEAP_I32()[a+(4
>>2)],"stencil\":"!!GROWABLE_HEAP_I32()[a+(8>>2)],"antialias\":"!!GROWABLE_HEAP_I32()[a+(12>>2)],"p
remultipliedAlpha\":"!!GROWABLE_HEAP_I32()[a+(16>>2)],"preserveDrawingBuffer\":"!!GROWABLE_HEAP_
I32()[a+(20>>2)],"powerPreference\":_emsripten_webgl_power_preferences[powerPreference],"failIfMajorPerf
ormanceCaveat\":"!!GROWABLE_HEAP_I32()[a+(28>>2)],majorVersion:GROWABLE_HEAP_I32()[a+(32>>2)],
minorVersion:GROWABLE_HEAP_I32()[a+(36>>2)],enableExtensionsByDefault:GROWABLE_HEAP_I32()[a+(
40>>2)],explicitSwapControl:GROWABLE_HEAP_I32()[a+(44>>2)],proxyContextToMainThread:GROWABLE_
HEAP_I32()[a+(48>>2)],renderViaOffscreenBackBuffer:GROWABLE_HEAP_I32()[a+(52>>2)]};var
canvas=findCanvasEventTarget(target);if(!canvas){return 0}if(contextAttributes.explicitSwapControl){return
0}var contextHandle=GL.createContext(canvas,contextAttributes);return contextHandle}function
_emsripten_webgl_create_context(a0,a1){return _emsripten_webgl_do_create_context(a0,a1)}var
SYSCALLS={ mappings:{ },buffers:[null,[],[]],printChar:function(stream,curr){ var
buffer=SYSCALLS.buffers[stream];if(curr===0||curr===10){ (stream===1?out:err)(UTF8ArrayToString(buffer,0));
buffer.length=0}else{ buffer.push(curr)}},varargs:undefined,get:function(){ SYSCALLS.varargs+=4;var
ret=GROWABLE_HEAP_I32()[SYSCALLS.varargs-4>>2];return ret},getStr:function(ptr){ var
ret=UTF8ToString(ptr);return ret},get64:function(low,high){return low}};function
_fd_close(fd){if(ENVIRONMENT_IS_PTHREAD)return _emsripten_proxy_to_main_thread_js(3,1,fd);return
0}function _fd_seek(fd,offset_low,offset_high,whence,newOffset){if(ENVIRONMENT_IS_PTHREAD)return
_emsripten_proxy_to_main_thread_js(4,1,fd,offset_low,offset_high,whence,newOffset)}function
_fd_write(fd,iow,iowcnt,pnum){if(ENVIRONMENT_IS_PTHREAD)return
_emsripten_proxy_to_main_thread_js(5,1,fd,iow,iowcnt,pnum);var num=0;for(var i=0;i<iowcnt;i++){ var
ptr=GROWABLE_HEAP_I32()[iow+i*8>>2];var len=GROWABLE_HEAP_I32()[iow+(i*8+4)>>2];for(var
j=0;j<len;j++){ SYSCALLS.printChar(fd,GROWABLE_HEAP_U8)[ptr+j]} num+=len}GROWABLE_HEAP_I32
()[pnum>>2]=num;return 0}function _pthread_cleanup_pop(execute){ var
routine=PThread.threadExitHandlers.pop();if(execute)routine()}function
_pthread_cleanup_push(routine,arg){PThread.threadExitHandlers.push(function(){ wasmTable.get(routine)(arg)})}f
unction
spawnThread(threadParams){if(ENVIRONMENT_IS_PTHREAD)throw"Internal Error! spawnThread() can only
ever be called from main application thread!";var
worker=PThread.getNewWorker();if(worker.pthread!==undefined)throw"Internal
error!";if(!threadParams.pthread_ptr)throw"Internal error, no pthread
ptr!";PThread.runningWorkers.push(worker);var tlsMemory=_malloc(128*4);for(var
i=0;i<128;++i){ GROWABLE_HEAP_I32()[tlsMemory+i*4>>2]=0}var
stackHigh=threadParams.stackBase+threadParams.stackSize;var
pthread=PThread.pthreads[threadParams.pthread_ptr]={ worker:worker,stackBase:threadParams.stackBase,stackSize
:threadParams.stackSize,allocatedOwnStack:threadParams.allocatedOwnStack,threadInfoStruct:threadParams.pthrea
d_ptr};var
tis=pthread.threadInfoStruct>>2;Atomics.store(GROWABLE_HEAP_U32(),tis+(64>>2),threadParams.detached);A
tomics.store(GROWABLE_HEAP_U32(),tis+(100>>2),tlsMemory);Atomics.store(GROWABLE_HEAP_U32(),tis
+(40>>2),pthread.threadInfoStruct);Atomics.store(GROWABLE_HEAP_U32(),tis+(80>>2),threadParams.stackSiz
e);Atomics.store(GROWABLE_HEAP_U32(),tis+(76>>2),stackHigh);Atomics.store(GROWABLE_HEAP_U32(),t
is+(104>>2),threadParams.stackSize);Atomics.store(GROWABLE_HEAP_U32(),tis+(104+8>>2),stackHigh);Atom
ics.store(GROWABLE_HEAP_U32(),tis+(104+12>>2),threadParams.detached);var
global_libc=_emsripten_get_global_libc();var
global_locale=global_libc+40;Atomics.store(GROWABLE_HEAP_U32(),tis+(172>>2),global_locale);worker.pthr
ead=pthread;var

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msg={"cmd\\":\\"run\\",\\"start_routine\\":threadParams.startRoutine,\\"arg\\":threadParams.arg,\\"threadInfoStruct\\":theadParams pthread_ptr,\\"stackBase\\":threadParams.stackBase,\\"stackSize\\":threadParams.stackSize};worker.runPthread=
function(){msg.time=performance.now();worker.postMessage(msg,threadParams.transferList)};if(worker.loaded){worker.runPthread();delete worker.runPthread}}function
pthread_create(pthread_ptr,attr,start_routine,arg){if(typeof SharedArrayBuffer===\\"undefined\\"){err(\\"Current
environment does not support SharedArrayBuffer, pthreads are not available!\");return
6}if(!pthread_ptr){err(\\"pthread_create called with a null thread pointer!\");return 28}var transferList=[];var
error=0;if(ENVIRONMENT_IS_PTHREAD&&(transferList.length===0||error)){return
_emscripten_sync_run_in_main_thread_4(687865856,pthread_ptr,attr,start_routine,arg)}if(error)return error;var
stackSize=0;var stackBase=0;var detached=0;if(attr&&attr!=
1){stackSize=GROWABLE_HEAP_I32()[attr>>2];stackSize+=81920;stackBase=GROWABLE_HEAP_I32()[attr+
8>>2];detached=GROWABLE_HEAP_I32()[attr+12>>2]!==0}else{stackSize=2097152}var
allocatedOwnStack=stackBase==0;if(allocatedOwnStack){stackBase=_memalign(16,stackSize)}else{stackBase=
stackSize;assert(stackBase>0)}var threadInfoStruct=_malloc(228);for(var
i=0;i<228>>2;++i)GROWABLE_HEAP_U32()[threadInfoStruct>>2+i]=0;GROWABLE_HEAP_I32()[pthread_p
tr>>2]=threadInfoStruct;GROWABLE_HEAP_I32()[threadInfoStruct+12>>2]=threadInfoStruct;var
headPtr=threadInfoStruct+152;GROWABLE_HEAP_I32()[headPtr>>2]=headPtr;var
threadParams={stackBase:stackBase,stackSize:stackSize,allocatedOwnStack:allocatedOwnStack,detached:detached
,startRoutine:start_routine,pthread_ptr:threadInfoStruct,arg:arg,transferList:transferList};if(ENVIRONMENT_IS_P
THREAD){threadParams.cmd=\\"spawnThread\\";postMessage(threadParams,transferList)}else{spawnThread(thread
Params)}return 0}function __pthread_testcancel_js(){if(!ENVIRONMENT_IS_PTHREAD)return;var
tb=__pthread_self();if(!tb)return;var
cancelDisabled=Atomics.load(GROWABLE_HEAP_U32(),tb+56>>2);if(cancelDisabled)return;var
canceled=Atomics.load(GROWABLE_HEAP_U32(),tb+0>>2);if(canceled===2)throw\\"Canceled!\\"}function
_emscripten_check_blocking_allowed(){if(ENVIRONMENT_IS_NODE)return;if(ENVIRONMENT_IS_WORKE
R)return;warnOnce(\\"Blocking on the main thread is very dangerous, see
https://emscripten.org/docs/porting/pthreads.html#blocking-on-the-main-browser-thread\")}function
__emscripten_do_pthread_join(thread,status,block){if(!thread){err(\\"pthread_join
attempted on a null thread pointer!\");return
ERRNO_CODES.ESRCH}if(ENVIRONMENT_IS_PTHREAD&&__pthread_self()===thread){err(\\"PThread
\\"+thread+\\" is attempting to join to itself!\");return ERRNO_CODES.EDEADLK}else
if(!ENVIRONMENT_IS_PTHREAD&&_emscripten_main_browser_thread_id()===thread){err(\\"Main thread
\\"+thread+\\" is attempting to join to itself!\");return ERRNO_CODES.EDEADLK}var
self=GROWABLE_HEAP_I32()[thread+12>>2];if(self!==thread){err(\\"pthread_join attempted on thread
\\"+thread+\\" , which does not point to a valid thread, or does not exist anymore!\");return
ERRNO_CODES.ESRCH}var
detached=Atomics.load(GROWABLE_HEAP_U32(),thread+64>>2);if(detached){err(\\"Attempted to join thread
\\"+thread+\\" , which was already detached!\");return
ERRNO_CODES.EINVAL}if(block){_emscripten_check_blocking_allowed()}for(;;){var
threadStatus=Atomics.load(GROWABLE_HEAP_U32(),thread+0>>2);if(threadStatus===1){var
threadExitCode=Atomics.load(GROWABLE_HEAP_U32(),thread+4>>2);if(status)GROWABLE_HEAP_I32()[sta
tus>>2]=threadExitCode;Atomics.store(GROWABLE_HEAP_U32(),thread+64>>2,1);if(!ENVIRONMENT_IS_PT
HREAD)cleanupThread(thread);else
postMessage({\\"cmd\\":\\"cleanupThread\\",\\"thread\\":thread});return 0}if(!block){return
ERRNO_CODES.EBUSY}__pthread_testcancel_js();if(!ENVIRONMENT_IS_PTHREAD)_emscripten_main_thre
ad_process_queued_calls();_emscripten_futex_wait(thread+0,threadStatus,ENVIRONMENT_IS_PTHREAD?100:1
)}}function _pthread_join(thread,status){return __emscripten_do_pthread_join(thread,status,true)}function
_sysconf(name){if(ENVIRONMENT_IS_PTHREAD)return

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_emsripten_proxy_to_main_thread_js(6,1,name);switch(name){case 30:return 16384;case 85:var
maxHeapSize=2147483648;return maxHeapSize/16384;case 132:case 133:case 12:case 137:case 138:case 15:case
235:case 16:case 17:case 18:case 19:case 20:case 149:case 13:case 10:case 236:case 153:case 9:case 21:case 22:case
159:case 154:case 14:case 77:case 78:case 139:case 82:case 68:case 67:case 164:case
11:case 29:case 47:case 48:case 95:case 52:case 51:case 46:return 200809;case 27:case 246:case 127:case 128:case
23:case 24:case 160:case 161:case 181:case 182:case 242:case 183:case 184:case 243:case 244:case 245:case
165:case 178:case 179:case 49:case 50:case 168:case 169:case 175:case 170:case 171:case 172:case 97:case 76:case
32:case 173:case 35:case 80:case 81:case 79:return-1;case 176:case 177:case 7:case 155:case 8:case 157:case
125:case 126:case 92:case 93:case 129:case 130:case 131:case 94:case 91:return 1;case 74:case 60:case 69:case
70:case 4:return 1024;case 31:case 42:case 72:return 32;case 87:case 26:case 33:return 2147483647;case 34:case
1:return 47839;case 38:case 36:return 99;case 43:case 37:return 2048;case 0:return 2097152;case 3:return
65536;case 28:return 32768;case 44:return 32767;case 75:return 16384;case 39:return 1e3;case 89:return 700;case
71:return 256;case 40:return 255;case 2:return 100;case 180:return 64;case 25:return 20;case 5:return 16;case
6:return
6;case 73:return 4;case 84:{if(typeof navigator===\"object\")return navigator[\"hardwareConcurrency\"]||1;return
1}}setErrNo(28);return-1}if(!ENVIRONMENT_IS_PTHREAD)PThread.initMainThreadBlock();var GLctx;var
proxiedFunctionTable=[null,_atexit,_emsripten_set_canvas_element_size_main_thread,_fd_close,_fd_seek,_fd_wr
ite,_sysconf];var
asmLibraryArg={\"e\":__assert_fail,\"r\":__call_main,\"x\":_emsripten_notify_thread_queue,\"b\":_abort,\"y\":
_emsripten_asm_const_int,\"j\":_emsripten_conditional_set_current_thread_status,\"d\":_emsripten_futex_wait,\"
c\":_emsripten_futex_wake,\"f\":_emsripten_get_now,\"p\":_emsripten_memcpy_big,\"A\":_emsripten_num_l
ogical_cores,\"u\":_emsripten_receive_on_main_thread_js,\"q\":_emsripten_resize_heap,\"v\":_emsripten_set_ca
nvas_element_size,\"i\":_emsripten_set_current_thread_status,\"s\":_emsripten_set_thread_name,\"w\":_emscript
en_webgl_create_context,\"l\":_fd_close,\"n\":_fd_seek,\"g\":_fd_write,\"o\":initPthreadsJS,\"a\":wasmMemory||Mo
dule[\"wasmMemory\"],\"z\":_pthread_cleanup_pop,\"k\":_pthread_cleanup_push,\"h\":_pthread_create,\"m\":_pthr
ead_join,\"t\":_sysconf};var
asm=createWasm();var
__wasm_call_ctors=Module[\"__wasm_call_ctors\"]=function(){return(__wasm_call_ctors=Module[\"__wasm
_call_ctors\"]=Module[\"asm\"][\"B\"]).apply(null,arguments)};var
_init=Module[\"_init\"]=function(){return(_init=Module[\"_init\"]=Module[\"asm\"][\"C\"]).apply(null,arguments)};
var
_init_with_threads_count=Module[\"_init_with_threads_count\"]=function(){return(_init_with_threads_count=Mod
ule[\"_init_with_threads_count\"]=Module[\"asm\"][\"D\"]).apply(null,arguments)};var
_get_threads_count=Module[\"_get_threads_count\"]=function(){return(_get_threads_count=Module[\"_get_threads
_count\"]=Module[\"asm\"][\"E\"]).apply(null,arguments)};var
_register_tensor=Module[\"_register_tensor\"]=function(){return(_register_tensor=Module[\"_register_tensor\"]=M
odule[\"asm\"][\"F\"]).apply(null,arguments)};var
_dispose_data=Module[\"_dispose_data\"]=function(){return(_dispose_data=Module[\"_dispose_data\"]=Module[\"
asm\"][\"G\"]).apply(null,arguments)};var
_dispose=Module[\"_dispose\"]=function(){return(_dispose=Module[\"_dispose\"]=Module[\"asm\"][\"H\"]).apply(
null,arguments)};var
_Abs=Module[\"_Abs\"]=function(){return(_Abs=Module[\"_Abs\"]=Module[\"asm\"][\"J\"]).apply(null,arguments
)};var
_Add=Module[\"_Add\"]=function(){return(_Add=Module[\"_Add\"]=Module[\"asm\"][\"K\"]).apply(null,argumen
ts)};var
_AddN=Module[\"_AddN\"]=function(){return(_AddN=Module[\"_AddN\"]=Module[\"asm\"][\"L\"]).apply(null,ar
guments)};var
_All=Module[\"_All\"]=function(){return(_All=Module[\"_All\"]=Module[\"asm\"][\"M\"]).apply(null,arguments)};

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var
_Any=Module["_Any"]=function(){return(_Any=Module["_Any"]=Module["asm"]()["N"]).apply(null,arguments)};var
_ArgMax=Module["_ArgMax"]=function(){return(_ArgMax=Module["_ArgMax"]=Module["asm"]()["O"]).apply(null,arguments)};var
_AvgPool=Module["_AvgPool"]=function(){return(_AvgPool=Module["_AvgPool"]=Module["asm"]()["P"]).apply(null,arguments)};var
_BatchMatMul=Module["_BatchMatMul"]=function(){return(_BatchMatMul=Module["_BatchMatMul"]=Module["asm"]()["Q"]).apply(null,arguments)};var
_Ceil=Module["_Ceil"]=function(){return(_Ceil=Module["_Ceil"]=Module["asm"]()["R"]).apply(null,arguments)};var
_ClipByValue=Module["_ClipByValue"]=function(){return(_ClipByValue=Module["_ClipByValue"]=Module["asm"]()["S"]).apply(null,arguments)};var
_Conv2D=Module["_Conv2D"]=function(){return(_Conv2D=Module["_Conv2D"]=Module["asm"]()["T"]).apply(null,arguments)};var
_Conv2DBackpropInput=Module["_Conv2DBackpropInput"]=function(){return(_Conv2DBackpropInput=Module["_Conv2DBackpropInput"]=Module["asm"]()["U"]).apply(null,arguments)};var
_Cos=Module["_Cos"]=function(){return(_Cos=Module["_Cos"]=Module["asm"]()["V"]).apply(null,arguments)};var
_Cosh=Module["_Cosh"]=function(){return(_Cosh=Module["_Cosh"]=Module["asm"]()["W"]).apply(null,arguments)};var
_CropAndResize=Module["_CropAndResize"]=function(){return(_CropAndResize=Module["_CropAndResize"]=Module["asm"]()["X"]).apply(null,arguments)};var
_Cumsum=Module["_Cumsum"]=function(){return(_Cumsum=Module["_Cumsum"]=Module["asm"]()["Y"]).apply(null,arguments)};var
_DepthToSpace=Module["_DepthToSpace"]=function(){return(_DepthToSpace=Module["_DepthToSpace"]=Module["asm"]()["Z"]).apply(null,arguments)};var
_DepthwiseConv2dNative=Module["_DepthwiseConv2dNative"]=function(){return(_DepthwiseConv2dNative=Module["_DepthwiseConv2dNative"]=Module["asm"]()["_"]).apply(null,arguments)};var
_Elu=Module["_Elu"]=function(){return(_Elu=Module["_Elu"]=Module["asm"]()["$"]).apply(null,arguments)};var
_Equal=Module["_Equal"]=function(){return(_Equal=Module["_Equal"]=Module["asm"]()["aa"]).apply(null,arguments)};var
_Exp=Module["_Exp"]=function(){return(_Exp=Module["_Exp"]=Module["asm"]()["ba"]).apply(null,arguments)};var
_FlipLeftRight=Module["_FlipLeftRight"]=function(){return(_FlipLeftRight=Module["_FlipLeftRight"]=Module["asm"]()["ca"]).apply(null,arguments)};var
_Floor=Module["_Floor"]=function(){return(_Floor=Module["_Floor"]=Module["asm"]()["da"]).apply(null,arguments)};var
_FloorDiv=Module["_FloorDiv"]=function(){return(_FloorDiv=Module["_FloorDiv"]=Module["asm"]()["ea"]).apply(null,arguments)};var
_FusedBatchNorm=Module["_FusedBatchNorm"]=function(){return(_FusedBatchNorm=Module["_FusedBatchNorm"]=Module["asm"]()["fa"]).apply(null,arguments)};var
_FusedConv2D=Module["_FusedConv2D"]=function(){return(_FusedConv2D=Module["_FusedConv2D"]=Module["asm"]()["ga"]).apply(null,arguments)};var
_FusedDepthwiseConv2D=Module["_FusedDepthwiseConv2D"]=function(){return(_FusedDepthwiseConv2D=Module["_FusedDepthwiseConv2D"]=Module["asm"]()["ha"]).apply(null,arguments)};var
_Gather=Module["_Gather"]=function(){return(_Gather=Module["_Gather"]=Module["asm"]()["ia"]).apply(null,arguments)};var

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l,arguments));var
_GatherNd=Module["_GatherNd"]=function(){return(_GatherNd=Module["_GatherNd"]=Module["asm"])[\ja\
]).apply(null,arguments)};var
_Greater=Module["_Greater"]=function(){return(_Greater=Module["_Greater"]=Module["asm"])[\ka\]).apply(
null,arguments)};var
_GreaterEqual=Module["_GreaterEqual"]=function(){return(_GreaterEqual=Module["_GreaterEqual"]=Module[
"asm"])[\la\]).apply(null,arguments)};var
_LeakyRelu=Module["_LeakyRelu"]=function(){return(_LeakyRelu=Module["_LeakyRelu"]=Module["asm"])[\
ma\]).apply(null,arguments)};var
_Less=Module["_Less"]=function(){return(_Less=Module["_Less"]=Module["asm"])[\na\]).apply(null,argume
nts)};var
_LessEqual=Module["_LessEqual"]=function(){return(_LessEqual=Module["_LessEqual"]=Module["asm"])[\o
a\]).apply(null,arguments)};var
_Log=Module["_Log"]=function(){return(_Log=Module["_Log"]=Module["asm"])[\pa\]).apply(null,argument
s)};var
_LogicalAnd=Module["_LogicalAnd"]=function(){return(_LogicalAnd=Module["_LogicalAnd"]=Module["asm
"])[\qa\]).apply(null,arguments)};var
_Max=Module["_Max"]=function(){return(_Max=Module["_Max"]=Module["asm"])[\ra\]).apply(null,argume
nts)};var
_MaxPool=Module["_MaxPool"]=function(){return(_MaxPool=Module["_MaxPool"]=Module["asm"])[\sa\]).
apply(null,arguments)};var
_Maximum=Module["_Maximum"]=function(){return(_Maximum=Module["_Maximum"]=Module["asm"])[\t
a\]).apply(null,arguments)};var
_Mean=Module["_Mean"]=function(){return(_Mean=Module["_Mean"]=Module["asm"])[\ua\]).apply(null,ar
guments)};var
_Min=Module["_Min"]=function(){return(_Min=Module["_Min"]=Module["asm"])[\va\]).apply(null,argumen
ts)};var
_Minimum=Module["_Minimum"]=function(){return(_Minimum=Module["_Minimum"]=Module["asm"])[\wa
\]).apply(null,arguments)};var
_MirrorPad=Module["_MirrorPad"]=function(){return(_MirrorPad=Module["_MirrorPad"]=Module["asm"])[\x
a\]).apply(null,arguments)};var
_Multiply=Module["_Multiply"]=function(){return(_Multiply=Module["_Multiply"]=Module["asm"])[\ya\]).a
pply(null,arguments)};var
_Neg=Module["_Neg"]=function(){return(_Neg=Module["_Neg"]=Module["asm"])[\za\]).apply(null,argumen
ts)};var
_NonMaxSuppressionV3=Module["_NonMaxSuppressionV3"]=function(){return(_NonMaxSuppressionV3=Mod
ule["_NonMaxSuppressionV3"]=Module["asm"])[\Aa\]).apply(null,arguments)};var
_NonMaxSuppressionV4=Module["_NonMaxSuppressionV4"]=function(){return(_NonMaxSuppressionV4=Mod
ule["_NonMaxSuppressionV4"]=Module["asm"])[\Ba\]).apply(null,arguments)};var
_NonMaxSuppressionV5=Module["_NonMaxSuppressionV5"]=function(){return(_NonMaxSuppressionV5=Mod
ule["_NonMaxSuppressionV5"]=Module["asm"])[\Ca\]).apply(null,arguments)};var
_NotEqual=Module["_NotEqual"]=function(){return(_NotEqual=Module["_NotEqual"]=Module["asm"])[\Da\
]).apply(null,arguments)};var
_OneHot=Module["_OneHot"]=function(){return(_OneHot=Module["_OneHot"]=Module["asm"])[\Ea\]).appl
y(null,arguments)};var
_PadV2=Module["_PadV2"]=function(){return(_PadV2=Module["_PadV2"]=Module["asm"])[\Fa\]).apply(nu
ll,arguments)};var

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_Pow=Module["_Pow"]=function(){return(_Pow=Module["_Pow"]=Module["asm"][_"Ga"]).apply(null,arguments)};var
_Prelu=Module["_Prelu"]=function(){return(_Prelu=Module["_Prelu"]=Module["asm"][_"Ha"]).apply(null,arguments)};var
_Prod=Module["_Prod"]=function(){return(_Prod=Module["_Prod"]=Module["asm"][_"Ia"]).apply(null,arguments)};var
_RealDiv=Module["_RealDiv"]=function(){return(_RealDiv=Module["_RealDiv"]=Module["asm"][_"Ja"]).apply(null,arguments)};var
_Relu=Module["_Relu"]=function(){return(_Relu=Module["_Relu"]=Module["asm"][_"Ka"]).apply(null,arguments)};var
_Relu6=Module["_Relu6"]=function(){return(_Relu6=Module["_Relu6"]=Module["asm"][_"La"]).apply(null,arguments)};var
_ResizeBilinear=Module["_ResizeBilinear"]=function(){return(_ResizeBilinear=Module["_ResizeBilinear"]=Module["asm"][_"Ma"]).apply(null,arguments)};var
_Reverse=Module["_Reverse"]=function(){return(_Reverse=Module["_Reverse"]=Module["asm"][_"Na"]).apply(null,arguments)};var
_RotateWithOffset=Module["_RotateWithOffset"]=function(){return(_RotateWithOffset=Module["_RotateWithOffset"]=Module["asm"][_"Oa"]).apply(null,arguments)};var
_Round=Module["_Round"]=function(){return(_Round=Module["_Round"]=Module["asm"][_"Pa"]).apply(null,arguments)};var
_Rsqrt=Module["_Rsqrt"]=function(){return(_Rsqrt=Module["_Rsqrt"]=Module["asm"][_"Qa"]).apply(null,arguments)};var
_ScatterNd=Module["_ScatterNd"]=function(){return(_ScatterNd=Module["_ScatterNd"]=Module["asm"][_"Ra"]).apply(null,arguments)};var
_SelectV2=Module["_SelectV2"]=function(){return(_SelectV2=Module["_SelectV2"]=Module["asm"][_"Sa"]).apply(null,arguments)};var
_Sigmoid=Module["_Sigmoid"]=function(){return(_Sigmoid=Module["_Sigmoid"]=Module["asm"][_"Ta"]).apply(null,arguments)};var
_Sin=Module["_Sin"]=function(){return(_Sin=Module["_Sin"]=Module["asm"][_"Ua"]).apply(null,arguments)};var
_Softmax=Module["_Softmax"]=function(){return(_Softmax=Module["_Softmax"]=Module["asm"][_"Va"]).apply(null,arguments)};var
_Sqrt=Module["_Sqrt"]=function(){return(_Sqrt=Module["_Sqrt"]=Module["asm"][_"Wa"]).apply(null,arguments)};var
_Square=Module["_Square"]=function(){return(_Square=Module["_Square"]=Module["asm"][_"Xa"]).apply(null,arguments)};var
_SquaredDifference=Module["_SquaredDifference"]=function(){return(_SquaredDifference=Module["_SquaredDifference"]=Module["asm"][_"Ya"]).apply(null,arguments)};var
_Step=Module["_Step"]=function(){return(_Step=Module["_Step"]=Module["asm"][_"Za"]).apply(null,arguments)};var
_StridedSlice=Module["_StridedSlice"]=function(){return(_StridedSlice=Module["_StridedSlice"]=Module["asm"][_"a"]).apply(null,arguments)};var
_Sub=Module["_Sub"]=function(){return(_Sub=Module["_Sub"]=Module["asm"][_"$a"]).apply(null,arguments)};var
_Sum=Module["_Sum"]=function(){return(_Sum=Module["_Sum"]=Module["asm"][_"ab"]).apply(null,arguments)};var
_Tan=Module["_Tan"]=function(){return(_Tan=Module["_Tan"]=Module["asm"][_"bb"]).apply(null,arguments)};var

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_Tanh=Module["_Tanh"]=function(){return(_Tanh=Module["_Tanh"]=Module["asm"][\`cb\`]).apply(null,arguments)};var
_Tile=Module["_Tile"]=function(){return(_Tile=Module["_Tile"]=Module["asm"][\`db\`]).apply(null,arguments)};var
_TopK=Module["_TopK"]=function(){return(_TopK=Module["_TopK"]=Module["asm"][\`eb\`]).apply(null,arguments)};var
_Transform=Module["_Transform"]=function(){return(_Transform=Module["_Transform"]=Module["asm"][\`fb\`]).apply(null,arguments)};var
_Transpose=Module["_Transpose"]=function(){return(_Transpose=Module["_Transpose"]=Module["asm"][\`gb\`]).apply(null,arguments)};var
__FusedMatMul=Module["__FusedMatMul"]=function(){return(__FusedMatMul=Module["__FusedMatMul"]=Module["asm"][\`hb\`]).apply(null,arguments)};var
_malloc=Module["_malloc"]=function(){return(_malloc=Module["_malloc"]=Module["asm"][\`ib\`]).apply(null,arguments)};var
_free=Module["_free"]=function(){return(_free=Module["_free"]=Module["asm"][\`jb\`]).apply(null,arguments)};var
__errno_location=Module["__errno_location"]=function(){return(__errno_location=Module["__errno_location"]=Module["asm"][\`kb\`]).apply(null,arguments)};var
_emscripten_get_global_libc=Module["_emscripten_get_global_libc"]=function(){return(_emscripten_get_global_libc=Module["_emscripten_get_global_libc"]=Module["asm"][\`lb\`]).apply(null,arguments)};var
_pthread_self=Module["_pthread_self"]=function(){return(_pthread_self=Module["_pthread_self"]=Module["asm"][\`mb\`]).apply(null,arguments)};var
__pthread_tsd_run_dtors=Module["__pthread_tsd_run_dtors"]=function(){return(__pthread_tsd_run_dtors=Module["__pthread_tsd_run_dtors"]=Module["asm"][\`nb\`]).apply(null,arguments)};var
_emscripten_main_thread_process_queued_calls=Module["_emscripten_main_thread_process_queued_calls"]=function(){return(_emscripten_main_thread_process_queued_calls=Module["_emscripten_main_thread_process_queued_calls"]=Module["asm"][\`ob\`]).apply(null,arguments)};var
_emscripten_current_thread_process_queued_calls=Module["_emscripten_current_thread_process_queued_calls"]=function(){return(_emscripten_current_thread_process_queued_calls=Module["_emscripten_current_thread_process_queued_calls"]=Module["asm"][\`pb\`]).apply(null,arguments)};var
_emscripten_register_main_browser_thread_id=Module["_emscripten_register_main_browser_thread_id"]=function(){return(_emscripten_register_main_browser_thread_id=Module["_emscripten_register_main_browser_thread_id"]=Module["asm"][\`qb\`]).apply(null,arguments)};var
_emscripten_main_browser_thread_id=Module["_emscripten_main_browser_thread_id"]=function(){return(_emscripten_main_browser_thread_id=Module["_emscripten_main_browser_thread_id"]=Module["asm"][\`rb\`]).apply(null,arguments)};var
__emscripten_do_dispatch_to_thread=Module["__emscripten_do_dispatch_to_thread"]=function(){return(__emscripten_do_dispatch_to_thread=Module["__emscripten_do_dispatch_to_thread"]=Module["asm"][\`sb\`]).apply(null,arguments)};var
_emscripten_sync_run_in_main_thread_4=Module["_emscripten_sync_run_in_main_thread_4"]=function(){return(_emscripten_sync_run_in_main_thread_4=Module["_emscripten_sync_run_in_main_thread_4"]=Module["asm"][\`tb\`]).apply(null,arguments)};var
_emscripten_run_in_main_runtime_thread_js=Module["_emscripten_run_in_main_runtime_thread_js"]=function(){return(_emscripten_run_in_main_runtime_thread_js=Module["_emscripten_run_in_main_runtime_thread_js"]=Module["asm"][\`ub\`]).apply(null,arguments)};var
__emscripten_call_on_thread=Module["__emscripten_call_on_thread"]=function(){return(__emscripten_call_on_thread=Module["__emscripten_call_on_thread"]=Module["asm"][\`vb\`]).apply(null,arguments)};var
_emscripten_tls_init=Module["_emscripten_tls_init"]=function(){return(_emscripten_tls_init=Module["_emscript

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end_tls_init["]=Module["asm"][["wb"]].apply(null,arguments));var
__emscripten_thread_init=Module["__emscripten_thread_init"]=function(){return(__emscripten_thread_init=Mod
ule["__emscripten_thread_init"]=Module["asm"][["xb"]]).apply(null,arguments));var
stackSave=Module["stackSave"]=function(){return(stackSave=Module["stackSave"]=Module["asm"][["yb"]]).a
pply(null,arguments));var
stackRestore=Module["stackRestore"]=function(){return(stackRestore=Module["stackRestore"]=Module["asm"
][["zb"]]).apply(null,arguments));var
stackAlloc=Module["stackAlloc"]=function(){return(stackAlloc=Module["stackAlloc"]=Module["asm"][["Ab"
]).apply(null,arguments));var
__emscripten_stack_set_limits=Module["_emscripten_stack_set_limits"]=function(){return(__emscripten_stack_set
limits=Module["_emscripten_stack_set_limits"]=Module["asm"][["Bb"]]).apply(null,arguments));var
__memalign=Module["_memalign"]=function(){return(__memalign=Module["_memalign"]=Module["asm"][["Cb
"]]).apply(null,arguments));var
__emscripten_allow_main_runtime_queued_calls=Module["__emscripten_allow_main_runtime_queued_calls"]=1
0512;var
__emscripten_main_thread_futex=Module["__emscripten_main_thread_futex"]=12148;Module["cwrap"]=cwrap
;Module["PThread"]=PThread;Module["PThread"]=PThread;Module["wasmMemory"]=wasmMemory;Module
["ExitStatus"]=ExitStatus;var calledRun;function
ExitStatus(status){this.name="__ExitStatus__";this.message="Program terminated with
exit(\"+status+\")";this.status=status}dependenciesFulfilled=function
runCaller(){if(!calledRun)run();if(!calledRun)dependenciesFulfilled=runCaller};function
run(args){args=args||arguments_;if(runDependencies>0){return}if(ENVIRONMENT_IS_PTHREAD){readyPromis
eResolve(Module);initRuntime();postMessage({"cmd":"loaded"});return}preRun();if(runDependencies>0){retur
n}function
doRun(){if(calledRun)return;calledRun=true;Module["calledRun"]=true;if(ABORT)return;initRuntime();preMain(
);readyPromiseResolve(Module);if(Module["onRuntimeInitialized"]){Module["onRuntimeInitialized"]();postRun(
)}if(Module["setStatus"]){Module["setStatus"]("Running...");setTimeout(function(){setTimeout(function(){Mo
dule["setStatus"]("")},1);doRun()},1)}else{doRun()}Module["run"]=run;function
exit(status,implicit){if(implicit&&noExitRuntime&&status===0){return}if(!implicit){if(ENVIRONMENT_IS_PT
HREAD){postMessage({"cmd":"exitProcess","returnCode":status});throw new
ExitStatus(status)}else{}}if(noExitRuntime){}else{PThread.terminateAllThreads();EXITSTATUS=status;exitRunti
me();if(Module["onExit"]){Module["onExit"](status);ABORT=true}quit_(status,new
ExitStatus(status))}if(Module["preInit"]){if(typeof
Module["preInit"]=="function")Module["preInit"]=[Module["preInit"]];while(Module["preInit"].length>0){
Module["preInit"].pop()}if(ENVIRONMENT_IS_PTHREAD){noExitRuntime=false;PThread.initWorker()}run
();\n\n  return WasmBackendModuleThreadedSimd.ready\n\n\n})();\nif
(typeof exports === 'object' && typeof module === 'object')\n  module.exports =
WasmBackendModuleThreadedSimd;\nelse if (typeof define === 'function' && define['amd'])\n  define([],
function() { return WasmBackendModuleThreadedSimd; });\nelse if (typeof exports === 'object')\n
exports["WasmBackendModuleThreadedSimd"] = WasmBackendModuleThreadedSimd;\n", "export const
wasmWorkerContents = 'var Module={};function threadPrintErr(){var
text=Array.prototype.slice.call(arguments).join(" ");console.error(text)}function threadAlert(){var
text=Array.prototype.slice.call(arguments).join(
");postMessage({cmd:"alert",text:text,threadId:Module["_pthread_self"]()})}}var
err=threadPrintErr;this.alert=threadAlert;Module["instantiateWasm"]=function(info,receiveInstance){var
instance=new
WebAssembly.Instance(Module["wasmModule"],info);Module["wasmModule"]=null;receiveInstance(instance);r
eturn instance.exports};function

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moduleLoaded() { } this.onmessage=function(e){ try { if(e.data.cmd===\"load\") { Module[\"wasmModule\"] = e.data.wasmModule; Module[\"wasmMemory\"] = e.data.wasmMemory; Module[\"buffer\"] = Module[\"wasmMemory\"].buffer; Module[\"ENVIRONMENT_IS_PTHREAD\"] = true; if(typeof
e.data.urlOrBlob===\"string\") { importScripts(e.data.urlOrBlob) } else { var
objectUrl=URL.createObjectURL(e.data.urlOrBlob); importScripts(objectUrl); URL.revokeObjectURL(objectUrl) }
WasmBackendModuleThreadedSimd(Module).then(function(instance) { Module=instance; moduleLoaded() }) } else
if(e.data.cmd===\"objectTransfer\") { Module[\"PThread\"].receiveObjectTransfer(e.data) } else
if(e.data.cmd===\"run\") { Module[\"__performance_now_clock_drift\"] = performance.now() -
e.data.time; Module[\"__emscripten_thread_init\"](e.data.threadInfoStruct, 0, 0); var max=e.data.stackBase; var
top=e.data.stackBase+e.data.stackSize; Module[\"establishStackSpace\"](top, max); Module[\"__emscripten_tls_init\"](
); Module[\"PThread\"].receiveObjectTransfer(e.data); Module[\"PThread\"].setThreadStatus(Module[\"_pthread_self
\"](), 1); try { var
result=Module[\"invokeEntryPoint\"](e.data.start_routine, e.data.arg); if(!Module[\"getNoExitRuntime\"]()) Module[\"
PThread\"].threadExit(result) } catch(ex) { if(ex===\"Canceled!\") { Module[\"PThread\"].threadCancel() } else
if(ex!==\"unwind\") { if(ex instanceof
Module[\"ExitStatus\"] { if(Module[\"getNoExitRuntime\"]()) { } else { Module[\"PThread\"].threadExit(ex.status) } } el
se { Module[\"PThread\"].threadExit(-2); throw ex } } } else
if(e.data.cmd===\"cancel\") { if(Module[\"_pthread_self\"]()) { Module[\"PThread\"].threadCancel() } } else
if(e.data.target===\"setimmediate\") { } else
if(e.data.cmd===\"processThreadQueue\") { if(Module[\"_pthread_self\"]()) { Module[\"__emscripten_current_thread_
process_queued_calls\"]() } } else { err(\"worker.js received unknown command
\"+e.data.cmd); err(e.data) } } catch(ex) { err(\"worker.js onmessage() captured an uncaught exception:
\"+ex); if(ex&&ex.stack) err(ex.stack); throw ex } } if(typeof process===\"object\"&&typeof
process.versions===\"object\"&&typeof process.versions.node===\"string\") { self={location:{href: __filename}}; var
onmessage=this.onmessage; var
nodeWorkerThreads=require(\"worker_threads\"); global.Worker=nodeWorkerThreads.Worker; var
parentPort=nodeWorkerThreads.parentPort; parentPort.on(\"message\", function(data) { onmessage({data: data}) }); var
nodeFS=require(\"fs\"); var nodeRead=function(filename) { return nodeFS.readFileSync(filename, \"utf8\") }; function
globalEval(x) { global.require=require; global.Module=Module; eval.call(null, x) } importScripts=function(f) { globalEva
l(nodeRead(f)); postMessage=function(msg) { parentPort.postMessage(msg) }; if(typeof
performance===\"undefined\") { performance={now: function() { return Date.now() } } }; \"nvar
WasmBackendModule = (function() { \\n var _scriptDir = typeof document !== 'undefined' &&
document.currentScript ? document.currentScript.src : undefined; \\n if (typeof __filename !== 'undefined')
_scriptDir = _scriptDir || __filename; \\n return (\\nfunction(WasmBackendModule) { \\n WasmBackendModule =
WasmBackendModule || {}; \\n\\nvar Module=typeof
WasmBackendModule!==\"undefined\"?WasmBackendModule:{ }; \\nvar
readyPromiseResolve, readyPromiseReject; Module[\"ready\"] = new
Promise(function(resolve, reject) { readyPromiseResolve=resolve; readyPromiseReject=reject }); \\nvar
moduleOverrides={ }; var key; for(key in
Module) { if(Module.hasOwnProperty(key)) { moduleOverrides[key]=Module[key] } } var arguments_=[]; var
thisProgram=\\. /this.program\\\"; var quit_=function(status, toThrow) { throw toThrow }; \\nvar
ENVIRONMENT_IS_WEB=false; var ENVIRONMENT_IS_WORKER=false; var
ENVIRONMENT_IS_NODE=false; var ENVIRONMENT_IS_SHELL=false; ENVIRONMENT_IS_WEB=typeof
window===\"object\"; ENVIRONMENT_IS_WORKER=typeof
importScripts===\"function\"; ENVIRONMENT_IS_NODE=typeof process===\"object\"&&typeof
process.versions===\"object\"&&typeof
process.versions.node===\"string\"; ENVIRONMENT_IS_SHELL=!ENVIRONMENT_IS_WEB&&!ENVIRONM
ENT_IS_NODE&&!ENVIRONMENT_IS_WORKER; var scriptDirectory=\\. /\\\"; function

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locateFile(path){if(Module["locateFile"]){return Module["locateFile"](path,scriptDirectory)}return
scriptDirectory+path}var read_,readAsync,readBinary,setWindowTitle;var nodeFS;var
nodePath;if(ENVIRONMENT_IS_NODE){if(ENVIRONMENT_IS_WORKER){scriptDirectory=require("path").
dirname(scriptDirectory)+"\\"}else{scriptDirectory=__dirname+"\\"}read_=function
shell_read(filename,binary){if(!nodeFS)nodeFS=require("fs");if(!nodePath)nodePath=require("path");filename=n
odePath["normalize"](filename);return
nodeFS["readFileSync"](filename,binary?null:"utf8");}readBinary=function readBinary(filename){var
ret=read_(filename,true);if(!ret.buffer){ret=new Uint8Array(ret)}assert(ret.buffer);return
ret};if(process["argv"].length>1){thisProgram=process["argv"][1].replace(/\\/g,"\\")}arguments_=process["arg
v"].slice(2);process["on"]("uncaughtException",function(ex){if(!(ex instanceof ExitStatus)){throw
ex}});process["on"]("unhandledRejection",abort);quit_=function(status){process["exit"](status)};Module["insp
ect"]=function(){return"[Emscripten Module object]"}else
if(ENVIRONMENT_IS_SHELL){if(typeof read!=="undefined"){read_=function shell_read(f){return
read(f)}}readBinary=function readBinary(f){var data;if(typeof readbuffer==="function"){return new
Uint8Array(readbuffer(f))}data=read(f,"binary");assert(typeof data==="object");return data};if(typeof
scriptArgs!="undefined"){arguments_=scriptArgs}else if(typeof
arguments!="undefined"){arguments_=arguments}if(typeof
quit==="function"){quit_=function(status){quit(status)}}if(typeof print!=="undefined"){if(typeof
console==="undefined")console={};console.log=print;console.warn=console.error=typeof
printErr!="undefined"?printErr:print}else
if(ENVIRONMENT_IS_WEB||ENVIRONMENT_IS_WORKER){if(ENVIRONMENT_IS_WORKER){scriptDire
ctory=self.location.href}else if(typeof
document!=="undefined"&&document.currentScript){scriptDirectory=document.currentScript.src}if(_scriptDir){s
criptDirectory=_scriptDir}if(scriptDirectory.indexOf("blob:")!==0){scriptDirectory=scriptDirectory.substr(0,script
Directory.lastIndexOf("/")+1)}else{scriptDirectory=""}}read_=function(url){var
xhr=new XMLHttpRequest;xhr.open("GET",url,false);xhr.send(null);return
xhr.responseText};if(ENVIRONMENT_IS_WORKER){readBinary=function(url){var xhr=new
XMLHttpRequest;xhr.open("GET",url,false);xhr.responseType="arraybuffer";xhr.send(null);return new
Uint8Array(xhr.response)}}readAsync=function(url,onload,onerror){var xhr=new
XMLHttpRequest;xhr.open("GET",url,true);xhr.responseType="arraybuffer";xhr.onload=function(){if(xhr.status
===200||xhr.status===0&&xhr.response){onload(xhr.response);return}onerror();}xhr.onerror=onerror;xhr.send(null)}
}setWindowTitle=function(title){document.title=title}else{var
out=Module["print"]||console.log.bind(console);var err=Module["printErr"]||console.warn.bind(console);for(key
in
moduleOverrides){if(moduleOverrides.hasOwnProperty(key)){Module[key]=moduleOverrides[key]}}moduleOverr
ides=null;if(Module["arguments"]){arguments_=Module["arguments"]};if(Module["thisProgram"]){thisProgram=
Module["thisProgram"]};if(Module["quit"]){quit_=Module["quit"]};var
wasmBinary;if(Module["wasmBinary"]){wasmBinary=Module["wasmBinary"]};var
noExitRuntime=Module["noExitRuntime"]||true;if(typeof WebAssembly!=="object"){abort("no native wasm
support detected")}var wasmMemory;var ABORT=false;var EXITSTATUS;function
assert(condition,text){if(!condition){abort("Assertion failed: "+text)}}function getCFunc(ident){var
func=Module["_"+ident];assert(func,"Cannot call unknown function "+ident+" , make sure it is exported");return
func}function ccall(ident,returnType,argTypes,args,opts){var toC={"string":function(str){var
ret=0;if(str!==null&&str!==undefined&&str!==0){var
len=(str.length<<2)+1;ret=stackAlloc(len);stringToUTF8(str,ret,len)}return ret},"array":function(arr){var
ret=stackAlloc(arr.length);writeArrayToMemory(arr,ret);return ret}};function
convertReturnValue(ret){if(returnType==="string")return UTF8ToString(ret);if(returnType==="boolean")return

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Boolean(ret);return ret}var func=getCFunc(ident);var cArgs=[];var stack=0;if(args){for(var
i=0;i<args.length;i++){var
converter=toC[argTypes[i]];if(converter){if(stack===0)stack=stackSave();cArgs[i]=converter(args[i])}else{cArgs[i]
]=args[i]}}var ret=func.apply(null,cArgs);ret=convertReturnValue(ret);if(stack!==0)stackRestore(stack);return
ret}function cwrap(ident,returnType,argTypes,opts){argTypes=argTypes||[];var
numericArgs=argTypes.every(function(type){return type==="number"});var
numericRet=returnType!=="string";if(numericRet&&numericArgs&&!opts){return getCFunc(ident)}return
function(){return ccall(ident,returnType,argTypes,arguments,opts)}}var UTF8Decoder=typeof
TextDecoder!=="undefined"?new TextDecoder("utf8"):undefined;function
UTF8ArrayToString(heap,idx,maxBytesToRead){var endIdx=idx+maxBytesToRead;var
endPtr=idx;while(heap[endPtr]&&!(endPtr>=endIdx))++endPtr;if(endPtr-
idx>16&&heap.subarray&&UTF8Decoder){return UTF8Decoder.decode(heap.subarray(idx,endPtr))}else{var
str="";while(idx<endPtr){var u0=heap[idx++];if(!(u0&128)){str+=String.fromCharCode(u0);continue}var
u1=heap[idx++]&63;if((u0&224)===192){str+=String.fromCharCode((u0&31)<<6|u1);continue}var
u2=heap[idx++]&63;if((u0&240)===224){u0=(u0&15)<<12|u1<<6|u2}else{u0=(u0&7)<<18|u1<<12|u2<<6|heap[id
x++]&63;if(u0<65536){str+=String.fromCharCode(u0)}else{var ch=u0-
65536;str+=String.fromCharCode(55296|ch>>10,56320|ch&1023)}}}return str}function
UTF8ToString(ptr,maxBytesToRead){return
ptr?UTF8ArrayToString(HEAPU8,ptr,maxBytesToRead):""}function
stringToUTF8Array(str,heap,outIdx,maxBytesToWrite){if(!(maxBytesToWrite>0))return 0;var startIdx=outIdx;var
endIdx=outIdx+maxBytesToWrite-1;for(var i=0;i<str.length;++i){var
u=str.charCodeAt(i);if(u>=55296&&u<=57343){var
u1=str.charCodeAt(++i);u=65536+((u&1023)<<10|u1&1023)}if(u<=127){if(outIdx>=endIdx)break;heap[outIdx++]
=u}else if(u<=2047){if(outIdx+1>=endIdx)break;heap[outIdx++]=192|u>>6;heap[outIdx++]=128|u&63}else
if(u<=65535){if(outIdx+2>=endIdx)break;heap[outIdx++]=224|u>>12;heap[outIdx++]=128|u>>6&63;heap[outIdx
++]=128|u&63}else{if(outIdx+3>=endIdx)break;heap[outIdx++]=240|u>>18;heap[outIdx++]=128|u>>12&63;heap[
outIdx++]=128|u>>6&63;heap[outIdx++]=128|u&63}}heap[outIdx]=0;return
outIdx-startIdx}function stringToUTF8(str,outPtr,maxBytesToWrite){return
stringToUTF8Array(str,HEAPU8,outPtr,maxBytesToWrite)}function
writeArrayToMemory(array,buffer){HEAP8.set(array,buffer)}function
alignUp(x,multiple){if(x%multiple>0){x+=multiple-x%multiple}return x}var
buffer,HEAP8,HEAPU8,HEAP16,HEAPU16,HEAP32,HEAPU32,HEAPF32,HEAPF64;function
updateGlobalBufferAndViews(buf){buffer=buf;Module["HEAP8"]=HEAP8=new
Int8Array(buf);Module["HEAP16"]=HEAP16=new Int16Array(buf);Module["HEAP32"]=HEAP32=new
Int32Array(buf);Module["HEAPU8"]=HEAPU8=new Uint8Array(buf);Module["HEAPU16"]=HEAPU16=new
Uint16Array(buf);Module["HEAPU32"]=HEAPU32=new
Uint32Array(buf);Module["HEAPF32"]=HEAPF32=new
Float32Array(buf);Module["HEAPF64"]=HEAPF64=new
Float64Array(buf)}var INITIAL_MEMORY=Module["INITIAL_MEMORY"]||16777216;var wasmTable;var
__ATPRERUN__=[];var __ATINIT__=[];var __ATMAIN__=[];var __ATPOSTRUN__=[];var
runtimeInitialized=false;__ATINIT__.push({func:function(){__wasm_call_ctors()}});function
preRun(){if(Module["preRun"]){if(typeof
Module["preRun"]=="function")Module["preRun"]=[Module["preRun"]];while(Module["preRun"].length){a
ddOnPreRun(Module["preRun"].shift())}}callRuntimeCallbacks(__ATPRERUN__)}function
initRuntime(){runtimeInitialized=true;callRuntimeCallbacks(__ATINIT__)}function
preMain(){callRuntimeCallbacks(__ATMAIN__)}function postRun(){if(Module["postRun"]){if(typeof
Module["postRun"]=="function")Module["postRun"]=[Module["postRun"]];while(Module["postRun"].lengt
h){addOnPostRun(Module["postRun"].shift())}}callRuntimeCallbacks(__ATPOSTRUN__)}function

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addOnPreRun(cb){__ATPRERUN__.unshift(cb)}function addOnPostRun(cb){__ATPOSTRUN__.unshift(cb)}var
runDependencies=0;var runDependencyWatcher=null;var
dependenciesFulfilled=null;function
addRunDependency(id){runDependencies++;if(Module["monitorRunDependencies"]){Module["monitorRunDep
endencies"](runDependencies)}}function removeRunDependency(id){runDependencies--
;if(Module["monitorRunDependencies"]){Module["monitorRunDependencies"](runDependencies)}if(runDepend
encies==0){if(runDependencyWatcher!==null){clearInterval(runDependencyWatcher);runDependencyWatcher=nul
l}if(dependenciesFulfilled){var
callback=dependenciesFulfilled;dependenciesFulfilled=null;callback()}}Module["preloadedImages"]={};Module
["preloadedAudios"]={};function
abort(what){if(Module["onAbort"]){Module["onAbort"](what)}what+="\n";err(what);ABORT=true;EXITSTAT
US=1;what="abort("+what+"). Build with -s ASSERTIONS=1 for more info.";var e=new
WebAssembly.RuntimeError(what);readyPromiseReject(e);throw e}function hasPrefix(str,prefix){return
String.prototype.startsWith?str.startsWith(prefix):str.indexOf(prefix)===0}var
dataURIPrefix="data:application/octet-stream;base64,";function
isDataURI(filename){return hasPrefix(filename,dataURIPrefix)}var fileURIPrefix="\file://";function
isFileURI(filename){return hasPrefix(filename,fileURIPrefix)}var wasmBinaryFile="\tfjs-backend-
wasm.wasm";if(!isDataURI(wasmBinaryFile)){wasmBinaryFile=locateFile(wasmBinaryFile)}function
getBinary(file){try{if(file===wasmBinaryFile&&wasmBinary){return new
Uint8Array(wasmBinary)}if(readBinary){return readBinary(file)}else{throw"both async and sync fetching of the
wasm failed"}}catch(err){abort(err)}}function
getBinaryPromise(){if(!wasmBinary&&(ENVIRONMENT_IS_WEB||ENVIRONMENT_IS_WORKER)){if(typeof
fetch==="function"&&!isFileURI(wasmBinaryFile)){return fetch(wasmBinaryFile,{credentials:"same-
origin"}).then(function(response){if(!response["ok"]){throw"failed to load wasm binary file at
"+wasmBinaryFile+""}return response["arrayBuffer"]()}).catch(function(){return
getBinary(wasmBinaryFile)})}else{if(readAsync){return new
Promise(function(resolve,reject){readAsync(wasmBinaryFile,function(response){resolve(new
Uint8Array(response))),reject}))}}return Promise.resolve().then(function(){return
getBinary(wasmBinaryFile)})}function createWasm(){var info={"a":asmLibraryArg};function
receiveInstance(instance,module){var
exports=instance.exports;Module["asm"]=exports;wasmMemory=Module["asm"]()["j"];updateGlobalBufferAnd
Views(wasmMemory.buffer);wasmTable=Module["asm"]()["r"];removeRunDependency("wasm-
instantiate")}addRunDependency("wasm-instantiate");function
receiveInstantiatedSource(output){receiveInstance(output["instance"]);function
instantiateArrayBuffer(receiver){return getBinaryPromise().then(function(binary){return
WebAssembly.instantiate(binary,info)}).then(receiver,function(reason){err("failed to asynchronously prepare
wasm: "+reason);abort(reason)})}function instantiateAsync(){if(!wasmBinary&&typeof
WebAssembly.instantiateStreaming==="function"&&!isDataURI(wasmBinaryFile)&&!isFileURI(wasmBinaryFil
e)&&typeof
fetch==="function"){return fetch(wasmBinaryFile,{credentials:"same-origin"}).then(function(response){var
result=WebAssembly.instantiateStreaming(response,info);return
result.then(receiveInstantiatedSource,function(reason){err("wasm streaming compile failed: "+reason);err("falling
back to ArrayBuffer instantiation");return instantiateArrayBuffer(receiveInstantiatedSource)}))}else{return
instantiateArrayBuffer(receiveInstantiatedSource)}}if(Module["instantiateWasm"]){try{var
exports=Module["instantiateWasm"](info,receiveInstance);return exports}catch(e){err("Module.instantiateWasm
callback failed with error: "+e);return false}}instantiateAsync().catch(readyPromiseReject);return{}}function
callRuntimeCallbacks(callbacks){while(callbacks.length>0){var callback=callbacks.shift();if(typeof
callback==="function"){callback(Module);continue}var func=callback.func;if(typeof

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func===\"number\\"){if(callback.arg===undefined){wasmTable.get(func)()}else{wasmTable.get(func)(callback.arg)
} }else{func(callback.arg===undefined?null:callback.arg)} }function
_abort(){abort()}function
_emscripten_memcpy_big(dest,src,num){HEAPU8.copyWithin(dest,src,src+num)}function
_emscripten_get_heap_size(){return HEAPU8.length}function
emscripten_realloc_buffer(size){try{wasmMemory.grow(size-
buffer.byteLength+65535>>>16);updateGlobalBufferAndViews(wasmMemory.buffer);return
1} catch(e){}}function _emscripten_resize_heap(requestedSize){var oldSize=_emscripten_get_heap_size();var
maxHeapSize=2147483648;if(requestedSize>maxHeapSize){return false}for(var
cutDown=1;cutDown<=4;cutDown*=2){var
overGrownHeapSize=oldSize*(1+.2/cutDown);overGrownHeapSize=Math.min(overGrownHeapSize,requestedSize
+100663296);var
newSize=Math.min(maxHeapSize,alignUp(Math.max(requestedSize,overGrownHeapSize),65536));var
replacement=emscripten_realloc_buffer(newSize);if(replacement){return true}}return false}var
SYSCALLS={mappings:{},buffers:[null,[],[]],printChar:function(stream,curr){var
buffer=SYSCALLS.buffers[stream];if(curr===0||curr===10){(stream===1?out:err)(UTF8ArrayToString(buffer,0));
buffer.length=0}else{buffer.push(curr)}},varargs:undefined,get:function(){SYSCALLS.varargs+=4;var
ret=HEAP32[SYSCALLS.varargs-4>>2];return ret},getStr:function(ptr){var ret=UTF8ToString(ptr);return
ret},get64:function(low,high){return low}};function _fd_close(fd){return 0}function
_fd_seek(fd,offset_low,offset_high,whence,newOffset){}function _fd_write(fd,iov,iovcnt,pnum){var num=0;for(var
i=0;i<iovcnt;i++){var ptr=HEAP32[iov+i*8>>2];var len=HEAP32[iov+(i*8+4)>>2];for(var
j=0;j<len;j++){SYSCALLS.printChar(fd,HEAPU8[ptr+j])}num+=len}HEAP32[pnum>>2]=num;return 0}function
_pthread_create(){return 6}function _pthread_join(){return 28}function
setErrNo(value){HEAP32[___errno_location()>>2]=value;return value}function
_sysconf(name){switch(name){case 30:return 16384;case 85:var maxHeapSize=2147483648;return
maxHeapSize/16384;case 132:case 133:case 12:case 137:case 138:case 15:case 235:case 16:case
17:case 18:case 19:case 20:case 149:case 13:case 10:case 236:case 153:case 9:case 21:case 22:case 159:case
154:case 14:case 77:case 78:case 139:case 82:case 68:case 67:case 164:case 11:case 29:case 47:case 48:case 95:case
52:case 51:case 46:return 200809;case 27:case 246:case 127:case 128:case 23:case 24:case 160:case 161:case
181:case 182:case 242:case 183:case 184:case 243:case 244:case 245:case 165:case 178:case 179:case 49:case
50:case 168:case 169:case 175:case 170:case 171:case 172:case 97:case 76:case 32:case 173:case 35:case 80:case
81:case 79:return -1;case 176:case 177:case 7:case 155:case 8:case 157:case 125:case 126:case 92:case 93:case
129:case 130:case 131:case 94:case 91:return 1;case 74:case 60:case 69:case 70:case 4:return 1024;case 31:case
42:case 72:return 32;case 87:case 26:case 33:return 2147483647;case 34:case 1:return 47839;case 38:case 36:return
99;case 43:case 37:return 2048;case 0:return 2097152;case 3:return 65536;case 28:return 32768;case 44:return
32767;case
75:return 16384;case 39:return 1e3;case 89:return 700;case 71:return 256;case 40:return 255;case 2:return 100;case
180:return 64;case 25:return 20;case 5:return 16;case 6:return 6;case 73:return 4;case 84:{if(typeof
navigator===\"object\")return navigator[\"hardwareConcurrency\"]||1;return 1}}setErrNo(28);return -1}var
asmLibraryArg={\"a\":_abort,\"d\":_emscripten_memcpy_big,\"e\":_emscripten_resize_heap,\"f\":_fd_close,\"c\":_f
d_seek,\"b\":_fd_write,\"h\":_pthread_create,\"g\":_pthread_join,\"i\":_sysconf};var asm=createWasm();var
___wasm_call_ctors=Module[\"___wasm_call_ctors\"]=function(){return(___wasm_call_ctors=Module[\"___wasm
_call_ctors\"])=Module[\"asm\"][\"k\"]}.apply(null,arguments)};var
_init=Module[\"_init\"]=function(){return(_init=Module[\"_init\"])=Module[\"asm\"][\"l\"]}.apply(null,arguments)};
var
_init_with_threads_count=Module[\"_init_with_threads_count\"]=function(){return(_init_with_threads_count=Mod
ule[\"_init_with_threads_count\"])=Module[\"asm\"][\"m\"]}.apply(null,arguments)};var

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_get_threads_count=Module["_get_threads_count"]=function(){return(_get_threads_count=Module["_get_threads_count"]=Module["_asm"][_"n"]).apply(null,arguments)};var
_register_tensor=Module["_register_tensor"]=function(){return(_register_tensor=Module["_register_tensor"]=Module["_asm"][_"o"]).apply(null,arguments)};var
_dispose_data=Module["_dispose_data"]=function(){return(_dispose_data=Module["_dispose_data"]=Module["_asm"][_"p"]).apply(null,arguments)};var
_dispose=Module["_dispose"]=function(){return(_dispose=Module["_dispose"]=Module["_asm"][_"q"]).apply(null,arguments)};var
_Abs=Module["_Abs"]=function(){return(_Abs=Module["_Abs"]=Module["_asm"][_"s"]).apply(null,arguments)};var
_Add=Module["_Add"]=function(){return(_Add=Module["_Add"]=Module["_asm"][_"t"]).apply(null,arguments)};var
_AddN=Module["_AddN"]=function(){return(_AddN=Module["_AddN"]=Module["_asm"][_"u"]).apply(null,arguments)};var
_All=Module["_All"]=function(){return(_All=Module["_All"]=Module["_asm"][_"v"]).apply(null,arguments)};var
_Any=Module["_Any"]=function(){return(_Any=Module["_Any"]=Module["_asm"][_"w"]).apply(null,arguments)};var
_ArgMax=Module["_ArgMax"]=function(){return(_ArgMax=Module["_ArgMax"]=Module["_asm"][_"x"]).apply(null,arguments)};var
_AvgPool=Module["_AvgPool"]=function(){return(_AvgPool=Module["_AvgPool"]=Module["_asm"][_"y"]).apply(null,arguments)};var
_BatchMatMul=Module["_BatchMatMul"]=function(){return(_BatchMatMul=Module["_BatchMatMul"]=Module["_asm"][_"z"]).apply(null,arguments)};var
_Ceil=Module["_Ceil"]=function(){return(_Ceil=Module["_Ceil"]=Module["_asm"][_"A"]).apply(null,arguments)};var
_ClipByValue=Module["_ClipByValue"]=function(){return(_ClipByValue=Module["_ClipByValue"]=Module["_asm"][_"B"]).apply(null,arguments)};var
_Conv2D=Module["_Conv2D"]=function(){return(_Conv2D=Module["_Conv2D"]=Module["_asm"][_"C"]).apply(null,arguments)};var
_Conv2DBackpropInput=Module["_Conv2DBackpropInput"]=function(){return(_Conv2DBackpropInput=Module["_Conv2DBackpropInput"]=Module["_asm"][_"D"]).apply(null,arguments)};var
_Cos=Module["_Cos"]=function(){return(_Cos=Module["_Cos"]=Module["_asm"][_"E"]).apply(null,arguments)};var
_Cosh=Module["_Cosh"]=function(){return(_Cosh=Module["_Cosh"]=Module["_asm"][_"F"]).apply(null,arguments)};var
_CropAndResize=Module["_CropAndResize"]=function(){return(_CropAndResize=Module["_CropAndResize"]=Module["_asm"][_"G"]).apply(null,arguments)};var
_Cumsum=Module["_Cumsum"]=function(){return(_Cumsum=Module["_Cumsum"]=Module["_asm"][_"H"]).apply(null,arguments)};var
_DepthToSpace=Module["_DepthToSpace"]=function(){return(_DepthToSpace=Module["_DepthToSpace"]=Module["_asm"][_"I"]).apply(null,arguments)};var
_DepthwiseConv2dNative=Module["_DepthwiseConv2dNative"]=function(){return(_DepthwiseConv2dNative=Module["_DepthwiseConv2dNative"]=Module["_asm"][_"J"]).apply(null,arguments)};var
_Elu=Module["_Elu"]=function(){return(_Elu=Module["_Elu"]=Module["_asm"][_"K"]).apply(null,arguments)};var
_Equal=Module["_Equal"]=function(){return(_Equal=Module["_Equal"]=Module["_asm"][_"L"]).apply(null,arguments)};var

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_Exp=Module["_Exp"]=function(){return(_Exp=Module["_Exp"]=Module["asm"][_"M"]).apply(null,arguments)};var
_FlipLeftRight=Module["_FlipLeftRight"]=function(){return(_FlipLeftRight=Module["_FlipLeftRight"]=Module["asm"][_"N"]).apply(null,arguments)};var
_Floor=Module["_Floor"]=function(){return(_Floor=Module["_Floor"]=Module["asm"][_"O"]).apply(null,arguments)};var
_FloorDiv=Module["_FloorDiv"]=function(){return(_FloorDiv=Module["_FloorDiv"]=Module["asm"][_"P"]).apply(null,arguments)};var
_FusedBatchNorm=Module["_FusedBatchNorm"]=function(){return(_FusedBatchNorm=Module["_FusedBatchNorm"]=Module["asm"][_"Q"]).apply(null,arguments)};var
_FusedConv2D=Module["_FusedConv2D"]=function(){return(_FusedConv2D=Module["_FusedConv2D"]=Module["asm"][_"R"]).apply(null,arguments)};var
_FusedDepthwiseConv2D=Module["_FusedDepthwiseConv2D"]=function(){return(_FusedDepthwiseConv2D=Module["_FusedDepthwiseConv2D"]=Module["asm"][_"S"]).apply(null,arguments)};var
_Gather=Module["_Gather"]=function(){return(_Gather=Module["_Gather"]=Module["asm"][_"T"]).apply(null,arguments)};var
_GatherNd=Module["_GatherNd"]=function(){return(_GatherNd=Module["_GatherNd"]=Module["asm"][_"U"]).apply(null,arguments)};var
_Greater=Module["_Greater"]=function(){return(_Greater=Module["asm"][_"V"]).apply(null,arguments)};var
_GreaterEqual=Module["_GreaterEqual"]=function(){return(_GreaterEqual=Module["_GreaterEqual"]=Module["asm"][_"W"]).apply(null,arguments)};var
_LeakyRelu=Module["_LeakyRelu"]=function(){return(_LeakyRelu=Module["_LeakyRelu"]=Module["asm"][_"X"]).apply(null,arguments)};var
_Less=Module["_Less"]=function(){return(_Less=Module["asm"][_"Y"]).apply(null,arguments)};var
_LessEqual=Module["_LessEqual"]=function(){return(_LessEqual=Module["asm"][_"Z"]).apply(null,arguments)};var
_Log=Module["_Log"]=function(){return(_Log=Module["asm"][_" _"]).apply(null,arguments)};var
_LogicalAnd=Module["_LogicalAnd"]=function(){return(_LogicalAnd=Module["_LogicalAnd"]=Module["asm"][_"$"]).apply(null,arguments)};var
_Max=Module["_Max"]=function(){return(_Max=Module["_Max"]=Module["asm"][_"aa"]).apply(null,arguments)};var
_MaxPool=Module["_MaxPool"]=function(){return(_MaxPool=Module["_MaxPool"]=Module["asm"][_"ba"]).apply(null,arguments)};var
_Maximum=Module["_Maximum"]=function(){return(_Maximum=Module["_Maximum"]=Module["asm"][_"ca"]).apply(null,arguments)};var
_Mean=Module["_Mean"]=function(){return(_Mean=Module["_Mean"]=Module["asm"][_"da"]).apply(null,arguments)};var
_Min=Module["_Min"]=function(){return(_Min=Module["asm"][_"ea"]).apply(null,arguments)};var
_Minimum=Module["_Minimum"]=function(){return(_Minimum=Module["_Minimum"]=Module["asm"][_"fa"]).apply(null,arguments)};var
_MirrorPad=Module["_MirrorPad"]=function(){return(_MirrorPad=Module["_MirrorPad"]=Module["asm"][_"ga"]).apply(null,arguments)};var
_Multiply=Module["_Multiply"]=function(){return(_Multiply=Module["_Multiply"]=Module["asm"][_"ha"]).apply(null,arguments)};var

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_Neg=Module["_Neg"]=function(){return(_Neg=Module["_Neg"]=Module["asm"][_"ia"]).apply(null,arguments)};var
_NonMaxSuppressionV3=Module["_NonMaxSuppressionV3"]=function(){return(_NonMaxSuppressionV3=Module["_NonMaxSuppressionV3"]=Module["asm"][_"ja"]).apply(null,arguments)};var
_NonMaxSuppressionV4=Module["_NonMaxSuppressionV4"]=function(){return(_NonMaxSuppressionV4=Module["_NonMaxSuppressionV4"]=Module["asm"][_"ka"]).apply(null,arguments)};var
_NonMaxSuppressionV5=Module["_NonMaxSuppressionV5"]=function(){return(_NonMaxSuppressionV5=Module["_NonMaxSuppressionV5"]=Module["asm"][_"la"]).apply(null,arguments)};var
_NotEqual=Module["_NotEqual"]=function(){return(_NotEqual=Module["_NotEqual"]=Module["asm"][_"ma"]).apply(null,arguments)};var
_OneHot=Module["_OneHot"]=function(){return(_OneHot=Module["_OneHot"]=Module["asm"][_"na"]).apply(null,arguments)};var
_PadV2=Module["_PadV2"]=function(){return(_PadV2=Module["_PadV2"]=Module["asm"][_"oa"]).apply(null,arguments)};var
_Pow=Module["_Pow"]=function(){return(_Pow=Module["_Pow"]=Module["asm"][_"pa"]).apply(null,arguments)};var
_Prelu=Module["_Prelu"]=function(){return(_Prelu=Module["_Prelu"]=Module["asm"][_"qa"]).apply(null,arguments)};var
_Prod=Module["_Prod"]=function(){return(_Prod=Module["_Prod"]=Module["asm"][_"ra"]).apply(null,arguments)};var
_RealDiv=Module["_RealDiv"]=function(){return(_RealDiv=Module["_RealDiv"]=Module["asm"][_"sa"]).apply(null,arguments)};var
_Relu=Module["_Relu"]=function(){return(_Relu=Module["_Relu"]=Module["asm"][_"ta"]).apply(null,arguments)};var
_Relu6=Module["_Relu6"]=function(){return(_Relu6=Module["_Relu6"]=Module["asm"][_"ua"]).apply(null,arguments)};var
_ResizeBilinear=Module["_ResizeBilinear"]=function(){return(_ResizeBilinear=Module["_ResizeBilinear"]=Module["asm"][_"va"]).apply(null,arguments)};var
_Reverse=Module["_Reverse"]=function(){return(_Reverse=Module["_Reverse"]=Module["asm"][_"wa"]).apply(null,arguments)};var
_RotateWithOffset=Module["_RotateWithOffset"]=function(){return(_RotateWithOffset=Module["_RotateWithOffset"]=Module["asm"][_"xa"]).apply(null,arguments)};var
_Round=Module["_Round"]=function(){return(_Round=Module["_Round"]=Module["asm"][_"ya"]).apply(null,arguments)};var
_Rsqrt=Module["_Rsqrt"]=function(){return(_Rsqrt=Module["_Rsqrt"]=Module["asm"][_"za"]).apply(null,arguments)};var
_ScatterNd=Module["_ScatterNd"]=function(){return(_ScatterNd=Module["_ScatterNd"]=Module["asm"][_"Aa"]).apply(null,arguments)};var
_SelectV2=Module["_SelectV2"]=function(){return(_SelectV2=Module["_SelectV2"]=Module["asm"][_"Ba"]).apply(null,arguments)};var
_Sigmoid=Module["_Sigmoid"]=function(){return(_Sigmoid=Module["_Sigmoid"]=Module["asm"][_"Ca"]).apply(null,arguments)};var
_Sin=Module["_Sin"]=function(){return(_Sin=Module["_Sin"]=Module["asm"][_"Da"]).apply(null,arguments)};var
_Softmax=Module["_Softmax"]=function(){return(_Softmax=Module["_Softmax"]=Module["asm"][_"Ea"]).apply(null,arguments)};var
_Sqrt=Module["_Sqrt"]=function(){return(_Sqrt=Module["_Sqrt"]=Module["asm"][_"Fa"]).apply(null,arguments)};var

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_Square=Module["_Square"]=function(){return(_Square=Module["_Square"]=Module["asm"]()["Ga"]).apply(null,arguments)};var
_SquaredDifference=Module["_SquaredDifference"]=function(){return(_SquaredDifference=Module["_SquaredDifference"]=Module["asm"]()["Ha"]).apply(null,arguments)};var
_Step=Module["_Step"]=function(){return(_Step=Module["_Step"]=Module["asm"]()["Ia"]).apply(null,arguments)};var
_StridedSlice=Module["_StridedSlice"]=function(){return(_StridedSlice=Module["_StridedSlice"]=Module["asm"]()["Ja"]).apply(null,arguments)};var
_Sub=Module["_Sub"]=function(){return(_Sub=Module["_Sub"]=Module["asm"]()["Ka"]).apply(null,arguments)};var
_Sum=Module["_Sum"]=function(){return(_Sum=Module["_Sum"]=Module["asm"]()["La"]).apply(null,arguments)};var
_Tan=Module["_Tan"]=function(){return(_Tan=Module["_Tan"]=Module["asm"]()["Ma"]).apply(null,arguments)};var
_Tanh=Module["_Tanh"]=function(){return(_Tanh=Module["_Tanh"]=Module["asm"]()["Na"]).apply(null,arguments)};var
_Tile=Module["_Tile"]=function(){return(_Tile=Module["_Tile"]=Module["asm"]()["Oa"]).apply(null,arguments)};var
_TopK=Module["_TopK"]=function(){return(_TopK=Module["_TopK"]=Module["asm"]()["Pa"]).apply(null,arguments)};var
_Transform=Module["_Transform"]=function(){return(_Transform=Module["_Transform"]=Module["asm"]()["Qa"]).apply(null,arguments)};var
_Transpose=Module["_Transpose"]=function(){return(_Transpose=Module["_Transpose"]=Module["asm"]()["Ra"]).apply(null,arguments)};var
__FusedMatMul=Module["__FusedMatMul"]=function(){return(__FusedMatMul=Module["__FusedMatMul"]=Module["asm"]()["Sa"]).apply(null,arguments)};var
_malloc=Module["_malloc"]=function(){return(_malloc=Module["_malloc"]=Module["asm"]()["Ta"]).apply(null,arguments)};var
_free=Module["_free"]=function(){return(_free=Module["_free"]=Module["asm"]()["Ua"]).apply(null,arguments)};var
__errno_location=Module["__errno_location"]=function(){return(__errno_location=Module["__errno_location"]=Module["asm"]()["Va"]).apply(null,arguments)};var
stackSave=Module["stackSave"]=function(){return(stackSave=Module["stackSave"]=Module["asm"]()["Wa"]).apply(null,arguments)};var
stackRestore=Module["stackRestore"]=function(){return(stackRestore=Module["stackRestore"]=Module["asm"]()["Xa"]).apply(null,arguments)};var
stackAlloc=Module["stackAlloc"]=function(){return(stackAlloc=Module["stackAlloc"]=Module["asm"]()["Ya"]).apply(null,arguments)};Module["cwrap"]=cwrap;var calledRun;function
ExitStatus(status){this.name="ExitStatus";this.message="Program terminated with
exit("+status+")";this.status=status}dependenciesFulfilled=function
runCaller(){if(!calledRun)run();if(!calledRun)dependenciesFulfilled=runCaller};function
run(args){args=args||arguments;if(runDependencies>0){return}preRun();if(runDependencies>0){return}function
doRun(){if(calledRun)return;calledRun=true;Module["calledRun"]=true;if(ABORT)return;initRuntime();preMain(
);readyPromiseResolve(Module);if(Module["onRuntimeInitialized"])Module["onRuntimeInitialized"]();postRun(
)}if(Module["setStatus"]){Module["setStatus"]("Running...");setTimeout(function(){setTimeout(function(){Module["setStatus"]("")},1);doRun()},1)}else{doRun()}}Module["run"]=run;if(Module["preInit"]){if(typeof
Module["preInit"]=="function")Module["preInit"]=[Module["preInit"]];while(Module["preInit"].length>0){
Module["preInit"].pop()}run();\n\n\n

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return WasmBackendModule.ready\n}\n);\n});\nnif (typeof exports === 'object' && typeof module === 'object')\nmodule.exports = WasmBackendModule;\nelse if (typeof define === 'function' && define['amd'])\n  define([], function() { return WasmBackendModule; });\nelse if (typeof exports === 'object')\nexports[\"WasmBackendModule\"] = WasmBackendModule;\n\", \"/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,\n software distributed under the License is distributed on an \"AS IS\"\n BASIS,\n WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND,\n either express or implied.\n * See the License for the specific language governing permissions and\n limitations under the License.\n */\n=====\n*/\nimport './flags_wasm';\nimport { backend_util, BackendTimingInfo, DataStorage, DataType, deprecationWarn,\nengine, env, KernelBackend, TensorInfo, util } from '@tensorflow/tfjs-core';\nimport { BackendWasmModule, WasmFactoryConfig } from '../wasm-out/tfjs-backend-wasm';\nimport { BackendWasmThreadedSimdModule } from '../wasm-out/tfjs-backend-wasm-threaded-simd';\nimport wasmFactoryThreadedSimd from '../wasm-out/tfjs-backend-wasm-threaded-simd.js';\n// @ts-ignore\nimport { wasmWorkerContents } from '../wasm-out/tfjs-backend-wasm-threaded-simd.worker.js';\nimport wasmFactory from '../wasm-out/tfjs-backend-wasm.js';\ninterface TensorData {\n id: number;\n memoryOffset: number;\n shape: number[];\n dtype: DataType;\n refCount: number;\n /** Only used for string tensors,\n storing encoded bytes. */\n stringBytes?: Uint8Array[];\n}\nexexport type DataId = object; // object instead of {} to force non-primitive.\nexexport class BackendWasm extends KernelBackend {\n // 0 is reserved for null data ids.\n private dataIdNextNumber = 1;\n dataIdMap: DataStorage<TensorData>;\n constructor(public wasm: BackendWasmModule|BackendWasmThreadedSimdModule) {\n super();\n this.wasm.tfjs.initWithThreadsCount(threadsCount);\n actualThreadsCount = this.wasm.tfjs.getThreadsCount();\n this.dataIdMap = new DataStorage(this, engine());\n }\n write(values: backend_util.BackendValues, shape: number[], dtype: DataType):\n   DataId {\n const dataId = {id: this.dataIdNextNumber++};\n this.move(dataId, values, shape, dtype, 1);\n return dataId;\n }\n numDataIds(): number {\n return this.dataIdMap.numDataIds();\n }\n async time(f: () => void): Promise<BackendTimingInfo> {\n const start = util.now();\n f();\n const kernelMs = util.now() - start;\n return {kernelMs};\n }\n move(\n   dataId: DataId, values:\nbackend_util.BackendValues, shape: number[],\n   dtype: DataType, refCount: number): void {\n const id = this.dataIdNextNumber++; \n if (dtype === 'string') {\n const stringBytes = values as Uint8Array[];\n this.dataIdMap.set(\n     dataId,\n     {id, stringBytes, shape, dtype, memoryOffset: null, refCount});\n return;\n }\n const size = util.sizeFromShape(shape);\n const numBytes = size * util.bytesPerElement(dtype);\n const memoryOffset = this.wasm._malloc(numBytes);\n this.dataIdMap.set(dataId, {id, memoryOffset, shape, dtype, refCount});\n this.wasm.tfjs.registerTensor(id, size, memoryOffset);\n if (values != null) {\n this.wasm.HEAPU8.set(\n     new Uint8Array(\n         (values as backend_util.TypedArray).buffer,\n         (values as backend_util.TypedArray).byteOffset, numBytes),\nmemoryOffset);\n }\n }\n\n async read(dataId: DataId): Promise<backend_util.BackendValues> {\n return this.readSync(dataId);\n }\n readSync(dataId: DataId): backend_util.BackendValues {\n const {memoryOffset, dtype, shape, stringBytes} =\nthis.dataIdMap.get(dataId); \n if (dtype === 'string') {\n return stringBytes;\n }\n const bytes = this.wasm.HEAPU8.slice(\n     memoryOffset,\n     memoryOffset + util.sizeFromShape(shape) * util.bytesPerElement(dtype));\n return typedArrayFromBuffer(bytes.buffer, dtype);\n }\n /**\n * Dispose the memory if the dataId has 0 refCount. Return true if the memory\n * is released, false otherwise.\n * @param dataId\n * @oaram force Optional, remove the data regardless of refCount\n */\n disposeData(dataId: DataId, force = false): boolean {\n if (this.dataIdMap.has(dataId)) {\n const data =
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this.dataIdMap.get(dataId);\n    data.refCount--;\n    if (!force && data.refCount > 0) {\n        return false;\n    }\n    this.wasm._free(data.memoryOffset);\n    this.wasm.tfjs.disposeData(data.id);\n    this.dataIdMap.delete(dataId);\n    }\n    return true;\n    }\n\n    /** Return refCount of a `TensorData`. */\n    refCount(dataId: DataId): number {\n        if (this.dataIdMap.has(dataId)) {\n            const tensorData =\n                this.dataIdMap.get(dataId);\n            return tensorData.refCount;\n        }\n        return 0;\n    }\n\n    incRef(dataId: DataId) {\n        const data = this.dataIdMap.get(dataId);\n        if (data != null) {\n            data.refCount++;\n        }\n    }\n\n    floatPrecision():\n        32 {\n        return 32;\n    }\n\n    // Returns the memory offset of a tensor. Useful for debugging and unit\n    // testing.\n    getMemoryOffset(dataId: DataId): number {\n        return this.dataIdMap.get(dataId).memoryOffset;\n    }\n\n    dispose() {\n        this.wasm.tfjs.dispose();\n        if ('PThread' in this.wasm) {\n            this.wasm.PThread.terminateAllThreads();\n        }\n        this.wasm = null;\n    }\n\n    memory() {\n        return {unreliable:\n            false};\n    }\n\n    /**\n     * Make a tensor info for the output of an op. If `memoryOffset` is not\n     * present, this method allocates memory on the WASM heap. If `memoryOffset`\n     * is present, the memory was allocated elsewhere (in c++) and we just record\n     * the pointer where that memory lives.\n     */\n    makeOutput(shape: number[], dtype:\n        DataType, memoryOffset?: number):\n        TensorInfo {\n        let dataId: {};\n        if (memoryOffset == null) {\n            dataId = this.write(null /* values */, shape, dtype);\n        } else {\n            const id = this.dataIdNextNumber++;\n            dataId = {id};\n            this.dataIdMap.set(dataId, {id, memoryOffset, shape, dtype, refCount: 1});\n            const size =\n                util.sizeFromShape(shape);\n            this.wasm.tfjs.registerTensor(id, size, memoryOffset);\n        }\n        return {dataId,\n            shape, dtype};\n    }\n\n    typedArrayFromHeap({shape, dtype, dataId}: TensorInfo):\n        backend_util.TypedArray {\n        const buffer = this.wasm.HEAPU8.buffer;\n        const {memoryOffset} = this.dataIdMap.get(dataId);\n        const size = util.sizeFromShape(shape);\n        switch (dtype) {\n            case 'float32':\n                return new\n                    Float32Array(buffer, memoryOffset, size);\n            case 'int32':\n                return new Int32Array(buffer, memoryOffset,\n                    size);\n            case 'bool':\n                return new Uint8Array(buffer, memoryOffset, size);\n            default:\n                throw new\n                    Error(`Unknown dtype ${dtype}`);\n        }\n    }\n\n    function createInstantiateWasmFunc(path: string) {\n        // this\n        // will be replace by rollup plugin patchWechatWebAssembly in\n        // miniprogram's output.\n        // tslint:disable-next-line:no-any\n        return (imports: any, callback: any) => {\n            util.fetch(path, {credentials: 'same-\n                origin'}).then((response) => {\n                if (!response['ok']) {\n                    imports.env.a(`failed to load wasm binary file at\n                        '${path}'`);\n                }\n                response.arrayBuffer().then(binary => {\n                    WebAssembly.instantiate(binary,\n                        imports).then(output => {\n                        callback(output.instance, output.module);\n                    });\n                });\n            });\n            return {};\n        });\n    }\n\n    /**\n     * Returns the path of the WASM binary.\n     */\n    @param\n        simdSupported whether SIMD is supported\n     * @param\n        threadsSupported whether multithreading is supported\n     * @param\n        wasmModuleFolder the directory containing the WASM binaries.\n     */\n    function getPathToWasmBinary(\n        simdSupported: boolean, threadsSupported: boolean,\n        wasmModuleFolder: string) {\n        if (wasmPath != null) {\n            // If wasmPath is defined, the user has supplied a full path to\n            // the vanilla .wasm binary.\n            return\n                wasmPath;\n        }\n        let path: WasmBinaryName = 'tfjs-backend-wasm.wasm';\n        if (simdSupported &&\n            threadsSupported) {\n            path = 'tfjs-backend-wasm-threaded-simd.wasm';\n        } else if (simdSupported) {\n            path =\n                'tfjs-backend-wasm-simd.wasm';\n        }\n        if (wasmFileMap != null) {\n            if (wasmFileMap[path] != null) {\n                return\n                    wasmFileMap[path];\n            }\n        }\n        return\n            wasmModuleFolder + path;\n    }\n\n    /**\n     * Initializes the wasm\n     * module and creates the js <--> wasm bridge.\n     */\n     * NOTE: We wrap the wasm module in a object with property\n     * 'wasm' instead of\n     * returning Promise<BackendWasmModule> to avoid freezing Chrome (last tested\n     * in\n     * Chrome 76).\n     */\n     * nexport\n     * async function\n     * init(): Promise<{wasm: BackendWasmModule}> {\n        const\n            [simdSupported, threadsSupported] = await Promise.all([\n                env().getAsync('WASM_HAS_SIMD_SUPPORT'),\n                env().getAsync('WASM_HAS_MULTITHREAD_SUPPORT')\n            ]);\n        return\n            new Promise((resolve, reject) => {\n                const\n                    factoryConfig: WasmFactoryConfig = {};\n                /**\n                 * This function overrides the Emscripten\n                 * module\n                 * locateFile utility.\n                 */\n                 * @param\n                 * path The relative path to the file that needs to be loaded.\n                 * @param\n                 * prefix The path to the main JavaScript file's directory.\n                 */\n                 * ^\n                factoryConfig.locateFile = (path, prefix) => {\n                    if (path.endsWith('.worker.js')) {\n                        const\n                            response = wasmWorkerContents;\n                        const\n                            blob = new\n                                Blob([response], {type: 'application/javascript'});\n                    }\n                }\n            });\n    }\n
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    return URL.createObjectURL(blob);\n    }\n\n    if (path.endsWith('.wasm')) {\n        return
getPathToWasmBinary(\n            simdSupported as boolean, threadsSupported as boolean,\n            wasmPathPrefix
!= null ? wasmPathPrefix : prefix);\n    }\n    return prefix + path;\n    };\n\n    // Use the instantiateWasm override
when system fetch is not available.\n    // Reference:\n    // https://github.com/emscripten-
core/emscripten/blob/2bca083cbbd5a4133db61fbd74d04f7feecfa907/tests/manual_wasm_instantiate.html#L170\n
if (customFetch) {\n    factoryConfig.instantiateWasm =\ncreateInstantiateWasmFunc(getPathToWasmBinary(\n            simdSupported as boolean, threadsSupported as
boolean,\n            wasmPathPrefix != null ? wasmPathPrefix : ''));\n    }\n\n    let initialized = false;\n
factoryConfig.onAbort = () => {\n        if (initialized) {\n            // Emscripten already called console.warn so no need to
double log.\n            return;\n        }\n        if (initAborted) {\n            // Emscripten calls `onAbort` twice, resulting in double error\n
// messages.\n            return;\n        }\n        initAborted = true;\n        const rejectMsg =\n            'Make sure the server can
serve the `.wasm` file relative to the '\n            'bundled js file. For more details see
https://github.com/tensorflow/tfjs/blob/master/tfjs-backend-wasm/README.md#using-bundlers';\n
reject({message: rejectMsg});\n    };\n\n    let wasm: Promise<BackendWasmModule>;\n    // If `wasmPath` has
been defined we must initialize the vanilla module.\n    if (threadsSupported && simdSupported && wasmPath ==
null) {\n        factoryConfig.mainScriptUrlOrBlob = new Blob(\n            [\n                var WasmBackendModuleThreadedSimd = `
+\n                wasmFactoryThreadedSimd.toString(),\n                {type: 'text/javascript'});\n        wasm =
wasmFactoryThreadedSimd(factoryConfig);\n    } else {\n        // The wasmFactory works for both vanilla and SIMD
binaries.\n        wasm = wasmFactory(factoryConfig);\n    }\n\n    // The WASM module has been successfully
created by the factory.\n    // Any error will be caught by the onAbort callback defined above.\n
wasm.then((module) => {\n        initialized = true;\n        initAborted = false;\n\n        const voidReturnType: string =
null;\n        // Using the tfjs namespace to avoid conflict with emscripten's API.\n        module.tfjs = {\n            init:
module.cwrap('init', null, []),\n            initWithThreadsCount:\n                module.cwrap('init_with_threads_count', null,
['number']),\n            getThreadsCount: module.cwrap('get_threads_count', 'number', []),\n            registerTensor:
module.cwrap(\n                'register_tensor', null,\n                [\n                    'number', // id\n                    'number', // size\n
                    'number', // memoryOffset\n                ]),\n            disposeData: module.cwrap('dispose_data', voidReturnType,
['number']),\n            dispose: module.cwrap('dispose', voidReturnType,
[],\n            );\n\n            resolve({wasm: module});\n        });\n    });\n\n    function typedArrayFromBuffer(\n        buffer:
ArrayBuffer, dtype: DataType): backend_util.TypedArray {\n        switch (dtype) {\n            case 'float32':\n                return new
Float32Array(buffer);\n            case 'int32':\n                return new Int32Array(buffer);\n            case 'bool':\n                return new
Uint8Array(buffer);\n            default:\n                throw new Error(`Unknown dtype ${dtype}`);\n        }\n    }\n\n    const
wasmBinaryNames = [\n        'tfjs-backend-wasm.wasm', 'tfjs-backend-wasm-simd.wasm',\n        'tfjs-backend-wasm-
threaded-simd.wasm'\n    ] as const;\n    type WasmBinaryName = typeof wasmBinaryNames[number];\n\n    let
wasmPath: string = null;\n    let wasmPathPrefix: string = null;\n    let wasmFileMap: {[key in WasmBinaryName]?:
string} = {};\n    let initAborted = false;\n    let customFetch = false;\n\n    /**\n     * @deprecated Use `setWasmPaths`
instead.\n     * Sets the path to the `.wasm` file which will be fetched when the wasm\n     * backend is initialized. See\n     *
https://github.com/tensorflow/tfjs/blob/master/tfjs-backend-wasm/README.md#using-bundlers\n     * for more details.\n     * @param path wasm file path or url\n     * @param usePlatformFetch optional boolean to use
platform fetch to download\n     * the wasm file, default to false.\n     */\n    /**\n     * @doc {heading: 'Environment', namespace:
'wasm'}\n     */\n    export function setWasmPath(path: string, usePlatformFetch = false): void {\n        deprecationWarn(\n
'setWasmPath has been deprecated in favor of setWasmPaths and '\n        ' will be removed in a future release.);\n        if
(initAborted) {\n            throw new Error(\n                'The WASM backend was already initialized. Make sure you call '\n                `setWasmPath()` before you call `tf.setBackend()` or `tf.ready()``);\n        }\n        wasmPath = path;\n        customFetch =
usePlatformFetch;\n    }\n\n    /**\n     * Configures the locations of the WASM binaries.\n     */\n    /**\n     * @js\n     */\n    setWasmPaths({\n        * 'tfjs-backend-wasm.wasm': 'renamed.wasm',\n        * 'tfjs-backend-wasm-simd.wasm': 'renamed-simd.wasm',\n        *
'tfjs-backend-wasm-threaded-simd.wasm': 'renamed-threaded-simd.wasm'\n    } *);\n    tf.setBackend('wasm');\n\n    /**\n     * @param prefixOrFileMap This can be either a string or object.\n     * - (string) The path to the directory

```

where the WASM binaries are located.
 * Note that this prefix will be used to load each binary (vanilla, SIMD-enabled, threading-enabled, etc.).
 * - (object) Mapping from names of WASM binaries to custom full paths specifying the locations of those binaries. This is useful if your WASM binaries are not all located in the same directory, or if your WASM binaries have been renamed.
 * @param usePlatformFetch optional boolean to use platform fetch to download the wasm file, default to false.
 * @doc {heading: 'Environment', namespace: 'wasm'}
 * @next export function setWasmPaths(prefixOrFileMap: string | {[key in WasmBinaryName]?: string}, usePlatformFetch = false): void {
 * if (initAborted) {
 * throw new Error(`The WASM backend was already initialized. Make sure you call 'setWasmPaths()' before you call 'tf.setBackend()' or 'tf.ready()'`);
 * }
 * if (typeof prefixOrFileMap === 'string') {
 * wasmPathPrefix = prefixOrFileMap;
 * } else {
 * wasmFileMap = prefixOrFileMap;
 * const missingPaths = wasmBinaryNames.filter(name => wasmFileMap[name] == null);
 * if (missingPaths.length > 0) {
 * throw new Error(`There were no entries found for the following binaries: ` + missingPaths.join(',').
 * Please either call setWasmPaths with a map providing a path for each binary, or with a string indicating the directory where all the binaries can be found.`);
 * }
 * }
 * customFetch = usePlatformFetch;
 * }
 * }
 * ** Used in unit tests. *
 * @next export function resetWasmPath(): void {
 * wasmPath = null;
 * wasmPathPrefix = null;
 * wasmFileMap = {};
 * customFetch = false;
 * initAborted = false;
 * }
 * }
 * let threadsCount = -1;
 * let actualThreadsCount = -1;
 * * Sets the number of threads that will be used by XNNPACK to create threadpool (default to the number of logical CPU cores).
 * * This must be called before calling 'tf.setBackend('wasm')'.
 * @next export function setThreadsCount(numThreads: number) {
 * threadsCount = numThreads;
 * }
 * * Gets the actual threads count that is used by XNNPACK.
 * * It is set after the backend is initialized.
 * @next export function getThreadsCount(): number {
 * if (actualThreadsCount === -1) {
 * throw new Error('WASM backend not initialized.');
 * }
 * return actualThreadsCount;
 * }
 * }
 * ** @license See the LICENSE file. *
 * @next // This code is auto-generated, do not modify this file!
 * const version = '3.11.0';
 * @next { version };
 * }
 * ** @license * Copyright 2020 Google LLC. All Rights Reserved.
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```

=====
* @next import './flags_wasm';
* @next import {registerBackend} from '@tensorflow/tfjs-core';
* @next import {BackendWasm, init} from './backend_wasm';
* @next export {BackendWasm, getThreadsCount, setThreadsCount, setWasmPath, setWasmPaths} from './backend_wasm';
* @next export {version as version_wasm} from './version';
* @next const WASM_PRIORITY = 2;
* @next registerBackend('wasm', async () => {
*   const {wasm} = await init();
*   return new BackendWasm(wasm);
* }, WASM_PRIORITY);
* ], "names": [
  "_FusedMatMul", "util", "Abs", "backend_util", "Add", "AddN", "Identity", "setup", "Transpose", "All", "Any", "wasmFunc", "ArgMax", "AvgPool", "Reshape", "BatchMatMul", "slice_util", "buffer", "slice1", "mplCPU", "Slice", "BatchToSpaceND", "Cast", "Ceil", "ClipByValue", "concatImplCPU", "Concat", "Conv2D", "Conv2D", "BackpropInput", "Cos", "Cosh", "CropAndResize", "Cumsum", "DepthToSpace", "DepthwiseConv2dNative", "Elu", "supportsFullBroadcast", "Equal", "Exp", "ExpandDims", "Fill", "FlipLeftRight", "Floor", "FloorDiv", "FusedBatchNorm", "FusedConv2D", "FusedDepthwiseConv2D", "GatherNd", "GatherV2", "Greater", "GreaterEqual", "setupFunc", "LeakyRelu", "Less", "LessEqual", "Log", "LogicalAnd", "Max", "Maximum", "MaxPool", "Mean", "Min", "Minimum", "MirrorPad", "Multiply", "Neg", "NonMaxSuppressionV3", "NonMaxSuppressionV4", "NonMaxSuppressionV5", "kernelFunc", "NotEqual", "OneHot", "OnesLike", "Pack", "PadV2", "Pow", "Prelu", "Prod", "rangeImplCPU", "Range", "RealDiv", "Relu", "Relu6", "ResizeBilinear", "Reverse", "RotateWithOffset", "Round", "Rsqr", "ScatterNd", "Select", "Sigmoid", "Sin", "Softmax", "SpaceToBatchND", "SplitV", "Sqr", "Square", "SquaredDifference", "Step", "StridedSlice", "Sub", "Sum",

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Open Source Used In Cisco Meeting Server (formerly Acano Server) 3.7 4113

```

inputChannels: number, outputChannels: number,\n  outId: number) => void;\n\nfunction setup(backend:
BackendWasm) {\n  wasmConv2d = backend.wasm.cwrap(Conv2D,
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strideWidth\n    'number', // inputChannels\n    'number', // outputChannels\n    'number', // outId\n  ]);\n}\n\nfunction conv2d(\n  args: {inputs: Conv2DInputs, backend: BackendWasm, attrs: Conv2DAttrs}) {\n
const {inputs, attrs, backend} = args;\n\n  const {x, filter} = inputs;\n  const xId =
backend.dataIdMap.get(x.dataId).id;\n  const filterId = backend.dataIdMap.get(filter.dataId).id;\n\n  const {strides,
dilations, pad, dimRoundingMode, dataFormat} = attrs;\n  const $dataFormat =
backend_util.convertConv2DDataFormat(dataFormat);\n
  const convInfo = backend_util.computeConv2DInfo((x as Tensor4D).shape, (filter as Tensor4D).shape,
strides, dilations,\n    pad, dimRoundingMode, false, $dataFormat);\n\n  const filterHeight =
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padRight = convInfo.padInfo.right;\n  const padBottom = convInfo.padInfo.bottom;\n  const padLeft =
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convInfo.dilationWidth;\n  const strideHeight = convInfo.strideHeight;\n  const strideWidth =
convInfo.strideWidth;\n  const inputChannels = convInfo.inChannels;\n  const outputChannels =
convInfo.outChannels;\n  const isSamePad = convInfo.padInfo.type === 'SAME' ? 1 : 0;\n\n  if
(convInfo.dataFormat !== 'channelsLast') {\n    throw new Error(`\n    `wasm backend Conv2D does not support
dataFormat:` +\n      `${convInfo.dataFormat}`. Please
    use 'channelsLast'.`);\n  }\n\n  const out = backend.makeOutput(convInfo.outShape, 'float32');\n  const outId =
backend.dataIdMap.get(out.dataId).id;\n  wasmConv2d(\n    xId, x.shape[0], x.shape[1], x.shape[2], filterId,
filterHeight,\n    filterWidth, padTop, padRight, padBottom, padLeft, isSamePad,\n    dilationHeight,
dilationWidth, strideHeight, strideWidth, inputChannels,\n    outputChannels, outId);\n  return out;\n}\n\nexport
const conv2DConfig: KernelConfig = {\n  kernelName: Conv2D,\n  backendName: 'wasm',\n  setupFunc: setup,\n
kernelFunc: conv2d as { } as KernelFunc\n};\n"]

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Found in path(s):

* /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Conv2D.js.map

No license file was found, but licenses were detected in source scan.

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x.dtype);\n const xId = backend.dataIdMap.get(x.dataId).id;\n const outId =
backend.dataIdMap.get(out.dataId).id;\n const permBytes = new Uint8Array(new Int32Array(perm).buffer);\n
const xShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);\n\n wasmTranspose(\n    xId,
xShapeBytes, x.shape.length, CppDType[x.dtype], outId, permBytes,\n    perm.length);\n return
out;\n}\n\nfunction computeOutShape(inShape:
number[], perm: number[]): number[] {\n const outShape = new Array(inShape.length);\n for (let i = 0; i <
outShape.length; i++) {\n outShape[i] = inShape[perm[i]];\n }\n return outShape;\n}\n\nfunction
removeOneSizeDims(\n    shape: number[], perm: number[]): [number[], number[]] {\n const newShape: number[]
= [];\n const newPerm: number[] = [];\n for (let i = 0; i < shape.length; ++i) {\n if (shape[i] !== 1) {\n
newShape.push(shape[i]);\n }\n if (shape[perm[i]] !== 1) {\n newPerm.push(perm[i]);\n }\n }\n for (let i =
0; i < newPerm.length; ++i) {\n let minValIdx = -1;\n for (let j = 0; j < newPerm.length; ++j) {\n if
(newPerm[j] >= i &&\n (minValIdx === -1 || newPerm[minValIdx] > newPerm[j])) {\n minValIdx = j;\n
}\n }\n newPerm[minValIdx] = i;\n }\n return [newShape, newPerm];\n}\n\nexport const transposeConfig:
KernelConfig = {\n kernelName: Transpose,\n backendName: 'wasm',\n kernelFunc: transpose as { } as
KernelFunc,\n setupFunc: setup,\n};\n"}

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Found in path(s):

* /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Transpose.js.map

No license file was found, but licenses were detected in source scan.

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under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License
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writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT
WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific
language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport { Identity, IdentityInputs, KernelConfig, KernelFunc } from '@tensorflow/tfjs-core';\nimport
{ TensorInfo } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\n\nexport function
identity(args: { inputs: IdentityInputs, backend: BackendWasm }):\n    TensorInfo {\n const { inputs: { x }, backend } =
args;\n const out = backend.makeOutput(x.shape, x.dtype);\n const inVals = backend.typedArrayFromHeap(x);\n
const outVals = backend.typedArrayFromHeap(out);\n outVals.set(inVals);\n return
out;\n}\n\nexport const identityConfig: KernelConfig = {\n kernelName: Identity,\n backendName: 'wasm',\n
kernelFunc: identity as { } as KernelFunc,\n};\n"}

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Found in path(s):

* /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Identity.js.map

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```
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```

```
=====\n\n*\n\nimport { KernelConfig, KernelFunc, NonMaxSuppressionV3, NonMaxSuppressionV3Attrs, NonMaxSuppressionV3Inputs, TensorInfo } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from './backend_wasm';\nimport { parseResultStruct } from './NonMaxSuppression_util';\n\nlet wasmFunc: (\n  boxesId: number, scoresId: number, maxOutputSize: number,\n  iouThreshold: number, scoreThreshold: number\n) => number;\n\nfunction setup(backend: BackendWasm): void {\n  wasmFunc = backend.wasm.cwrap(\n    NonMaxSuppressionV3,\n    'number', // Result*\n    [\n      'number', // boxesId\n      'number', // scoresId\n      'number', // maxOutputSize\n      'number', // iouThreshold\n      'number', // scoreThreshold\n    ]\n  );\n\n  function kernelFunc(args: {\n    backend: BackendWasm,\n    inputs: NonMaxSuppressionV3Inputs,\n    attrs: NonMaxSuppressionV3Attrs\n  }): TensorInfo {\n    const { backend, inputs, attrs } = args;\n    const { iouThreshold, maxOutputSize, scoreThreshold } = attrs;\n    const { boxes, scores } = inputs;\n    const boxesId = backend.dataIdMap.get(boxes.dataId).id;\n    const scoresId = backend.dataIdMap.get(scores.dataId).id;\n    const resOffset =\n      wasmFunc(boxesId, scoresId, maxOutputSize, iouThreshold, scoreThreshold);\n    const { pSelectedIndices, selectedSize, pSelectedScores, pValidOutputs } =\n      parseResultStruct(backend, resOffset);\n    // Since we are not using scores for V3, we have to delete it from the heap.\n    backend.wasm._free(pSelectedScores);\n    backend.wasm._free(pValidOutputs);\n    const selectedIndicesTensor =\n      backend.makeOutput([selectedSize], 'int32', pSelectedIndices);\n    return selectedIndicesTensor;\n  }\n\n  export const nonMaxSuppressionV3Config: KernelConfig = {\n    kernelName: NonMaxSuppressionV3,\n    backendName: 'wasm',\n    setupFunc: setup,\n    kernelFunc: kernelFunc as { } as KernelFunc,\n  };\n}
```

Found in path(s):

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* /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/NonMaxSuppressionV3.js.map
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No license file was found, but licenses were detected in source scan.

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```
=====\n*\n\nimport { KernelConfig, KernelFunc, NonMaxSuppressionV5, NonMaxSuppressionV5Attrs, NonMaxSuppressionV5Inputs, TensorInfo } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from './backend_wasm';\nimport { parseResultStruct } from './NonMaxSuppression_util';\nlet wasmFunc:\n  (boxesId: number, scoresId: number, maxOutputSize: number,\n    iouThreshold: number, scoreThreshold: number, softNmsSigma: number) =>\n    number;\n\nfunction setup(backend: BackendWasm): void {\n  wasmFunc = backend.wasm.cwrap(\n    NonMaxSuppressionV5,\n    'number', // Result*\n    [\n      'number', // boxesId\n      'number', // scoresId\n      'number', // maxOutputSize\n      'number', // iouThreshold\n      'number', // scoreThreshold\n      'number', // softNmsSigma\n    ],\n  );\n\n  function kernelFunc(args: {\n    backend: BackendWasm,\n    inputs: NonMaxSuppressionV5Inputs,\n    attrs: NonMaxSuppressionV5Attrs\n  }): TensorInfo[] {\n    const { backend, inputs, attrs } = args;\n    const { iouThreshold, maxOutputSize, scoreThreshold, softNmsSigma } = attrs;\n    const { boxes, scores } = inputs;\n\n    const boxesId = backend.dataIdMap.get(boxes.dataId).id;\n    const scoresId = backend.dataIdMap.get(scores.dataId).id;\n\n    const resOffset = wasmFunc(\n      boxesId, scoresId, maxOutputSize, iouThreshold, scoreThreshold,\n      softNmsSigma\n    );\n\n    const { pSelectedIndices, selectedSize, pSelectedScores, pValidOutputs } =\n      parseResultStruct(backend, resOffset);\n\n    // Since we are not using validOutputs for V5, we have to delete it from\n    // the heap.\n    backend.wasm._free(pValidOutputs);\n\n    const selectedIndicesTensor =\n      backend.makeOutput([selectedSize], 'int32',\n        pSelectedIndices);\n    const selectedScoresTensor =\n      backend.makeOutput([selectedSize], 'float32',\n        pSelectedScores);\n\n    return [selectedIndicesTensor, selectedScoresTensor];\n  }\n\n  export const
```

```
nonMaxSuppressionV5Config: KernelConfig = {\n kernelName: NonMaxSuppressionV5,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: kernelFunc as {} as KernelFunc,\n};\n"]}
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Found in path(s):

* /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/NonMaxSuppressionV5.js.map

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```
=====
*\n\nimport { backend_util, Conv2DBackpropInput, Conv2DBackpropInputAttrs, Conv2DBackpropInputInputs,
  KernelConfig, KernelFunc, TensorInfo, util } from '@tensorflow/tfjs-core';\n\nimport { BackendWasm } from
'./backend_wasm';\n\nlet wasmConv2DBackpropInput: (\n  dyId: number, filterId: number, batchSize: number,
  filterHeight: number,\n  filterWidth: number, inHeight: number, inWidth: number, inChannels: number,\n  outHeight: number, outWidth: number, outChannels: number,\n  strideHeight: number, strideWidth: number,
  topPad: number, leftPad: number,\n  fltS0: number, fltS1: number, fltS2: number, xBatchStride: number,\n  xRowStride: number, xColStride: number, xChannelStride: number,\n  yBatchStride: number, yRowStride:
  number, yColStride: number,\n  yChannelStride: number, outId: number) => void;\n\nfunction setup(backend:
BackendWasm): void {\n  wasmConv2DBackpropInput = backend.wasm.cwrap(Conv2DBackpropInput, null, [\n
'number', // dyId\n 'number', // filterId\n 'number', // batchSize\n 'number', // filterHeight\n 'number', //
filterWidth\n
  'number', // inHeight\n 'number', // inWidth\n 'number', // inChannels\n 'number', // outHeight\n
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'number', // topPad\n 'number', // leftPad\n 'number', // fltS0\n 'number', // fltS1\n 'number', // fltS2\n
'number', // xBatchStride\n 'number', // xRowStride\n 'number', // xColStride\n 'number', // xChannelStride\n
'number', // yBatchStride\n 'number', // yRowStride\n 'number', // yColStride\n 'number', //
yChannelStride\n 'number', // outId\n ]);\n\nfunction conv2DBackpropInput(args: {\n  backend:
BackendWasm,\n  inputs: Conv2DBackpropInputInputs,\n  attrs: Conv2DBackpropInputAttrs\n}): TensorInfo {\n
const { backend, inputs, attrs } = args;\n  const { dy, filter } = inputs;\n  const { strides, pad, dataFormat,
dimRoundingMode, inputShape } = attrs;\n\n  const dilations = 1;\n\n  const $dataFormat
= backend_util.convertConv2DDataFormat(dataFormat);\n  const convInfo = backend_util.computeConv2DInfo(\n
inputShape, filter.shape as [number, number, number, number], strides,\n  dilations, pad, dimRoundingMode,
false /* depthwise */, $dataFormat);\n  const {\n    batchSize,\n    filterHeight,\n    filterWidth,\n    inChannels,\n
inHeight,\n    inWidth,\n    outChannels,\n    outHeight,\n    outWidth,\n    strideHeight,\n    strideWidth\n  } =
convInfo;\n\n  const topPad = filterHeight - 1 - convInfo.padInfo.top;\n  const leftPad = filterWidth - 1 -
convInfo.padInfo.left;\n\n  const isChannelsLast = convInfo.dataFormat === 'channelsLast';\n  const dxStrides =
util.computeStrides(convInfo.inShape);\n  const dyStrides = util.computeStrides(dy.shape);\n  const [fltS0, fltS1,
fltS2] = util.computeStrides(filter.shape);\n  const xBatchStride = dxStrides[0];\n  const xRowStride =
isChannelsLast ? dxStrides[1] : dxStrides[2];\n  const xColStride = isChannelsLast ? dxStrides[2]
: 1;\n  const xChannelStride = isChannelsLast ? 1 : dxStrides[1];\n  const yBatchStride = dyStrides[0];\n  const
yRowStride = isChannelsLast ? dyStrides[1] : dyStrides[2];\n  const yColStride = isChannelsLast ? dyStrides[2] :
1;\n  const yChannelStride = isChannelsLast ? 1 : dyStrides[1];\n\n  const out =
backend.makeOutput(convInfo.inShape, 'float32');\n  const outId = backend.dataIdMap.get(out.dataId).id;\n  const
dyId = backend.dataIdMap.get(dy.dataId).id;\n  const filterId = backend.dataIdMap.get(filter.dataId).id;\n\n
wasmConv2DBackpropInput(\n    dyId, filterId, batchSize, filterHeight, filterWidth, inHeight, inWidth,\n    inChannels, outHeight, outWidth, outChannels, strideHeight, strideWidth,\n    topPad, leftPad, fltS0, fltS1, fltS2,
xBatchStride, xRowStride,\n    xColStride, xChannelStride, yBatchStride, yRowStride, yColStride,\n    yChannelStride, outId);\n  return out;\n}\n\nexport const conv2DBackpropInputConfig: KernelConfig = {\n
kernelName: Conv2DBackpropInput,\n
  backendName: 'wasm',\n  setupFunc: setup,\n  kernelFunc: conv2DBackpropInput as {} as KernelFunc\n};\n\n"}
=====
```

Found in path(s):

* /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Conv2DBackpropInput.js.map

No license file was found, but licenses were detected in source scan.

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- * /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Pow.js
- * /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Conv2D.js
- * /tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/GatherV2.ts
- * /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Sigmoid.js
- * /tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/NonMaxSuppression_util.ts
- * /tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/ResizeBilinear.ts
- * /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Greater.d.ts
- * /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Max.js
- * /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Reshape.d.ts
- *
- /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Cast.js
- * /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/NonMaxSuppressionV5.d.ts
- * /tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/Multiply.ts
- * /tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/Slice.ts
- * /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/PadV2.d.ts
- * /tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/Reshape.ts
- * /tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/PadV2.ts
- * /tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/ArgMax.ts
- * /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/LogicalAnd.js

- * /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/DepthwiseConv2dNative.d.ts
- * /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Unpack.js
- * /tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/Transpose.ts
- * /tfjs-backend-wasm-zip/tfjs-backend-wasm/wasm-out/tfjs-backend-wasm.d.ts
- * /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/types.js
- *
- /tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/Concat.ts
- * /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Transpose.d.ts
- * /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/AddN.js
- * /tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/ExpandDims.ts
- * /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/CropAndResize.js
- * /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Maximum.js
- * /tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/MaxPool.ts
- * /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Min.d.ts
- * /tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/Rsqrt.ts
- * /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/ExpandDims.d.ts
- * /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Sin.js
- * /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/GreaterEqual.d.ts
- * /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Add.js
- * /tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/unary_kernel.ts
- * /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Less.js
- *
- /tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/Abs.ts
- * /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/setup_test.d.ts
- * /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/FusedDepthwiseConv2D.d.ts
- * /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Slice.d.ts
- * /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/FusedBatchNorm.js
- * /tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/Sin.ts
- * /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Abs.js
- * /tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/AvgPool.ts
- * /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/DepthwiseConv2dNative.js
- * /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Cos.js
- * /tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/Relu.ts
- * /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Relu6.js
- * /tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/Pow.ts
- * /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/SquaredDifference.js
- * /tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/Exp.ts
- *
- /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/NonMaxSuppression_util.d.ts
- * /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/NonMaxSuppression_util.js
- * /tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/Square.ts
- * /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/ScatterNd.js
- * /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/PadV2.js
- * /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Sigmoid.d.ts
- * /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/LessEqual.d.ts
- * /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Maximum.d.ts
- * /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Sub.js

No license file was found, but licenses were detected in source scan.

```
{ "version":3,"file":"Tan.js","sourceRoot":"","sources":["../src/kernels/Tan.ts"],"names":[],"mappings":"AAAA;,,,,;
;GAG;AACH,OAAO,EAAe,GAAG,EAAC,MAAM,uBAAuB,CAAC;AAExD,OAAO,EAAC,uBAAuB,EA
AC,MAAM,gBAAgB,CAAC;AACvD,MAAM,CAAC,MAAM,SAAS,GAAiB,uBAAuB,CAAC,GAAG,CAAC,CA
AC","sourcesContent":["/**\n * @license\n * Copyright 2021 Google LLC. All Rights Reserved.\n * Licensed
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License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n
* =====\n
*\nimport {KernelConfig, Tan} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from
'./unary_kernel';\nexport const tanConfig: KernelConfig = createUnaryKernelConfig(Tan);\n\n"]}
```

Found in path(s):

* /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Tan.js.map

No license file was found, but licenses were detected in source scan.

```
{ "version":3,"file":"tf-backend-
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dentity.ts","../src/kernels/Transpose.ts","../src/kernels/kernel_utils.ts","../src/kernels/All.ts","../src/kernels/Any.ts","..
../src/kernels/ArgMax.ts","../src/kernels/AvgPool.ts","../src/kernels/Reshape.ts","../src/kernels/BatchMatMul.ts","../no
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backend-cpu/dist/kernels/Range_impl.js","../node_modules/@tensorflow/tfjs-backend-
cpu/dist/kernels/Slice.js","../src/kernels/Slice.ts","../src/kernels/BatchToSpaceND.ts","../src/kernels/Cast.ts","../src/k
ernels/Ceil.ts","../src/kernels/ClipByValue.ts","../src/kernels/Concat.ts","../src/kernels/Conv2D.ts","../src/kernels/Co
nv2DBackpropInput.ts","../src/kernels/Cos.ts","../src/kernels/Cosh.ts","../src/kernels/CropAndResize.ts","../src/kerne
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","../src/kernels/Greater.ts","../src/kernels/GreaterEqual.ts","../src/kernels/LeakyRelu.ts","../src/kernels/Less.ts","../sr
c/kernels/LessEqual.ts","../src/kernels/Log.ts","../src/kernels/LogicalAnd.ts","../src/kernels/Max.ts","../src/kernels/M
aximum.ts","../src/kernels/MaxPool.ts","../src/kernels/Mean.ts","../src/kernels/Min.ts","../src/kernels/Minimum.ts",".
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ck.ts","../src/kernels/PadV2.ts","../src/kernels/Pow.ts","../src/kernels/Prelu.ts","../src/kernels/Prod.ts","../src/kernels/
Range.ts","../src/kernels/RealDiv.ts","../src/kernels/Relu.ts","../src/kernels/Relu6.ts","../src/kernels/ResizeBilinear.ts
","../src/kernels/Reverse.ts","../src/kernels/RotateWithOffset.ts","../src/kernels/Round.ts","../src/kernels/Rsqrt.ts","../
src/kernels/ScatterNd.ts","../src/kernels/Select.ts","../src/kernels/Sigmoid.ts","../src/kernels/Sin.ts","../src/kernels/Sof
tmax.ts","../src/kernels/SpaceToBatchND.ts","../src/kernels/SplitV.ts","../src/kernels/Sqrt.ts","../src/kernels/Square.ts
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../src/kernels/Sum.ts","../src/kernels/Tan.ts","../src/kernels/Tanh.ts","../src/kernels/Tile.ts","../src/kernels/TopK.ts","../
src/kernels/Transform.ts","../src/kernels/Unpack.ts","../src/kernels/ZerosLike.ts","../src/register_all_kernels.ts","../sr
```

```

c/flags_wasm.ts", "../wasm-out/tfjs-backend-wasm-threaded-simd.js", "../wasm-out/tfjs-backend-wasm-threaded-
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 * distributed under the License is distributed on an "AS IS" BASIS,
 * WITHOUT
WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.
 * See the License for the specific
language governing permissions and
 * limitations under the License.
 */
=====
 *
 * This enum must align with the enum defined in cc/backend.h.
 * export enum CppDType {
 *   float32 = 0,
 *   int32 = 1,
 *   bool = 2,
 *   string = 3,
 *   complex64 = 4
 * }
 * Must match enum in cc/fusable_activations.h.
 * export
enum FusableActivation {
 *   linear = 0,
 *   relu = 1,
 *   relu6 = 2,
 *   prelu = 3,
 *   leakyrelu = 4,
 *   sigmoid = 5,
 *   elu = 6
 * }
 */
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 * You
may obtain a copy of the License at
 * http://www.apache.org/licenses/LICENSE-2.0
 * Unless required
by applicable law or agreed to in writing, software
 * distributed under the License is distributed on an "AS IS" BASIS,
 * WITHOUT WARRANTIES OR
CONDITIONS OF ANY KIND, either express or implied.
 * See the License for the specific language governing
permissions and
 * limitations under the License.
 */
=====
 *
 * import { _FusedMatMul, _FusedMatMulAttrs, _FusedMatMulInputs, KernelConfig, KernelFunc } from
 '@tensorflow/tfjs-core';
 * import { BackendWasm } from '../backend_wasm';
 * import { FusableActivation } from
 './types';
 * let wasmFusedMatMul:
 *   (aId: number, aShape: Uint8Array, aShapeSize: number, bId: number,
 *   bShape: Uint8Array, bShapeSize: number, transposeA: boolean,
 *   transposeB: boolean, activation: number,
 *   biasId: number,
 *   preluActivationWeightsId: number, leakyreluAlpha: number, outId: number) =>
 *   void;
 * function setup(backend: BackendWasm) {
 *   wasmFusedMatMul = backend.wasm.cwrap(_FusedMatMul,
 *   null /* void */, [
 *     'number',
 *     // a_id
 *     'array', // a_shape
 *     'number', // a_shape.length
 *     'number', // b_id
 *     'array', // b_shape
 *     'number', // b_shape.length
 *     'number', // transpose_a
 *     'number', // transpose_b
 *     'number', // activation
 *     'number', // biasId
 *     'number', // preluActivationWeightsId
 *     'number', // leakyreluAlpha
 *     'number' //
 *     out_id
 *   ]);
 *   function fusedBatchMatMul(args: {
 *     inputs: _FusedMatMulInputs,
 *     backend:
BackendWasm,
 *     attrs: _FusedMatMulAttrs
 *   }) {
 *     const { inputs, backend, attrs } = args;
 *     const { a, b, bias,
 *     preluActivationWeights } = inputs;
 *     if (a.dtype !== 'float32' || b.dtype !== 'float32') {
 *       throw new Error(
 *         `_FusedMatMul for non non-float32 tensors not yet supported.`);
 *     }
 *     const { transposeA, transposeB,
 *     activation, leakyreluAlpha } = attrs;
 *     const aId = backend.dataIdMap.get(a.dataId).id;
 *     const bId =
 *     backend.dataIdMap.get(b.dataId).id;
 *     let biasId = 0;
 *     if (bias != null) {
 *       const biasData = backend.dataIdMap.get(bias.dataId);
 *       if (biasData.shape.length !== 1) {
 *         throw new
 *         Error(
 *           `_FusedMatMul only supports rank-1 bias but got ` +
 *           `rank ${biasData.shape.length}.`);
 *       }
 *       biasId = biasData.id;
 *     }
 *     const preluActivationWeightsId = preluActivationWeights == null ? 0 :
 *     backend.dataIdMap.get(preluActivationWeights.dataId).id;
 *     const fusedActivation =
 *     FusableActivation[activation as { } as keyof typeof FusableActivation];
 *     if (fusedActivation == null) {
 *       throw
 *       new Error(
 *         `${activation} activation not yet supported for FusedConv2D ` +
 *         `in the wasm backend.`);
 *     }
 *     const leftDim = transposeA ? a.shape[2] : a.shape[1];
 *     const rightDim = transposeB ? b.shape[1] :
 *     b.shape[2];
 *     const batchDim = a.shape[0];
 *     const out = backend.makeOutput([batchDim, leftDim, rightDim],
 *     a.dtype);
 *     const outId = backend.dataIdMap.get(out.dataId).id;
 *     const aShapeBytes = new Uint8Array(new

```

```
Int32Array(a.shape).buffer);\n const bShapeBytes = new Uint8Array(new Int32Array(b.shape).buffer);\n\nwasmFusedMatMul(\n  aId, aShapeBytes, a.shape.length, bId, bShapeBytes, b.shape.length,\n  transposeA,\n  transposeB, fusedActivation, biasId, preluActivationWeightsId,\n  leakyreluAlpha || 0, outId);\n\nreturn\nout);\n\n\nexport const fusedMatMulConfig: KernelConfig = {\n  kernelName: '_FusedMatMul',\n  backendName:\n  'wasm',\n  setupFunc: setup,\n  kernelFunc: fusedBatchMatMul as { } as KernelFunc\n};\n\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\n * License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or\n * agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
```

```
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n governing permissions and\n * limitations under the License.\n *
```

```
=====\n\n*\n\nimport {DataType, KernelConfig, TensorInfo, UnaryInputs, util} from '@tensorflow/tfjs-core';\n\nimport\n{BackendWasm} from '../backend_wasm';\n\nimport {CppType} from './types';\n\nexport function\ncreateUnaryKernelConfig(\n  kernelName: string, outType?: DataType): KernelConfig {\n  let wasmFunc: (xId:\n  number, dtype: number, outId: number) => void;\n\n  function setupFunc(backend: BackendWasm): void {\n    wasmFunc = backend.wasm.cwrap(kernelName, null /* void */, [\n      'number', // x_id\n      'number', // dtype\n      'number', // out_id\n    ]);\n  }\n\n  function kernelFunc(args: {backend: BackendWasm, inputs: UnaryInputs}): \n  TensorInfo {\n    const {backend, inputs: {x}} = args;\n    const xId = backend.dataIdMap.get(x.dataId).id;\n\n    const out = backend.makeOutput(x.shape, outType || x.dtype);\n    const outId =\n    backend.dataIdMap.get(out.dataId).id;\n\n    // Short-circuit zero-sized tensors.\n    if (util.sizeFromShape(out.shape)\n    === 0) {\n      return out;\n    }\n\n    wasmFunc(xId, CppDType[x.dtype], outId);\n    return out;\n  }\n\n  return\n  {kernelName, backendName: 'wasm', setupFunc, kernelFunc};\n}\n\n", "/*\n * @license\n * Copyright 2019 Google\n LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not\n use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\n OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n governing permissions\n and\n * limitations under the License.\n *
```

```
=====\n\n*\n\nimport {Abs, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from\n '../unary_kernel';\n\nexport const absConfig: KernelConfig = createUnaryKernelConfig(Abs);\n\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\n * License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or\n * agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n\n*\n\nimport {backend_util, BinaryInputs, DataType, KernelConfig, TensorInfo, util} from '@tensorflow/tfjs-\n core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport {CppType} from './types';\n\nexport\nfunction createBinaryKernelConfig(\n  kernelName: string, supportsFullBroadcast: boolean,\n  dtype?:\n  DataType): KernelConfig {\n  let wasmFunc:\n    (aId: number, aShape: Uint8Array, aShapeLen: number, bId:\n    number,\n    bShape: Uint8Array, bShapeLen: number, dtype: number, outId: number) =>\n    void;\n\n  function setupFunc(backend: BackendWasm): void {\n    wasmFunc = backend.wasm.cwrap(kernelName, null /*\n    void */, [\n      'number', // a_id,\n      'array', // a_shape\n      'number', // a_shape.length\n      'number', // b_id\n
```

```

'array', // b_shape\n    'number', // b_shape.length\n    'number', // dtype\n    'number' // out_id\n  ]);\n}\n\nfunction kernelFunc(args: {backend: BackendWasm, inputs: BinaryInputs});\n\n  TensorInfo {\n    const {backend, inputs} = args;\n    const {a, b} = inputs;\n    const aId =\n      backend.dataIdMap.get(a.dataId).id;\n    const bId = backend.dataIdMap.get(b.dataId).id;\n    const outputType =\n      dtype != null ? dtype : a.dtype;\n    const newShape = backend_util.assertAndGetBroadcastShape(a.shape,\n      b.shape);\n    const out = backend.makeOutput(newShape, outputType);\n    // Short-circuit zero-sized tensors.\n    if (util.sizeFromShape(newShape) === 0) {\n      return out;\n    }\n    const aShapeBytes = new Uint8Array(new\n      Int32Array(a.shape).buffer);\n    const bShapeBytes = new Uint8Array(new Int32Array(b.shape).buffer);\n    const\n      outId = backend.dataIdMap.get(out.dataId).id;\n    const kernelFunc = () => wasmFunc(\n      aId, aShapeBytes,\n      a.shape.length, bId, bShapeBytes, b.shape.length,\n      CppDType[a.dtype], outId);\n    // Currently only some\n    float operations support full broadcast.\n    if (supportsFullBroadcast && a.dtype === 'float32')\n      {\n        kernelFunc();\n        return out;\n      }\n    const aBroadcastDims = backend_util.getBroadcastDims(a.shape,\n      newShape);\n    const bBroadcastDims = backend_util.getBroadcastDims(b.shape, newShape);\n    const\n      loopsOverAllOfA = aBroadcastDims.every((v, i) => v === i);\n    const loopsOverAllOfB =\n      bBroadcastDims.every((v, i) => v === i);\n    if (loopsOverAllOfA && loopsOverAllOfB) {\n      kernelFunc();\n      return out;\n    } else {\n      throw new Error(\n        `Broadcasting along outer dims is not yet ` +\n        `supported for ${a.dtype} ${kernelName}.`);\n    }\n    return {kernelName, backendName: 'wasm', setupFunc,\n      kernelFunc};\n  }\n  /**\n   * @license\n   * Copyright 2019 Google LLC. All Rights Reserved.\n   * Licensed under the\n   Apache License, Version 2.0 (the "License");\n   * you may not use this file except in compliance with the\n   License.\n   * You may obtain a copy of the License at\n   * http://www.apache.org/licenses/LICENSE-2.0\n   * Unless required\n   by applicable law or agreed to in writing, software\n   * distributed under the License is distributed on an "AS IS"\n   BASIS,\n   * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n   * See the\n   License for the specific language governing permissions and\n   * limitations under the License.\n   *\n   =====\n\n   *\n   *\n   import {Add, KernelConfig} from '@tensorflow/tfjs-core';\n   import {createBinaryKernelConfig} from\n   './binary_kernel';\n   const supportsFullBroadcast = true;\n   export const addConfig: KernelConfig =\n   createBinaryKernelConfig(Add, supportsFullBroadcast);\n   /**\n    * @license\n    * Copyright 2019 Google LLC. All\n    Rights Reserved.\n    * Licensed under the Apache License, Version 2.0 (the "License");\n    * you may not use this\n    file except in compliance with the License.\n    * You may obtain a copy of the License at\n    * http://www.apache.org/licenses/LICENSE-2.0\n    * Unless required by applicable\n    law or agreed to in writing, software\n    * distributed under the License is distributed on an "AS IS" BASIS,\n    * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n    * See the License for\n    the specific language governing permissions and\n    * limitations under the License.\n    *\n    =====\n\n   *\n   *\n   import {AddN, KernelConfig, KernelFunc, TensorInfo, util} from '@tensorflow/tfjs-core';\n   import\n   {BackendWasm} from '../backend_wasm';\n   import {CppType} from './types';\n   let wasmFunc: (\n     inputIds:\n     Uint8Array, inputIdsLen: number, dtype: number, outId: number) =>\n     void;\n   function setupFunc(backend:\n     BackendWasm): void {\n     wasmFunc = backend.wasm.cwrap(AddN, null /* void */, [\n       'array', // input_ids\n       'number', // input_ids.length\n       'number', // dtype\n       'number', // out_id\n     ]);\n   }\n   function addn(args: {inputs:\n     TensorInfo[], backend: BackendWasm}) {\n     const {inputs,\n       backend} = args;\n     const out = backend.makeOutput(inputs[0].shape, inputs[0].dtype);\n     // Short-circuit zero-\n     sized tensors.\n     if (util.sizeFromShape(out.shape) === 0) {\n       return out;\n     }\n     const inputIds = inputs.map(x\n       => backend.dataIdMap.get(x.dataId).id);\n     const inputIdsBytes = new Uint8Array(new\n       Int32Array(inputIds).buffer);\n     const outId = backend.dataIdMap.get(out.dataId).id;\n     wasmFunc(inputIdsBytes,\n       inputIds.length, CppDType[out.dtype], outId);\n     return out;\n   }\n   export const addNConfig: KernelConfig = {\n     kernelName: AddN,\n     backendName: 'wasm',\n     setupFunc,\n     kernelFunc: addn as {\n       } as KernelFunc,\n   };\n   /**\n    * @license\n    * Copyright 2020 Google LLC. All Rights Reserved.\n    * Licensed under the Apache License, Version

```

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to in writing, software distributed under the License is distributed on an "AS IS" BASIS, WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied. See the License for the specific language governing permissions and limitations under the License.

```
=====
*
import {Identity, IdentityInputs, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';
import {TensorInfo} from '@tensorflow/tfjs-core';
import {BackendWasm} from '../backend_wasm';
export function identity(args: {inputs: IdentityInputs, backend: BackendWasm}): TensorInfo {
  const {inputs: {x}, backend} = args;
  const out = backend.makeOutput(x.shape, x.dtype);
  const inVals = backendtypedArrayFromHeap(x);
  const outVals = backendtypedArrayFromHeap(out);
  outVals.set(inVals);
  return out;
}
export const identityConfig: KernelConfig = {
  kernelName: Identity,
  backendName: 'wasm',

```

kernelFunc: identity as { } as KernelFunc;
};
"/**
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software distributed under the License is distributed on an "AS IS" BASIS,
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.
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```
=====
*
import {KernelConfig, KernelFunc, TensorInfo, Transpose, TransposeAttrs, TransposeInputs} from '@tensorflow/tfjs-core';
import {BackendWasm} from '../backend_wasm';
import {identity} from './Identity';
import {CppType} from './types';
let wasmTranspose: (xId: number, xShape: Uint8Array, xShapeLength: number, dtype: CppDType, outId: number, perm: Uint8Array, permLength: number) => void;
function setup(backend: BackendWasm) {
  wasmTranspose = backend.wasm.cwrap(Transpose, null /* void */, [
    'number', // xId
    'array', // x.shape
    'number', // x.shape.length
    'number', // dtype
    'number', // outId
    'array', // perm
    'number', // perm.length
  ]);
  export function transpose(args: {inputs: TransposeInputs, backend: BackendWasm, attrs: TransposeAttrs}): TensorInfo {
    const {inputs, backend, attrs} = args;
    // Reduce any dimensions with size one. Lower-rank transpose kernel performs better due to simpler memory access pattern.
    const [reducedShape, perm] = removeOneSizeDims(inputs.x.shape, attrs.perm);
    let permIsNoOp = true;
    for (let i = 0; i < perm.length; i++) {
      if (perm[i] !== i) {
        permIsNoOp = false;
      }
    }
    const outShape = computeOutShape(inputs.x.shape, attrs.perm);
    const x = {
      dataId: inputs.x.dataId,
      shape: reducedShape,
      dtype: inputs.x.dtype,
    };
    if (permIsNoOp) {
      const cloned = identity({inputs, backend});
      cloned.shape = outShape;
      return cloned;
    }
    const out = backend.makeOutput(outShape, x.dtype);
    const xId = backend.dataIdMap.get(x.dataId).id;
    const outId = backend.dataIdMap.get(out.dataId).id;
    const permBytes = new Uint8Array(new Int32Array(perm).buffer);
    const xShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);
    wasmTranspose(xId, xShapeBytes, x.shape.length, CppDType[x.dtype], outId, permBytes, perm.length);
    return out;
  }
  function computeOutShape(inShape: number[], perm: number[]): number[] {
    const outShape = new Array(inShape.length);
    for (let i = 0; i < outShape.length; i++) {
      outShape[i] = inShape[perm[i]];
    }
    return outShape;
  }
  function removeOneSizeDims(shape: number[], perm: number[]): [number[], number[]] {
    const newShape: number[] = [];
    const newPerm: number[] = [];
    for (let i = 0; i < shape.length; i++) {
      if (shape[i] !== 1) {
        newShape.push(shape[i]);
      }
      if (shape[perm[i]] !== 1) {
        newPerm.push(perm[i]);
      }
    }
    for (let i = 0; i < newPerm.length; i++) {
      let minValIdx = -1;
      for (let j = 0; j < newPerm.length; j++) {
        if (newPerm[j] >= i && (minValIdx === -1 || newPerm[minValIdx] > newPerm[j])) {
          minValIdx = j;
        }
      }
    }
  }
}

```

```

    }\n    }\n    newPerm[minValIdx] = i;\n    }\n    return [newShape, newPerm];\n}\n\nexport const transposeConfig:
KernelConfig = {\n  kernelName: Transpose,\n  backendName: 'wasm',\n  kernelFunc: transpose as {} as
KernelFunc,\n  setupFunc: setup,\n};\n", "/*\n * @license\n * Copyright 2020 Google Inc. All Rights Reserved.\n *
Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this
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http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {backend_util, TensorInfo, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from
'../backend_wasm';\nimport {transpose} from './Transpose';\n\n/*\n * Compute permutation axes and do a transpose
if necessary.\n *\n * Used by reduction ops.\n *\n * @param x input TensorInfo\n *\n * @param axis reduction axes\n *\n *
@param backend wasm backend instance\n */\nexport function permuteAxesAndTranspose(\n  x: TensorInfo,
axis: number|number[],
backend: BackendWasm): {\n  transposed: TensorInfo|null,\n  axes: number[],\n  originalAxes: number[],\n  inputWasTransposed: boolean\n} {\n  const xShape = x.shape;\n  const xRank = x.shape.length;\n  const
originalAxes = util.parseAxisParam(axis, xShape);\n  let axes = originalAxes;\n  const permutedAxes =
backend_util.getAxesPermutation(axes, xRank);\n  let xTransposed = null;\n  let inputWasTransposed = false;\n  if
(permutedAxes != null) {\n    const newShape: number[] = new Array(xRank);\n    for (let i = 0; i <
newShape.length; i++) {\n      newShape[i] = xShape[permutedAxes[i]];\n    }\n    axes =
backend_util.getInnerMostAxes(axes.length, xRank);\n    xTransposed =\n      transpose({inputs: {x}, attrs: {perm:
permutedAxes}, backend});\n    const xId = backend.dataIdMap.get(x.dataId).id;\n    const transposedId =
backend.dataIdMap.get(xTransposed.dataId).id;\n    if (transposedId !== xId) {\n      inputWasTransposed = true;\n    }\n  }\n  }\n  return {transposed:
xTransposed, originalAxes, axes, inputWasTransposed};\n}\n", "/*\n * @license\n * Copyright 2021 Google LLC.
All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {All, AllAttrs, AllInputs, backend_util, KernelConfig, KernelFunc, TensorInfo, util} from
'@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nimport
{permuteAxesAndTranspose} from './kernel_utils';\n\nlet
wasmAll: (xId: number, reduceSize: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm):
void {\n  wasmAll = backend.wasm.cwrap(All, null /*void*/, ['number, number, number']);\n}\n\nfunction all(args:
{backend: BackendWasm, inputs: AllInputs, attrs: AllAttrs}): TensorInfo {\n  const {backend, inputs, attrs} =
args;\n  const {axis, keepDims} = attrs;\n  const {x} = inputs;\n  const xId = backend.dataIdMap.get(x.dataId).id;\n
let inputId = xId;\n  let input = x;\n  const {transposed, axes, originalAxes, inputWasTransposed} =\n    permuteAxesAndTranspose(x, axis, backend);\n  if (inputWasTransposed) {\n    const transposedId =
backend.dataIdMap.get(transposed.dataId).id;\n    input = transposed;\n    inputId = transposedId;\n  }\n  const
inputRank = input.shape.length;\n  backend_util.assertAxesAreInnerMostDims('all', axes, inputRank);\n  const
[outShape, reduceShape] =\n    backend_util.computeOutAndReduceShapes(input.shape, axes);\n  const reduceSize = util.sizeFromShape(reduceShape);\n  const out = backend.makeOutput(outShape, x.dtype);\n  if (util.sizeFromShape(input.shape) !== 0) {\n    const outId = backend.dataIdMap.get(out.dataId).id;\n
wasmAll(inputId, reduceSize, outId);\n  }\n  if (inputWasTransposed) {\n    // dispose of the transposed tensor.\n

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backend.disposeData(transposed.dataId);\n }\n\n if (keepDims) {\n  // reshape\n  const newShape =
backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n  out.shape = newShape;\n }\n\n return
out;\n}\n\nexport const allConfig: KernelConfig = {\n  kernelName: All,\n  backendName: 'wasm',\n  setupFunc:
setup,\n  kernelFunc: all as {} as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2021 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file
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http://www.apache.org/licenses/LICENSE-2.0\n
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distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n *
=====
*\n\nimport { Any, AnyAttrs, AnyInputs, backend_util, KernelConfig, KernelFunc, TensorInfo, util } from
'@tensorflow/tfjs-core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nimport
{ permuteAxesAndTranspose } from './kernel_utils';\n\nlet wasmAny: (xId: number, reduceSize: number, outId:
number) => void;\n\nfunction setup(backend: BackendWasm): void {\n  wasmAny = backend.wasm.cwrap(Any,
null /*void*/, ['number, number, number']);\n}\n\nfunction any(args: { backend: BackendWasm, inputs: AnyInputs,
attrs: AnyAttrs }):\n  TensorInfo {\n  const { backend, inputs,
attrs } = args;\n  const { axis, keepDims } = attrs;\n  const { x } = inputs;\n  const xId =
backend.dataIdMap.get(x.dataId).id;\n  let inputId = xId;\n  let input = x;\n\n  const { transposed, axes, originalAxes,
inputWasTransposed } =\n    permuteAxesAndTranspose(x, axis, backend);\n\n  if (inputWasTransposed) {\n
const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n  input = transposed;\n  inputId =
transposedId;\n  }\n\n  const inputRank = input.shape.length;\n  backend_util.assertAxesAreInnerMostDims('any',
axes, inputRank);\n  const [outShape, reduceShape] =\n
backend_util.computeOutAndReduceShapes(input.shape, axes);\n  const reduceSize =
util.sizeFromShape(reduceShape);\n\n  const out = backend.makeOutput(outShape, x.dtype);\n  if
(util.sizeFromShape(input.shape) !== 0) {\n    const outId = backend.dataIdMap.get(out.dataId).id;\n
wasmAny(inputId, reduceSize, outId);\n  }\n\n  if (inputWasTransposed) {\n    // dispose of the transposed tensor.\n
backend.disposeData(transposed.dataId);\n
  }\n\n  if (keepDims) {\n    // reshape\n    const newShape = backend_util.expandShapeToKeepDim(out.shape,
originalAxes);\n    out.shape = newShape;\n  }\n\n  return out;\n}\n\nexport const anyConfig: KernelConfig = {\n
kernelName: Any,\n  backendName: 'wasm',\n  setupFunc: setup,\n  kernelFunc: any as {} as
KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
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on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n
*\n * =====
*\n\nimport { ArgMax, ArgMaxAttrs, ArgMaxInputs, KernelConfig, KernelFunc, util } from '@tensorflow/tfjs-
core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nimport { permuteAxesAndTranspose } from
'./kernel_utils';\n\nimport { CppDType } from './types';\n\nlet wasmFunc: (\n  xId: number, dtype: number, outerSize:
number, innerSize: number,\n  outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n
wasmFunc = backend.wasm.cwrap(ArgMax, null /* void */, [\n  'number', // x_id\n  'number', // dtype\n
'number', // outer_size\n  'number', // inner_size\n  'number' // out_id\n]);\n}\n\nfunction argmax(\n  args:
{ inputs: ArgMaxInputs, backend: BackendWasm, attrs: ArgMaxAttrs }) {\n  const { backend, inputs, attrs } = args;\n
const { axis } = attrs as {} as ArgMaxAttrs;\n  const { x } = inputs as {} as ArgMaxInputs;\n  const xId =

```



```

backend.dataIdMap.get(x.dataId).id;\n let inputId
= xId;\n let input = x;\n\n const {transposed, axes, inputWasTransposed} =\n permuteAxesAndTranspose(x,
axis, backend);\n\n if (inputWasTransposed) {\n const transposedId =
backend.dataIdMap.get(transposed.dataId).id;\n if (transposedId !== xId) {\n // transpose was not a no-op. We
will need to dispose of this\n // once we are done.\n input = transposed;\n inputId = transposedId;\n }\n }\n\n const outShape = input.shape.slice(0, -1);\n const out = backend.makeOutput(outShape, 'int32');\n const
outId = backend.dataIdMap.get(out.dataId).id;\n const outerSize = util.sizeFromShape(out.shape);\n const
innerSize = input.shape[axes[0]];\n wasmFunc(inputId, CppDType[input.dtype], outerSize, innerSize, outId);\n\n if
(inputWasTransposed) {\n // dispose of the transposed tensor.\n backend.disposeData(transposed.dataId);\n }\n\n return out;\n}\n\nexport const argMaxConfig: KernelConfig = {\n kernelName: ArgMax,\n backendName:
'wasm',\n
kernelFunc: argmax as { } as KernelFunc,\n setupFunc: setup\n};\n\n", "/*\n * @license\n * Copyright 2019 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *\n
=====*\n\nimport {AvgPool, AvgPoolAttrs, AvgPoolInputs, backend_util, KernelConfig, KernelFunc, Tensor4D} from
'@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nlet wasmAvgPool: (\n xId:
number, batchSize: number, inputHeight: number, inputWidth: number,\n filterHeight: number, filterWidth:
number, padTop: number, padRight: number,\n padBottom: number, padLeft: number, strideHeight: number,\n
strideWidth: number, channels: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n
wasmAvgPool = backend.wasm.cwrap(AvgPool, null /* void */, [\n 'number', // xId\n 'number', // batchSize\n
'number', // inputHeight\n 'number', // inputWidth\n 'number', // filterHeight\n 'number', // filterWidth\n
'number', // padTop\n 'number', // padRight\n 'number', // padBottom\n 'number', // padLeft\n 'number', //
strideHeight\n 'number', // strideWidth\n 'number', // channels\n 'number', // outId\n ]);\n\nfunction
avgPool(\n args: {inputs: AvgPoolInputs, backend: BackendWasm, attrs: AvgPoolAttrs}) {\n const {inputs, attrs,
backend} = args;\n\n const x = inputs.x as Tensor4D;\n const xId = backend.dataIdMap.get(x.dataId).id;\n\n
const {filterSize, strides, pad, dimRoundingMode} = attrs;\n const convInfo =
backend_util.computePool2DInfo(\n x.shape, filterSize, strides, 1 /* dilations */, pad, dimRoundingMode);\n\n
const filterHeight = convInfo.filterHeight;\n const filterWidth = convInfo.filterWidth;\n const padTop =
convInfo.padInfo.top;\n const padRight = convInfo.padInfo.right;\n const padBottom = convInfo.padInfo.bottom;\n
const padLeft = convInfo.padInfo.left;\n const strideHeight = convInfo.strideHeight;\n const strideWidth =
convInfo.strideWidth;\n const channels = convInfo.inChannels;\n\n if (convInfo.dataFormat !== 'channelsLast') {\n
throw new Error(\n `wasm backend does not support dataFormat:~` +\n ` ${convInfo.dataFormat}'. Please
use 'channelsLast'.`);\n }\n\n if (convInfo.dilationWidth !== 1 || convInfo.dilationHeight !== 1) {\n throw new
Error(\n `was backend only supports average pooling with dilation = [1, 1], ` +\n
`got [${convInfo.dilationHeight}, ${convInfo.dilationWidth}].`);\n }\n\n const out =
backend.makeOutput(convInfo.outShape, 'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n
wasmAvgPool(\n xId, x.shape[0], x.shape[1], x.shape[2], filterHeight, filterWidth,\n padTop, padRight,
padBottom, padLeft, strideHeight, strideWidth, channels,\n outId);\n return out;\n}\n\nexport const
avgPoolConfig: KernelConfig = {\n kernelName: AvgPool,\n backendName: 'wasm',\n setupFunc: setup,\n
kernelFunc: avgPool as { } as KernelFunc\n};\n\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file
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```

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```
=====
*\n\nimport { KernelConfig, KernelFunc, Reshape, ReshapeAttrs, ReshapeInputs, util } from '@tensorflow/tfjs-core';
\n\nimport { BackendWasm } from './backend_wasm';
\n\nexport function reshape(\n  args: { inputs: ReshapeInputs, attrs: ReshapeAttrs, backend: BackendWasm }) {\n  const { inputs, attrs } = args;\n  const { x } = inputs;\n  const { shape } = attrs;\n\n  const xSize = util.sizeFromShape(x.shape);\n  const $shape = util.inferFromImplicitShape(shape, xSize);\n\n  util.assert(\n    xSize === util.sizeFromShape($shape),\n    () => `new shape: ${$shape}, old shape: ${x.shape}. New shape and old\n    `shape must have the same number of elements.`);\n\n  // Backend needs to track refCount\n  for the dataId for reshape op\n  args.backend.incRef(x.dataId);\n  return { dataId: x.dataId, shape: $shape, dtype: x.dtype };\n}\n\nexport const reshapeConfig: KernelConfig = {\n  kernelName: Reshape,\n  backendName: 'wasm',\n  kernelFunc: reshape as { } as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

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=====
*\n\nimport { BatchMatMul, BatchMatMulAttrs, BatchMatMulInputs, KernelConfig, KernelFunc, util } from '@tensorflow/tfjs-core';
\n\nimport { BackendWasm } from './backend_wasm';
\n\nimport { reshape } from './Reshape';
\n\nlet wasmBatchMatMul: (\n  aId: number, aShape: Uint8Array, aShapeSize: number, bId: number, bShape: Uint8Array, bShapeSize: number, transposeA: boolean, transposeB: boolean, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n  wasmBatchMatMul = backend.wasm.cwrap(BatchMatMul, null /* void */, [\n    'number', // a_id\n    'array', // a_shape\n    'number', // a_shape.length\n    'number', // b_id\n    'array', // b_shape\n    'number', // b_shape.length\n    'number', // transpose_a\n    'number', // transpose_b\n    'number' // out_id\n  ]);\n\n  function batchMatMul(args: {\n    inputs: BatchMatMulInputs,\n    backend: BackendWasm,\n    attrs: BatchMatMulAttrs\n  }) {\n    const { inputs, backend, attrs } = args;\n    const { a, b } = inputs;\n    const { transposeA, transposeB } = attrs;\n\n    if (a.dtype !== 'float32' || b.dtype !== 'float32') {\n      throw new Error(`BatchMatMul for non non-float32 tensors not yet supported.`);\n    }\n\n    const aRank = a.shape.length;\n    const bRank = b.shape.length;\n\n    const innerShapeA = transposeA ? a.shape[aRank - 2] : a.shape[aRank - 1];\n    const innerShapeB = transposeB ? b.shape[bRank - 1] : b.shape[bRank - 2];\n\n    const outerShapeA = transposeA ? a.shape[aRank - 1] : a.shape[aRank - 2];\n    const outerShapeB = transposeB ? b.shape[bRank - 2] : b.shape[bRank - 1];\n\n    const outerDimsA = a.shape.slice(0, -2);\n    const outerDimsB = b.shape.slice(0, -2);\n\n    const batchDimA = util.sizeFromShape(outerDimsA);\n    const batchDimB = util.sizeFromShape(outerDimsB);\n\n    const batchDimsCompatible = batchDimA === batchDimB || batchDimA === 1 || batchDimB === 1;\n\n    util.assert(\n      aRank >= 2 && bRank >= 2 && batchDimsCompatible,\n      () => `Error in matMul: the input batch dimensions\n      must either be the\n      `same or at least one input batch dimension must be 1. Got input\n      `batch dimensions of (${outerDimsA}) and (${outerDimsB}).`);\n\n    const outShapeOuterDims = batchDimA > batchDimB ? a.shape.slice(0, -2) : b.shape.slice(0, -2);\n    const outShape = outShapeOuterDims.concat([outerShapeA, outerShapeB]);\n\n    util.assert(\n      innerShapeA === innerShapeB,\n      () => `Error in matMul: inner shapes (${innerShapeA}) and\n      `${innerShapeB}) of Tensors with shapes
```

[illegible]

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2luZ1JhbmdlTmVnYXRpdmdVTdGVwID0gc3RhcncQgPCBzdG9wICYmIHN0ZXAgPCAwO1xuICBjb25zdCBkZWNyZWZfaW5nUmFuZ2VQb3NpdGl2ZVN0ZXAgPSBzdG9wIDwgc3RhcncQgJiYgc3RlcCA+IDE7XG5cbiAgaWYgKHNBbWVTdGFydFN0b3AgfHwgaW5jcmVhc2luZ1JhbmdlTmVnYXRpdmdVTdGVwIHx8XG4gICAgICBkZWNYZWZfaW5nUmFuZ2VQb3NpdGl2ZVN0ZXApIHtcbiAgICByZXR1cm4gdXRpbC5tYWtlWmVyb3NUeXBIZEFycmF5KDAsIGR0eXBikTtcbiAgfVxuXG4gIGNvbnN0IG51bUVsZW1lbnRzID0gTWF0aC5hYnMoTWf0aC5jZWlsKChzdG9wIC0gc3RhcncQpIC8gc3RlcCkpO1xuICBjb25zdCB2YWx1ZXMGPSB1dGlsLm1ha2VaZXJvc1R5cGVkQXJyYXkobnVtRWxlbWVudHMsIGR0eXBikTtcbiAgfVxuICBpZiAoc3RvcCA8IHN0YXJ0ICYmIHN0ZXAgPT09IDEpIHtcbiAgICAvLyBBdXRvIGFkanVzdCB0aGUgc3RlcCdzIHNPZ24gaWYgaXQgaGFzbid0IGJlZW4gc2V0XG4gICAgLy8gKG9yIHdhcyBzZXQgdG8gMSlcbiAgICBzdGVwID0gLTE7XG4gIH1cblxuICB2YWx1ZXNBmF0gPSBzdGFydDtcbiAgZm9yIChsZXQgaSA9IDE7IGkgPCB2YWx1ZXMuYVUzRoOyBpKyspIHtcbiAgICB2YWx1ZXNBaV0gPSB2YWx1ZXNBaSAtdIdfIDcsgc3RlcDtcbiAgfVxuICByZXR1cm4gdmFsdWVzO1xufVxuIl19"

[illegible]

4gICAgZHR5cGU6IERhdGFueXB1KTogQmFja2VuZFZhbnHVlcyB7XG4gIGNvbnN0IGlzQ29udGlub3VzID0gc2xpY2VfdXRpbC5pc1NsaWNIQ29udGlub3VzKHNoYXBILCBiZWdpbiwgc2l6ZSk7XG4gIGNvbnN0IGxlbmd0aCA9IHV0aWwuc2l6ZUZyb21TaGFwZShzaXplKTtcbiAgY29uc3QgeFN0cmllkZXMGPSBldGlsLmNvbXB1dGVtDHIpZGVzKHNoYXB1KTtcbixuICBpZiAoaXNDb250aW5vdXMpIHTcbiAgICBjb25zdCBmbGF0T2Zmc2V0ID0gc2xpY2VfdXRpbC5jb21wdXRIRmxhdE9mZnNldChiZWdpbiwgeFN0cmllkZXMPo1xuXG4gICAgaWYgKGR0eXBlID09PSAnc3RyaW5nJykgelxuICAgICAgcmV0dXJuICh2YWxzIGFzIFVpbnQ4QXJyYXlibXSku2xpY2UoZmxhdE9mZnNldCwgZmxhdE9mZnNldCArIGxlbmd0aCk7XG4gICAgfVxuXG4gICAgcmV0dXJuICh2YWxzIGFzIFR5cGVkQXJyYXkplLnN1YmFycmF5KGZsYXRPMmZzZXQsIGZsYXRPMmZzZXQgKyBsZW5ndGgpO1xuICB9XG5cbiAgY29uc3QgZGVjb2RlZERhdGEgPSBkdHlwZSA9PT0gJ3N0cmllkZycgP1xuICAgICAgYmFja2VuZF91dGlsLmZyb21VaW50OFrVU3RyaW5nQXJyYXkodmFscyBheYBvaW50OEFycmF5W10pIDpobiAgICAgIHZhbmgyYXMGVHlwZWRBcnJheTtcbixuICBjb25zdCBpbk1JiA9IGJlZmZlcihzaGFwZSwgZHR5cGUsIGRIY29kZWREYXRhKTtcbiAgY29uc3Qgb3V0QnVmMlD0gYnVmZmVyKHNPemUsIGR0eXB1KTtcbiAgZm9yIChsZXQgaS9IDA7IGkgPCBvdXRCDWYuc2l6ZTsKYtpKSB7XG4gICAgY29uc3Qgb3V0TG9jID0gb3V0QnVmLmluZGV4VG9Mb2MoasK7XG4gICAgY29uc3QgaW5Mb2MgPSBvdXRMB2MubWFwKCChpZHhg6IG51bWJlciwgaikPT4gaWR4ICsgYmVnaW5balOpO1xuICAgICAgIG91dEJlZi5zZXQoaW5CdWYuZ2V0KC4uLmluTG9jKSswLi4ub3V0TG9jKTtcbiAgfVxuXG4gIGlmIChkdHlwZSA9PT0gJ3N0cmllkZycpIHTcbiAgICByZXRLcm4gYmFja2VuZF91dGlsLmZyb21TdHJpbmdBcnJheVRvVWludDgob3V0QnVmLnZhbnHVlcyBheYBzdHJpbmdbXSsk7XG4gIH1cbiAgcmV0dXJuIG91dEJlZi52YWxlZXMGYXMGVHlwZWRBcnJheTtcbnlcbixuZXhw3J0IGZlbnN0aW9uIHNSaWNlKFxuICAgIGFyZ3M6IHtpbnBldHM6IFNsawNISW5wdXRzLCBiYWNRZW5kOiBNYXR0QmFja2VuZENQVSswYXR0cnM6IFNsawNIQR0cnN9KTpciAgICBUZSW5zb3JJbmZvIHTcbiAgY29uc3Qge2lucHV0cywgYmFja2VuZCwgYXR0cnN9ID0gYXJncztcbiAgY29uc3Qge3h9ID0gaW5wdXRzo1xuICBjb25zdCB7YmVnaW4sIHNPemV9ID0gYXR0cnM7XG5cbiAgYXNZzXJ0Tm90Q29tcGxleCh4LCAnc2xpY2UnKTtcbixuICBjb25zdCBbGJIJZ2luLCAkc2l6ZV0gPSBzbGljZV91dGlsLnBhcniU2xpY2VQYXJhbXMOecWgYmVnaW4sIHNPemUpO1xuICBzbGljZV91dGlsLmFzc2VydFBhcmtFcilZhbGlkKHGsICRiZWdpbiwJHNpemUpO1xuXG4gIGNvbnN0IHZhbnHMgPSBiYWNRZW5kLmRhGEuZ2V0KHguZGF0YUlKS52YWxlZXM7XG4gIGNvbnN0IG91dFZhbnHMgPSBzbGljZUltcGwodmFscywGJIJZ2luLCAkc2l6ZSwgeC5zaGFwZSwgeC5kdHlwZSk7XG4gIHJldHVybiBiYWNRZW5kLmlha2VUZW5zb3JJbmZvKCRzaXplLCB4LmR0eXBILCBvdXRWYWxzKTtcbnlcbixuZXhw3J0IGNvbnN0IHNSaWNlQ29uZmlnOiBLZXJuZWxD25maWcgPSB7XG4gIGtlcm5lbE5hbWU6IFNsawNILFxuICBiYWNRZW5kTmFtZTogJ2NwdScsXG4gIGtlcm5lbEZlbnM6IHNSawNIIGFziHT9IGFziETlcm5lbEZlbnNcbn07XG4iXX0=", "/>*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *


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sliceImplCPU(xVals, begin_, size_, x.shape, x.dtype);\n  outData.stringBytes = res as UInt8Array[];\n  return
out;\n }\n\n const outVals = backend.toArrayFromHeap(out);\n const rank = x.shape.length;\n if (rank === 2)
{\n  slice2d(\n    xVals as TypedArray, xStrides[0], outVals, begin_ as [number, number],\n    size_ as [number, number]);\n } else if (rank === 3) {\n  slice3d(\n    xVals
as TypedArray, xStrides[0], xStrides[1], outVals,\n    begin_ as [number, number, number], size_ as [number,
number, number]);\n } else if (rank === 4) {\n  slice4d(\n    xVals as TypedArray, xStrides[0], xStrides[1],
xStrides[2], outVals,\n    begin_ as [number, number, number, number],\n    size_ as [number, number, number,
number]);\n } else {\n  const res =\n    sliceImplCPU(xVals, begin_, size_, x.shape, x.dtype) as TypedArray;\n  outVals.set(res);\n }\n\n return out;\n }\n\nfunction slice2d(\n  xVals: backend_util.TypedArray, xStride:
number,\n  outVals: backend_util.TypedArray, begin: [number, number],\n  size: [number, number]): void {\n  let
outOffset = 0;\n  const beginI = begin[0];\n  const beginJ = begin[1];\n  const endI = beginI + size[0];\n  for (let i =
beginI; i < endI; i++) {\n    const xOffset = i * xStride + beginJ;\n    outVals.set(xVals.subarray(xOffset, xOffset +
size[1]), outOffset);\n    outOffset += size[1];\n  }\n}\n\nfunction
slice3d(\n  xVals: backend_util.TypedArray, xStride1: number, xStride2: number,\n  outVals:
backend_util.TypedArray, begin: [number, number, number],\n  size: [number, number, number]): void {\n  let
outOffset = 0;\n  const beginI = begin[0];\n  const beginJ = begin[1];\n  const beginK = begin[2];\n  const endI =
beginI + size[0];\n  const endJ = beginJ + size[1];\n  for (let i = beginI; i < endI; i++) {\n    for (let j = beginJ; j <
endJ; j++) {\n      const xOffset = i * xStride1 + j * xStride2 + beginK;\n      outVals.set(xVals.subarray(xOffset,
xOffset + size[2]), outOffset);\n      outOffset += size[2];\n    }\n  }\n}\n\nfunction slice4d(\n  xVals:
backend_util.TypedArray, xStride1: number, xStride2: number,\n  xStride3: number, outVals:
backend_util.TypedArray,\n  begin: [number, number, number, number],\n  size: [number, number, number,
number]): void {\n  let outOffset = 0;\n  const beginI = begin[0];\n  const beginJ = begin[1];\n  const beginK =
begin[2];\n
const endI = beginI + size[0];\n  const endJ = beginJ + size[1];\n  const endK = beginK + size[2];\n  const beginL =
begin[3];\n  for (let i = beginI; i < endI; i++) {\n    for (let j = beginJ; j < endJ; j++) {\n      for (let k = beginK; k <
endK; k++) {\n        const xOffset = i * xStride1 + j * xStride2 + k * xStride3 + beginL;\n        outVals.set(xVals.subarray(xOffset, xOffset + size[3]), outOffset);\n        outOffset += size[3];\n      }\n    }\n  }\n}\n\nexport const sliceConfig: KernelConfig = {\n  kernelName: Slice,\n  backendName: 'wasm',\n  kernelFunc:
slice as {} as KernelFunc,\n};\n\n/**\n * @license\n * Copyright 2021 Google LLC. All Rights Reserved.\n *
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ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n *
limitations under the License.\n *
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*\n\nimport {backend_util, BatchToSpaceND, BatchToSpaceNDAttrs, BatchToSpaceNDInputs, KernelConfig,
KernelFunc} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport
{reshape} from './Reshape';\n\nimport {slice} from './Slice';\n\nimport {transpose} from './Transpose';\n\nfunction
batchToSpaceND(args: {\n  inputs: BatchToSpaceNDInputs,\n  backend: BackendWasm,\n  attrs:
BatchToSpaceNDAttrs\n}) {\n  const {inputs, backend, attrs} = args;\n  const {x} = inputs;\n  const {blockShape,
crops} = attrs;\n\n  const prod = blockShape.reduce((a, b) => a * b);\n\n  const reshaped =
backend_util.getReshaped(x.shape, blockShape, prod);\n  const
permuted = backend_util.getPermuted(reshaped.length, blockShape.length);\n  const reshapedPermuted =\n
backend_util.getReshapedPermuted(x.shape, blockShape, prod);\n  const sliceBeginCoords =\n
backend_util.getSliceBeginCoords(crops, blockShape.length);\n  const sliceSize =\n
backend_util.getSliceSize(reshapedPermuted, crops, blockShape.length);\n\n  const xReshaped = reshape({inputs:

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[x], backend, attrs: {shape: reshaped}});\n const xTransposed =\n    transpose({inputs: {x: xReshaped}, backend,\nattrs: {perm: permuted}});\n const xTransposedReshaped = reshape(\n    {inputs: {x: xTransposed}, backend,\nattrs: {shape: reshapedPermuted}});\n const result = slice({\n    inputs: {x: xTransposedReshaped},\n    backend,\nattrs: {begin: sliceBeginCoords, size: sliceSize}\n });\n\n backend.disposeData(xReshaped.dataId);\n backend.disposeData(xTransposed.dataId);\n backend.disposeData(xReshaped.dataId);\n\n return\nresult;\n}\n\nexport const batchToSpaceNDConfig: KernelConfig\n= {\n kernelName: BatchToSpaceND,\n backendName: 'wasm',\n kernelFunc: batchToSpaceND as {} as\nKernelFunc\n};\n","/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the\nApache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the\nLicense.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed\non an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or\nimplied.\n * See the License for the specific language governing permissions and\n * limitations under the\nLicense.\n */\n=====\n\n*/\n\nimport {Cast, CastAttrs, CastInputs, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';\nimport\n{TensorInfo} from '@tensorflow/tfjs-core';\nimport\n{BackendWasm} from '../backend_wasm';\n\nexport function cast(\n    args: {inputs: CastInputs, attrs: CastAttrs,\nbackend: BackendWasm});\n    TensorInfo {\n        const {inputs: {x}, attrs: {dtype}, backend} = args;\n        const out =\nbackend.makeOutput(x.shape, dtype);\n        const inVals = backend.typedArrayFromHeap(x);\n        const outVals =\nbackend.typedArrayFromHeap(out);\n        outVals.set(inVals);\n        return out;\n    }\n\nexport const castConfig:\nKernelConfig = {\n kernelName: Cast,\n backendName: 'wasm',\n kernelFunc: cast as {} as\nKernelFunc,\n};\n","/*\n * @license\n * Copyright 2021 Google LLC. All Rights Reserved.\n * Licensed under the\nApache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the\nLicense.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed\non an \"AS IS\" BASIS,\n\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License\nfor the specific language governing permissions and\n * limitations under the License.\n */\n=====\n\n*/\n\nimport {KernelConfig, Ceil} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from\n'./unary_kernel';\n\nexport const ceilConfig: KernelConfig = createUnaryKernelConfig(Ceil);\n","/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version\n2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a\ncopy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable\nlaw or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n=====\n\n*/\n\nimport {ClipByValue, ClipByValueAttrs, ClipByValueInputs, KernelConfig, KernelFunc} from\n'@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\n\nlet wasmClip: (xId: number, min:\nnumber, max: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n    wasmClip =\nbackend.wasm.cwrap(ClipByValue, null /* void */, [\n        'number', // x_id\n        'number', // min\n        'number', //\nmax\n        'number' // out_id\n    ]);\n\n    function clip(args: {\n        inputs: ClipByValueInputs,\n        backend:\nBackendWasm,\n        attrs: ClipByValueAttrs\n    }) {\n        const {inputs, backend, attrs} = args;\n        const {x} = inputs;\n        const {clipValueMin, clipValueMax} = attrs;\n        const xId = backend.dataIdMap.get(x.dataId).id;\n        const out =\nbackend.makeOutput(x.shape, x.dtype);\n        const outId = backend.dataIdMap.get(out.dataId).id;\n
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wasmClip(xId, clipValueMin, clipValueMax, outId);\n return out;\n}\n\nexport const clipByValueConfig:
KernelConfig = {\n  kernelName: ClipByValue,\n  backendName: 'wasm',\n  setupFunc: setup,\n  kernelFunc: clip
as { } as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed
under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
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on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *

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*/\n\nimport
{ backend_util, Concat, ConcatAttrs, ConcatInputs, KernelConfig, KernelFunc, util } from '@tensorflow/tfjs-
core';\n\nimport { BackendWasm } from '../backend_wasm';\nimport { concatImplCPU } from
'../kernel_utils/shared';\nimport { identity } from './Identity';\nimport { reshape } from './Reshape';\n\nexport function
concat(\n  args: { inputs: ConcatInputs, backend: BackendWasm, attrs: ConcatAttrs }) {\n    const { inputs, backend }
= args;\n\n    const axis = util.parseAxisParam(args.attrs.axis, inputs[0].shape)[0];\n\n    let outShape =
backend_util.computeOutShape(inputs.map(t => t.shape), axis);\n\n    // Keep only non-empty tensors (ignore tensors
with 0 in their shape).\n    const $inputs = inputs.filter(t => util.sizeFromShape(t.shape) > 0);\n    if ($inputs.length ===
1) {\n      return identity({ inputs: { x: $inputs[0] }, backend });\n    }\n\n    const out = backend.makeOutput(outShape,
inputs[0].dtype);\n\n    if (util.sizeFromShape(outShape) === 0) {\n      return out;\n    }\n\n    const shapes =
$inputs.map(t
=> t.shape);\n    backend_util.assertParamsConsistent(shapes, axis);\n\n    if ($inputs[0].dtype === 'string') {\n      //
Any concat of n-dimensional tensors across any axis can be reduced to\n      // a concatenation of two-dimensional
tensors across the axis 1 by first\n      // partitioning the axes of the original tensors into those less than the\n      // axis
to be concatenated and the rest. Then reshape the tensors\n      // into a two-dimensional tensor by collapsing these
two sets of axes and\n      // concatenate the resulting matrices across the axis 1, finally reshaping\n      // the result to
have the proper shape.\n      const inputs2D = $inputs.map(t => {\n        const innerSize =
util.sizeFromShape(t.shape.slice(axis));\n        const shape = [-1, innerSize];\n        return reshape({ inputs: { x: t },
backend, attrs: { shape } });\n      });\n      const inputsValShapes = inputs2D.map(t => {\n        return { vals:
backend.readSync(t.dataId, shape: t.shape); }\n      });\n      // Concat 2d tensors
along axis=1.\n      outShape =\n        backend_util.computeOutShape(inputs2D.map(t => t.shape), 1 /* axis */);\n      const simplyConcat = inputs2D[0].shape[0] === 1;\n      const outVals = concatImplCPU(\n
inputsValShapes, outShape, inputs[0].dtype,\n        simplyConcat) as string[];\n      const finalOutShape
=\n        backend_util.computeOutShape($inputs.map(t => t.shape), axis);\n      out.shape = finalOutShape;\n      const outData = backend.dataIdMap.get(out.dataId);\n      outData.stringBytes =
backend_util.fromStringArrayToUint8(outVals);\n      inputs2D.forEach(t => backend.disposeData(t.dataId));\n      return out;\n    }\n\n    const batchDim = util.sizeFromShape($inputs[0].shape.slice(0, axis));\n    let sumInnerDims =
0;\n    const innerDims = $inputs.map(input => {\n      const innerDim = util.sizeFromShape(input.shape.slice(axis));\n      sumInnerDims += innerDim;\n      return innerDim;\n    });\n    const inVals = $inputs.map(input =>
backend.typedArrayFromHeap(input));\n\n    const outVals = backend.typedArrayFromHeap(out);\n    for (let b = 0; b < batchDim; b++) {\n      let outOffset = b *
sumInnerDims;\n      for (let i = 0; i < inVals.length; i++) {\n        const innerDim = innerDims[i];\n        const inOffset =
b * innerDim;\n        const vals = inVals[i].subarray(inOffset, inOffset + innerDim);\n        outVals.set(vals,
outOffset);\n        outOffset += innerDim;\n      }\n      return out;\n    }\n\n    export const concatConfig: KernelConfig =
{\n      kernelName: Concat,\n      backendName: 'wasm',\n      kernelFunc: concat as { } as KernelFunc,\n    };\n    "/*\n *
@license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version
2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable

```

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distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n *

```
=====
*\n\nimport {backend_util, Conv2D, Conv2DAttrs, Conv2DInputs, KernelConfig, KernelFunc, Tensor4D} from
'@tensorflow/tfjs-core';\n\nimport {BackendWasm} from './backend_wasm';\n\nlet wasmConv2d: (\n  xId:
number, batchSize: number, inputHeight: number, inputWidth: number,\n  filterId: number, filterHeight: number,
filterWidth: number, padTop: number,\n  padRight: number, padBottom: number, padLeft: number, isSamePad:
number,\n  dilationHeight: number, dilationWidth: number, strideHeight: number,\n  strideWidth: number,
inputChannels: number, outputChannels: number,\n  outId: number) => void;\n\nfunction setup(backend:
BackendWasm) {\n  wasmConv2d = backend.wasm.cwrap(Conv2D,
    null /* void */, [\n    'number', // xId\n    'number', // batchSize\n    'number', // inputHeight\n    'number', //
inputWidth\n    'number', // filterId\n    'number', // filterHeight\n    'number', // filterWidth\n    'number', //
padTop\n    'number', // padRight\n    'number', // padBottom\n    'number', // padLeft\n    'number', // isSamePad\n
    'number', // dilationHeight\n    'number', // dilationWidth\n    'number', // strideHeight\n    'number', //
strideWidth\n    'number', // inputChannels\n    'number', // outputChannels\n    'number', // outId\n
  ]);\n\n  function conv2d(\n    args: {inputs: Conv2DInputs, backend: BackendWasm, attrs: Conv2DAttrs}) {\n
    const {inputs, attrs, backend} = args;\n\n    const {x, filter} = inputs;\n    const xId =
backend.dataIdMap.get(x.dataId).id;\n    const filterId = backend.dataIdMap.get(filter.dataId).id;\n\n    const {strides,
dilations, pad, dimRoundingMode, dataFormat} = attrs;\n    const $dataFormat =
backend_util.convertConv2DDataFormat(dataFormat);\n
    const convInfo = backend_util.computeConv2DInfo((x as Tensor4D).shape, (filter as Tensor4D).shape,
strides, dilations,\n    pad, dimRoundingMode, false, $dataFormat);\n\n    const filterHeight =
convInfo.filterHeight;\n    const filterWidth = convInfo.filterWidth;\n    const padTop = convInfo.padInfo.top;\n    const
padRight = convInfo.padInfo.right;\n    const padBottom = convInfo.padInfo.bottom;\n    const padLeft =
convInfo.padInfo.left;\n    const dilationHeight = convInfo.dilationHeight;\n    const dilationWidth =
convInfo.dilationWidth;\n    const strideHeight = convInfo.strideHeight;\n    const strideWidth =
convInfo.strideWidth;\n    const inputChannels = convInfo.inChannels;\n    const outputChannels =
convInfo.outChannels;\n    const isSamePad = convInfo.padInfo.type === 'SAME' ? 1 : 0;\n\n    if
(convInfo.dataFormat !== 'channelsLast') {\n      throw new Error(\n        `wasm backend Conv2D does not support
dataFormat: ` +\n        `${convInfo.dataFormat}`. Please
      use 'channelsLast'.`);\n    }\n\n    const out = backend.makeOutput(convInfo.outShape, 'float32');\n    const outId =
backend.dataIdMap.get(out.dataId).id;\n    wasmConv2d(\n      xId, x.shape[0], x.shape[1], x.shape[2], filterId,
filterHeight,\n      filterWidth, padTop, padRight, padBottom, padLeft, isSamePad,\n      dilationHeight,
dilationWidth, strideHeight, strideWidth, inputChannels,\n      outputChannels, outId);\n    return out;\n  }\n\n  export
const conv2DConfig: KernelConfig = {\n    kernelName: Conv2D,\n    backendName: 'wasm',\n    setupFunc: setup,\n
    kernelFunc: conv2d as { } as KernelFunc\n  };
  \n\n  /**\n   * @license\n   * Copyright 2020 Google LLC. All Rights
Reserved.\n   * Licensed under the Apache License, Version 2.0 (the \"License\");\n   * you may not use this file
except in compliance with the License.\n   * You may obtain a copy of the License at\n   *\n   *
http://www.apache.org/licenses/LICENSE-2.0\n   *\n   * Unless required by applicable law or agreed to in writing,
software\n   * distributed under
the License is distributed on an \"AS IS\" BASIS,\n   * WITHOUT WARRANTIES OR CONDITIONS OF ANY
KIND, either express or implied.\n   * See the License for the specific language governing permissions and\n   *
limitations under the License.\n   */
  \n\n  =====
  \n\n  *\n\n  import {backend_util, Conv2DBackpropInput, Conv2DBackpropInputAttrs, Conv2DBackpropInputInputs,
KernelConfig, KernelFunc, TensorInfo, util} from '@tensorflow/tfjs-core';\n\n  import {BackendWasm} from
```

```

'./backend_wasm';\n\nlet wasmConv2DBackpropInput: (\n  dyId: number, filterId: number, batchSize: number,
filterHeight: number,\n  filterWidth: number, inHeight: number, inWidth: number, inChannels: number,\n
outHeight: number, outWidth: number, outChannels: number,\n  strideHeight: number, strideWidth: number,
topPad: number, leftPad: number,\n  fltS0: number, fltS1: number, fltS2: number, xBatchStride: number,\n
xRowStride: number, xColStride: number,
  xChannelStride: number,\n  yBatchStride: number, yRowStride: number, yColStride: number,\n  yChannelStride:
number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n
wasmConv2DBackpropInput = backend.wasm.cwrap(Conv2DBackpropInput, null, [\n  'number', // dyId\n
'number', // filterId\n  'number', // batchSize\n  'number', // filterHeight\n  'number', // filterWidth\n  'number',
// inHeight\n  'number', // inWidth\n  'number', // inChannels\n  'number', // outHeight\n  'number', //
outWidth\n  'number', // outChannels\n  'number', // strideHeight\n  'number', // strideWidth\n  'number', //
topPad\n  'number', // leftPad\n  'number', // fltS0\n  'number', // fltS1\n  'number', // fltS2\n  'number', //
xBatchStride\n  'number', // xRowStride\n  'number', // xColStride\n  'number', // xChannelStride\n  'number',
// yBatchStride\n  'number', // yRowStride\n  'number', // yColStride\n
'number', // yChannelStride\n  'number', // outId\n ]);\n\nfunction conv2DBackpropInput(args: {\n  backend:
BackendWasm,\n  inputs: Conv2DBackpropInputInputs,\n  attrs: Conv2DBackpropInputAttrs\n}): TensorInfo {\n
const {backend, inputs, attrs} = args;\n  const {dy, filter} = inputs;\n  const {strides, pad, dataFormat,
dimRoundingMode, inputShape} = attrs;\n\n  const dilations = 1;\n\n  const $dataFormat =
backend_util.convertConv2DDDataFormat(dataFormat);\n  const convInfo = backend_util.computeConv2DInfo(\n
inputShape, filter.shape as [number, number, number, number], strides,\n    dilations, pad, dimRoundingMode,
false /* depthwise */, $dataFormat);\n  const {\n    batchSize,\n    filterHeight,\n    filterWidth,\n    inChannels,\n
inHeight,\n    inWidth,\n    outChannels,\n    outHeight,\n    outWidth,\n    strideHeight,\n    strideWidth\n  } =
convInfo;\n\n  const topPad = filterHeight - 1 - convInfo.padInfo.top;\n  const leftPad = filterWidth - 1 -
convInfo.padInfo.left;\n\n  const isChannelsLast = convInfo.dataFormat === 'channelsLast';\n  const dxStrides =
util.computeStrides(convInfo.inShape);\n  const dyStrides = util.computeStrides(dy.shape);\n  const [fltS0, fltS1,
fltS2] = util.computeStrides(filter.shape);\n  const xBatchStride = dxStrides[0];\n  const xRowStride =
isChannelsLast ? dxStrides[1] : dxStrides[2];\n  const xColStride = isChannelsLast ? dxStrides[2] : 1;\n  const
xChannelStride = isChannelsLast ? 1 : dxStrides[1];\n  const yBatchStride = dyStrides[0];\n  const yRowStride =
isChannelsLast ? dyStrides[1] : dyStrides[2];\n  const yColStride = isChannelsLast ? dyStrides[2] : 1;\n  const
yChannelStride = isChannelsLast ? 1 : dyStrides[1];\n\n  const out = backend.makeOutput(convInfo.inShape,
'float32');\n  const outId = backend.dataIdMap.get(out.dataId).id;\n  const dyId =
backend.dataIdMap.get(dy.dataId).id;\n  const filterId = backend.dataIdMap.get(filter.dataId).id;\n\n
wasmConv2DBackpropInput(\n  dyId, filterId, batchSize,
  filterHeight, filterWidth, inHeight, inWidth,\n    inChannels, outHeight, outWidth, outChannels, strideHeight,
strideWidth,\n    topPad, leftPad, fltS0, fltS1, fltS2, xBatchStride, xRowStride,\n    xColStride, xChannelStride,
yBatchStride, yRowStride, yColStride,\n    yChannelStride, outId);\n  return out;\n}\n\nexport const
conv2DBackpropInputConfig: KernelConfig = {\n  kernelName: Conv2DBackpropInput,\n  backendName:
'wasm',\n  setupFunc: setup,\n  kernelFunc: conv2DBackpropInput as {} as KernelFunc\n};\n\n"/**\n * @license\n *
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WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*/\n\nimport {Cos, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from

```


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=====\\n
*\\n\\nimport {backend_util, KernelConfig, KernelFunc, Cumsum, CumsumAttrs, CumsumInputs, TensorInfo, util}
from '@tensorflow/tfjs-core';\\n\\nimport {BackendWasm} from '../backend_wasm';\\n\\nimport {CppType} from
'./types';\\n\\nimport {transpose} from './Transpose';\\n\\nlet wasmCumsum: (xId: number, exclusive: number, reverse:
number,\\n          finalDim: number, outId: number, dtype: CppDType) => void;\\n\\nfunction setup(backend:
BackendWasm) {\\n  wasmCumsum = backend.wasm.cwrap(Cumsum, null /* void */, [\\n    'number', // x_id\\n
'number', // exclusive\\n    'number', // reverse\\n    'number', // final_dim\\n
    'number', // out_id\\n    'number' // dtype\\n  ]);\\n}\\n\\nexport function cumsum(\\n  args: {inputs: CumsumInputs,
backend: BackendWasm, attrs: CumsumAttrs}):\\nTensorInfo {\\n  const {inputs, backend, attrs} = args;\\n  const {x}
= inputs;\\n  const {axis, exclusive, reverse} = attrs;\\n  const xRank = x.shape.length;\\n\\n  util.assert(x.dtype ===
'float32' || x.dtype === 'int32',\\n    () => `cumsum does not support ${x.dtype} tensors in the WASM backend`);\\n  //
permute required axis to inner most axis\\n  const permutation = backend_util.getAxesPermutation([axis], xRank);\\n
let permutedX = x;\\n  if (permutation !== null) {\\n    permutedX = transpose({inputs: {x}, attrs: {perm:
permutation}, backend});\\n  }\\n  const permutedAxis = backend_util.getInnerMostAxes(1, xRank)[0];\\n
backend_util.assertAxesAreInnerMostDims('cumsum', [permutedAxis], xRank);\\n  const permutedOut =
backend.makeOutput(permutedX.shape, permutedX.dtype);\\n  const finalDim = permutedX.shape[permutedAxis];\\n
const permutedXId
= backend.dataIdMap.get(permutedX.dataId).id;\\n  const permutedOutId =
backend.dataIdMap.get(permutedOut.dataId).id;\\n  wasmCumsum(permutedXId, exclusive ? 1 : 0, reverse ? 1 : 0,
finalDim,\\n    permutedOutId, CppDType[x.dtype]);\\n\\n  // transpose data back if permuted\\n  let out =
permutedOut;\\n  if (permutation !== null) {\\n    const undoPermutation =
backend_util.getUndoAxesPermutation(permutation);\\n    out = transpose(\\n      {inputs: {x: permutedOut}, attrs:
{perm: undoPermutation}, backend});\\n    backend.disposeData(permutedX.dataId);\\n
backend.disposeData(permutedOut.dataId);\\n  }\\n  return out;\\n}\\n}\\n\\nexport const cumsumConfig: KernelConfig =
{\\n  kernelName: Cumsum,\\n  backendName: 'wasm',\\n  setupFunc: setup,\\n  kernelFunc: cumsum as {} as
KernelFunc\\n};\\n", "/*\\n * @license\\n * Copyright 2019 Google LLC. All Rights Reserved.\\n * Licensed under the
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Unless required by applicable law or agreed to in writing, software\\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\\n * See the License for the specific language governing permissions and\\n * limitations under the
License.\\n *
```

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=====\\n
*\\n\\nimport {DepthToSpace, DepthToSpaceAttrs, DepthToSpaceInputs, KernelConfig, KernelFunc, TensorInfo,
util} from '@tensorflow/tfjs-core';\\n\\nimport {BackendWasm} from '../backend_wasm';\\n\\nlet wasmDepthToSpace:
(\\n  xId: number, blockSize: number, channelsLast: number, xStrides: Uint8Array,\\n  xStridesLength: number,
outputShape: Uint8Array, outputStrides: Uint8Array,\\n  outSize: number, outId: number) => void;\\n\\nfunction
setup(backend: BackendWasm): void {\\n  wasmDepthToSpace
= backend.wasm.cwrap(DepthToSpace, null /*void*/, [\\n    'number', // xId\\n    'number', // blockSize\\n    'number',
// channelsLast\\n    'array', // xStrides\\n    'number', // xStridesLength\\n    'array', // outputShape\\n    'array', //
outputStrides\\n    'number', // outSize\\n    'number', // outId\\n  ]);\\n}\\n\\nexport function depthToSpace(args: {\\n
backend: BackendWasm,\\n  inputs: DepthToSpaceInputs,\\n  attrs: DepthToSpaceAttrs\\n}): TensorInfo {\\n  const
{backend, inputs, attrs} = args;\\n  const {x} = inputs;\\n  const {blockSize, dataFormat} = attrs;\\n\\n  const batchSize
= x.shape[0];\\n  const inputHeight = (dataFormat === 'NHWC') ? x.shape[1] : x.shape[2];\\n  const inputWidth =
(dataFormat === 'NHWC') ? x.shape[2] : x.shape[3];\\n  const inputDepth = (dataFormat === 'NHWC') ? x.shape[3]
```

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: x.shape[1];\n\n const outputHeight = inputHeight * blockSize;\n const outputWidth = inputWidth * blockSize;\n
const outputDepth = inputDepth / (blockSize * blockSize);\n\n
const outputShape = (dataFormat === 'NHWC') ?\n    [batchSize, outputHeight, outputWidth, outputDepth] :\n    [batchSize, outputDepth, outputHeight, outputWidth];\n\n const out = backend.makeOutput(outputShape,\n'float32');\n\n const xData = backend.dataIdMap.get(x.dataId);\n const xId = xData.id;\n const xStridesBytes =\nnew Uint8Array(new Int32Array(util.computeStrides(x.shape)).buffer);\n\n const outputShapeBytes = new\nUint8Array(new Int32Array(outputShape).buffer);\n\n const outStridesBytes =\n    new Uint8Array(new\nInt32Array(util.computeStrides(outputShape)).buffer);\n\n const outId = backend.dataIdMap.get(out.dataId).id;\n
const channelsLast = dataFormat === 'NHWC' ? 1 : 0;\n wasmDepthToSpace(\n    xId, blockSize, channelsLast,\n    xStridesBytes, x.shape.length - 1,\n    outputShapeBytes, outStridesBytes, outputShape.length, outId);\n\n return\nout;\n}\n\nexport const depthToSpaceConfig: KernelConfig = {\n kernelName: DepthToSpace,\n backendName:\n'wasm',\n
setupFunc: setup,\n kernelFunc: depthToSpace as {} as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2019\nGoogle LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you\nmay not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * \nhttp://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,\nsoftware\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES\nOR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\ngoverning permissions and\n * limitations under the License.\n *
=====
*\n\nimport {backend_util, DepthwiseConv2dNative, DepthwiseConv2dNativeAttrs,\nDepthwiseConv2dNativeInputs, KernelConfig, KernelFunc, Tensor4D} from '@tensorflow/tfjs-core';\n\nimport\n{BackendWasm} from\n'../backend_wasm';\n\nlet wasmDepthwiseConv2d: (\n    xId: number, batchSize: number, inputHeight: number,\ninputWidth: number,\n    filterId: number, filterHeight: number, filterWidth: number, padTop: number,\npadRight: number, padBottom: number, padLeft: number, isSamePad: number,\n    dilationHeight: number,\ndilationWidth: number, strideHeight: number,\n    strideWidth: number, inputChannels: number, outputChannels:\nnumber,\n    outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n    wasmDepthwiseConv2d =\nbackend.wasm.cwrap(DepthwiseConv2dNative, null /* void */, [\n        'number', // xId\n        'number', //\nbatchSize\n        'number', // inputHeight\n        'number', // inputWidth\n        'number', // filterId\n        'number', //\nfilterHeight\n        'number', // filterWidth\n        'number', // padTop\n        'number', // padRight\n        'number', //\npadBottom\n        'number', // padLeft\n        'number', // isSamePad\n        'number',\n        // dilationHeight\n        'number', // dilationWidth\n        'number', // strideHeight\n        'number', // strideWidth\n        'number', // inputChannels\n        'number', // outputChannels\n        'number', // outId\n    ]);\n\nfunction\ndepthwiseConv2d(args: {\n    inputs: DepthwiseConv2dNativeInputs,\n    backend: BackendWasm,\n    attrs:\nDepthwiseConv2dNativeAttrs\n}) {\n    const {inputs, attrs, backend} = args;\n\n    const {x, filter} = inputs;\n    const\nxId = backend.dataIdMap.get(x.dataId).id;\n    const filterId = backend.dataIdMap.get(filter.dataId).id;\n\n    const\n{strides, dilations, pad, dimRoundingMode} = attrs;\n\n    const $dilations = dilations == null ? [1, 1] : dilations;\n\n    const convInfo = backend_util.computeConv2DInfo(\n        (x as Tensor4D).shape, (filter as Tensor4D).shape,\n        strides,\n        ($dilations as number | [number, number]), pad, dimRoundingMode,\n        true /* depthwise */);\n\n    const filterHeight = convInfo.filterHeight;\n    const filterWidth\n    = convInfo.filterWidth;\n    const padTop = convInfo.padInfo.top;\n    const padRight = convInfo.padInfo.right;\n    const\npadBottom = convInfo.padInfo.bottom;\n    const padLeft = convInfo.padInfo.left;\n    const dilationHeight =\nconvInfo.dilationHeight;\n    const dilationWidth = convInfo.dilationWidth;\n    const strideHeight =\nconvInfo.strideHeight;\n    const strideWidth = convInfo.strideWidth;\n    const inputChannels =\nconvInfo.inChannels;\n    const outputChannels = convInfo.outChannels;\n    const isSamePad = convInfo.padInfo.type\n=== 'SAME' ? 1 : 0;\n\n    if (convInfo.dataFormat !== 'channelsLast') {\n        throw new Error(\n            `wasm backend\nDepthwiseConv2dNative does not support dataFormat: "` +\n            `${convInfo.dataFormat}` +\n            `". Please use

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'channelsLast'.');\n }\n\n const out = backend.makeOutput(convInfo.outShape, 'float32');\n const outId =
backend.dataIdMap.get(out.dataId).id;\n wasmDepthwiseConv2d(\n    xId, x.shape[0], x.shape[1], x.shape[2],
filterId, filterHeight,\n    filterWidth,
    padTop, padRight, padBottom, padLeft, isSamePad,\n    dilationHeight, dilationWidth, strideHeight, strideWidth,
inputChannels,\n    outputChannels, outId);\n return out;\n}\n\nexport const depthwiseConv2dNativeConfig:
KernelConfig = {\n  kernelName: DepthwiseConv2dNative,\n  backendName: 'wasm',\n  setupFunc: setup,\n  kernelFunc: depthwiseConv2d as { } as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2021 Google LLC. All
Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations
under the License.\n *
=====
\n
*/\nimport {Elu, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from
'./unary_kernel';\n\nexport const eluConfig: KernelConfig = createUnaryKernelConfig(Elu);\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
\"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====
\n
*/\nimport {Equal, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createBinaryKernelConfig} from
'./binary_kernel';\n\nconst supportsFullBroadcast = false;\nexport const equalConfig: KernelConfig =\ncreateBinaryKernelConfig(Equal, supportsFullBroadcast, 'bool');\n", "/*\n * @license\n * Copyright 2019 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not
use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
\n
*/\nimport {Exp, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from
'./unary_kernel';\n\nexport const expConfig: KernelConfig = createUnaryKernelConfig(Exp, 'float32');\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version
2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a
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the specific language governing permissions and\n * limitations under the License.\n *
=====
\n
*/\n\nimport {ExpandDims, ExpandDimsAttrs, ExpandDimsInputs,
KernelConfig, KernelFunc, util} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from
'./backend_wasm';\n\nimport {reshape} from './Reshape';\n\nexport function expandDims(args: {\n  inputs:
ExpandDimsInputs,\n  attrs: ExpandDimsAttrs,\n  backend: BackendWasm\n}) {\n  const {inputs, attrs, backend} =
args;\n  const {input} = inputs;\n  const {dim} = attrs;\n\n  const inputRank = input.shape.length;\n  const newShape

```

```

import shape.slice(); let $dim = dim; if (dim < 0) { // Negative value is counted from the tail of rank.
util.assert(-(inputRank + 1) <= dim, () => `Axis must be in the interval [${-(inputRank + 1)}, ${inputRank}]`); $dim = inputRank + dim + 1; } newShape.splice($dim, 0, 1); return reshape({inputs:
{x: input}, backend, attrs: {shape: newShape}}); } }
export const expandDimsConfig: KernelConfig = {
kernelName: ExpandDims, backendName: 'wasm', kernelFunc: expandDims as {} as KernelFunc, };
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 * distributed under the License is distributed on an "AS IS" BASIS,
 * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.
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 * limitations under the License.
 */
=====
import {KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';
import {Fill, FillAttrs} from '@tensorflow/tfjs-core';
import {BackendWasm} from '../backend_wasm';
export function fill(args: {attrs: FillAttrs, backend: BackendWasm}) {
const {attrs: {shape, value, dtype}, backend} = args;
const out = backend.makeOutput(shape, dtype);
const outVals = backendtypedArrayFromHeap(out);
outVals.fill(value as number);
return out; }
export const fillConfig: KernelConfig = {
kernelName: Fill, backendName: 'wasm', kernelFunc: fill as {} as KernelFunc, };
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 * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.
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 * limitations under the License.
 */
=====
import {FlipLeftRight, FlipLeftRightInputs, KernelConfig, KernelFunc, TensorInfo} from '@tensorflow/tfjs-core';
import {BackendWasm} from '../backend_wasm';
let wasmFlipLeftRight: (xId: number, batch: number, imageHeight: number, imageWidth: number, numChannels: number, outId: number) => void;
function setup(backend: BackendWasm) {
wasmFlipLeftRight = backend.wasm.cwrap(FlipLeftRight, null /* void */, [
'number', // xId
'number', // batch
'number', // imageHeight
'number', // imageWidth
'number', // numChannels
'number', // outId
]); }
export function flipLeftRight(args: {inputs: FlipLeftRightInputs, backend: BackendWasm}): TensorInfo {
const {inputs, backend} = args;
const {image} = inputs;
const out = backend.makeOutput(image.shape, image.dtype);
const imageId = backend.dataIdMap.get(image.dataId).id;
const outId = backend.dataIdMap.get(out.dataId).id;
const [batch, imageHeight, imageWidth, numChannels] = image.shape;
wasmFlipLeftRight(imageId, batch, imageHeight, imageWidth, numChannels, outId);
return out; }
export const flipLeftRightConfig: KernelConfig = {
kernelName: FlipLeftRight, backendName: 'wasm', kernelFunc: flipLeftRight as {} as KernelFunc,
setupFunc: setup; };
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 * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.
 * See the License for the specific language governing permissions and
 * limitations under the License.
 */
=====
import {Floor, KernelConfig} from '@tensorflow/tfjs-core';
import {createUnaryKernelConfig} from

```

```

'./unary_kernel';\nexport const floorConfig: KernelConfig = createUnaryKernelConfig(Floor);\n", "/*\n *
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2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a
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law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *

=====
*\n\nimport {FloorDiv, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createBinaryKernelConfig} from
'./binary_kernel';\n\nconst supportsFullBroadcast = false;\nexport const floorDivConfig: KernelConfig =\ncreateBinaryKernelConfig(FloorDiv, supportsFullBroadcast);\n", "/*\n * @license\n * Copyright 2019 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not
use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *

=====
*\n\nimport {FusedBatchNorm, FusedBatchNormAttrs, FusedBatchNormInputs, KernelConfig, KernelFunc,
TensorInfo, util} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nlet
wasmBatchNorm: (\n  xId: number, meanId: number, varianceId: number, offsetId: number,\n  scaleId: number,
varianceEpsilon: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n
wasmBatchNorm = backend.wasm.cwrap(\n  FusedBatchNorm, null /* void */,\n  ['number', 'number',
'number', 'number', 'number', 'number', 'number']);\n\nfunction fusedBatchNorm(args: {\n  backend:
BackendWasm,\n  inputs: FusedBatchNormInputs,\n  attrs: FusedBatchNormAttrs\n}): TensorInfo {\n  const
{backend, inputs, attrs} = args;\n  const {varianceEpsilon} = attrs;\n  const {x, mean, variance, offset, scale} =
inputs;\n  const xId = backend.dataIdMap.get(x.dataId).id;\n  const meanId =
backend.dataIdMap.get(mean.dataId).id;\n  const varianceId = backend.dataIdMap.get(variance.dataId).id;\n
const offsetId = offset != null ? backend.dataIdMap.get(offset.dataId).id : 0;\n  const scaleId = scale != null ?
backend.dataIdMap.get(scale.dataId).id : 0;\n\n  const out = backend.makeOutput(x.shape, x.dtype);\n  // Short-
circuit zero-sized tensors.\n  if (util.sizeFromShape(x.shape) === 0) {\n    return out;\n  }\n\n  const outId =
backend.dataIdMap.get(out.dataId).id;\n\n  wasmBatchNorm(\n    xId, meanId, varianceId, offsetId, scaleId,
varianceEpsilon, outId);\n  return out;\n}\n\nexport const fusedBatchNormConfig: KernelConfig = {\n  kernelName:
FusedBatchNorm,\n  backendName: 'wasm',\n  setupFunc: setup,\n  kernelFunc: fusedBatchNorm as {} as
KernelFunc\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n
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distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n *

=====
*\n\nimport {backend_util, FusedConv2D, FusedConv2DAttrs, FusedConv2DInputs, KernelConfig, KernelFunc,
Tensor4D} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport
{FusableActivation} from './types';\n\nlet wasmFusedConv2d: (\n  xId: number, batchSize: number, inputHeight:
number, inputWidth: number,\n  filterId: number, filterHeight: number, filterWidth: number,\n  biasId: number,
padTop: number, padRight: number, padBottom: number,\n  padLeft: number, isSamePad: number,
dilationHeight: number,\n  dilationWidth:

```

```

    number, strideHeight: number, strideWidth: number,\n    inputChannels: number, outputChannels: number,\n    activation: number,\n    preluActivationWeightsId: number, leakyreluAlpha: number, outId: number) =>\n    void;\n\nfunction setup(backend: BackendWasm) {\n    wasmFusedConv2d = backend.wasm.cwrap(FusedConv2D,\n    null /* void */, [\n        'number', // xId\n        'number', // batchSize\n        'number', // inputHeight\n        'number', // inputWidth\n        'number', // filterId\n        'number', // filterHeight\n        'number', // filterWidth\n        'number', // biasId\n        'number', // padTop\n        'number', // padRight\n        'number', // padBottom\n        'number', // padLeft\n        'number', // isSamePad\n        'number', // dilationHeight\n        'number', // dilationWidth\n        'number', // strideHeight\n        'number', // strideWidth\n        'number', // inputChannels\n        'number', // outputChannels\n        'number', // activation\n        'number', // preluActivationWeightsId\n        'number', // leakyreluAlpha\n        'number', // outId\n    ]);\n\nfunction fusedConv2d(args: {\n    inputs: FusedConv2DInputs,\n    backend: BackendWasm,\n    attrs: FusedConv2DAttrs\n}) {\n    const {inputs, attrs, backend} = args;\n    const {x, filter, bias, preluActivationWeights} = inputs;\n    const {\n        strides,\n        pad,\n        dilations,\n        dataFormat,\n        dimRoundingMode,\n        activation,\n        leakyreluAlpha\n    } = attrs;\n\n    const convInfo = backend_util.computeConv2DInfo(\n        (x as Tensor4D).shape, (filter as Tensor4D).shape, strides, dilations,\n        pad, dimRoundingMode);\n\n    const fusedActivation =\n        FusableActivation[activation as {}] as keyof typeOf FusableActivation;\n    if (fusedActivation == null) {\n        throw new Error(\n            `${activation} activation not yet supported for FusedConv2D` +\n            `in the wasm backend.`);\n    }\n\n    const xId = backend.dataIdMap.get(x.dataId).id;\n    const filterId = backend.dataIdMap.get(filter.dataId).id;\n    const outputChannels = convInfo.outChannels;\n\n    let biasId = 0;\n    if (bias != null) {\n        const biasData = backend.dataIdMap.get(bias.dataId);\n        if (biasData.shape.length !== 1) {\n            throw new Error(\n                `FusedConv2D only supports rank-1 bias but got ` +\n                `rank ${biasData.shape.length}.`);\n        }\n        if (biasData.shape[0] !== outputChannels) {\n            throw new Error(\n                `FusedConv2D bias shape (${biasData.shape}) does not ` +\n                `match the number of output channels (${outputChannels}).`);\n        }\n        biasId = biasData.id;\n    }\n\n    const filterHeight = convInfo.filterHeight;\n    const filterWidth = convInfo.filterWidth;\n    const padTop = convInfo.padInfo.top;\n    const padRight = convInfo.padInfo.right;\n    const padBottom = convInfo.padInfo.bottom;\n    const padLeft = convInfo.padInfo.left;\n    const dilationHeight = convInfo.dilationHeight;\n    const dilationWidth = convInfo.dilationWidth;\n    const strideHeight = convInfo.strideHeight;\n    const strideWidth = convInfo.strideWidth;\n\n    const inputChannels = convInfo.inChannels;\n    const isSamePad = convInfo.padInfo.type === 'SAME' ? 1 : 0;\n    const batchSize = convInfo.batchSize;\n    const inHeight = convInfo.inHeight;\n    const inWidth = convInfo.inWidth;\n\n    if (dataFormat !== 'NHWC') {\n        throw new Error(\n            `wasm backend FusedConv2D does not support dataFormat:` +\n            `${dataFormat}. Please use 'NHWC'.`);\n    }\n\n    const out = backend.makeOutput(convInfo.outShape, 'float32');\n    const outId = backend.dataIdMap.get(out.dataId).id;\n    const preluActivationWeightsId = preluActivationWeights == null ?\n        0 : backend.dataIdMap.get(preluActivationWeights.dataId).id;\n\n    wasmFusedConv2d(\n        xId, batchSize, inHeight, inWidth, filterId, filterHeight, filterWidth,\n        biasId, padTop, padRight, padBottom, padLeft, isSamePad, dilationHeight,\n        dilationWidth, strideHeight, strideWidth, inputChannels, outputChannels,\n        fusedActivation, preluActivationWeightsId, leakyreluAlpha ||\n        0, outId);\n\n    return out;\n}\n\nexport const fusedConv2DConfig: KernelConfig = {\n    kernelName: 'FusedConv2D',\n    backendName: 'wasm',\n    setupFunc: setup,\n    kernelFunc: fusedConv2d as {} as KernelFunc\n};\n\n/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */

```

```

=====\\n
*\\n\\nimport {backend_util, FusedDepthwiseConv2D, FusedDepthwiseConv2DAttrs,
  FusedDepthwiseConv2DInputs, KernelConfig, KernelFunc, Tensor4D} from '@tensorflow/tfjs-core';\\n\\nimport
  {BackendWasm} from './backend_wasm';\\n\\nimport {FusableActivation} from './types';\\n\\nlet
  wasmFusedDepthwiseConv2d:\\n  (xId: number, batchSize: number, inputHeight: number, inputWidth: number,\\n
  filterId: number, filterHeight: number, filterWidth: number,\\n    biasId: number, padTop: number, padRight:
  number, padBottom: number,\\n    padLeft: number, isSamePad: number, dilationHeight: number,\\n
  dilationWidth: number, strideHeight: number, strideWidth: number,\\n    inputChannels: number, outputChannels:
  number, activation: number,\\n    preluActivationWeightsId: number, leakyreluAlpha: number, outId: number) =>\\n
    void;\\n\\nfunction setup(backend: BackendWasm) {\\n  wasmFusedDepthwiseConv2d =\\n
  backend.wasm.cwrap(FusedDepthwiseConv2D, null /* void */, [\\n    'number', // xId\\n    'number', //
  batchSize\\n    'number', // inputHeight\\n
  'number', // inputWidth\\n    'number', // filterId\\n    'number', // filterHeight\\n    'number', // filterWidth\\n
  'number', // biasId\\n    'number', // padTop\\n    'number', // padRight\\n    'number', // padBottom\\n
  'number', // padLeft\\n    'number', // isSamePad\\n    'number', // dilationHeight\\n    'number', //
  dilationWidth\\n    'number', // strideHeight\\n    'number', // strideWidth\\n    'number', // inputChannels\\n
  'number', // outputChannels\\n    'number', // activation\\n    'number', // preluActivationWeightsId\\n
  'number', // leakyreluAlpha\\n    'number', // outId\\n  ]);\\n\\nfunction fusedDepthwiseConv2d(args: {\\n
  inputs: FusedDepthwiseConv2DInputs,\\n  backend: BackendWasm,\\n  attrs: FusedDepthwiseConv2DAttrs\\n}) {\\n
  const {inputs, attrs, backend} = args;\\n  const {x, filter, bias, preluActivationWeights} = inputs;\\n  const {\\n
  strides,\\n  pad,\\n  dilations,\\n
  dataFormat,\\n  dimRoundingMode,\\n  activation,\\n  leakyreluAlpha\\n} = attrs;\\n\\n  const convInfo =
  backend_util.computeConv2DInfo(\\n    (x as Tensor4D).shape, (filter as Tensor4D).shape, strides, dilations,\\n
  pad, dimRoundingMode, true /* depthwise */);\\n\\n  const fusedActivation =\\n    FusableActivation[activation as {}
  as keyof typeof FusableActivation];\\n  if (fusedActivation == null) {\\n    throw new Error(\\n      `${activation}
  activation not yet supported for FusedDepthwiseConv2D` +\\n      `in the wasm backend.`);\\n  }\\n\\n  const xId =
  backend.dataIdMap.get(x.dataId).id;\\n  const filterId = backend.dataIdMap.get(filter.dataId).id;\\n  const
  outputChannels = convInfo.outChannels;\\n\\n  let biasId = 0;\\n  if (bias != null) {\\n    const biasData =
  backend.dataIdMap.get(bias.dataId);\\n    if (biasData.shape.length !== 1) {\\n      throw new Error(\\n
  `FusedDepthwiseConv2D only supports rank-1 bias but got` +\\n      `rank ${biasData.shape.length}`);\\n
  }\\n    if (biasData.shape[0] !== outputChannels) {\\n      throw new Error(\\n      `FusedDepthwiseConv2D bias
  shape (${biasData.shape}) does not` +\\n      `match the number of output channels (${outputChannels})`);\\n    }\\n
  biasId = biasData.id;\\n  }\\n\\n  const filterHeight = convInfo.filterHeight;\\n  const filterWidth =
  convInfo.filterWidth;\\n  const padTop = convInfo.padInfo.top;\\n  const padRight = convInfo.padInfo.right;\\n  const
  padBottom = convInfo.padInfo.bottom;\\n  const padLeft = convInfo.padInfo.left;\\n  const dilationHeight =
  convInfo.dilationHeight;\\n  const dilationWidth = convInfo.dilationWidth;\\n  const strideHeight =
  convInfo.strideHeight;\\n  const strideWidth = convInfo.strideWidth;\\n  const inputChannels =
  convInfo.inChannels;\\n  const isSamePad = convInfo.padInfo.type === 'SAME' ? 1 : 0;\\n  const batchSize =
  convInfo.batchSize;\\n  const inHeight = convInfo.inHeight;\\n  const inWidth = convInfo.inWidth;\\n\\n  if
  (dataFormat !== 'NHWC') {\\n    throw
  new Error(\\n      `wasm backend FusedDepthwiseConv2D does not support dataFormat:` +\\n      `${dataFormat}`.
  Please use 'NHWC'.`);\\n  }\\n\\n  const out = backend.makeOutput(convInfo.outShape, 'float32');\\n  const outId =
  backend.dataIdMap.get(out.dataId).id;\\n  const preluActivationWeightsId = preluActivationWeights == null ?\\n    0
  :\\n    backend.dataIdMap.get(preluActivationWeights.dataId).id;\\n\\n  wasmFusedDepthwiseConv2d(\\n    xId,
  batchSize, inHeight, inWidth, filterId, filterHeight, filterWidth,\\n    biasId, padTop, padRight, padBottom, padLeft,
  isSamePad, dilationHeight,\\n    dilationWidth, strideHeight, strideWidth, inputChannels, outputChannels,\\n
  fusedActivation, preluActivationWeightsId, leakyreluAlpha || 0, outId);\\n\\n  return out;\\n}\\n\\nexport const
  fusedDepthwiseConv2DConfig: KernelConfig = {\\n  kernelName: FusedDepthwiseConv2D,\\n  backendName:

```

```
'wasm',\n setupFunc: setup,\n kernelFunc: fusedDepthwiseConv2d as { } as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\n * License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or\n * agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n * the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n\n*\n\nimport { gather_util, GatherNd, GatherNdInputs, KernelConfig, TensorInfo } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nimport { CppDType } from './types';\n\nlet\nwasmGatherNd: (\n  xId: number, dtype: CppDType, indicesId: number, numSlices: number,\n  sliceRank: number, sliceSize: number, strides: Uint8Array, outId: number) => void;\n\nfunction\nsetup(backend: BackendWasm): void {\n  wasmGatherNd = backend.wasm.cwrap(GatherNd, null /*void*/, [\n    'number', // xId\n    'number', // dtype\n    'number', // indicesId\n    'number', // numSlices\n    'number', // sliceRank\n    'number', // sliceSize\n    'array', // strides\n    'number', // outId\n  ]);\n\n  function gatherNd(args: {\n    backend: BackendWasm, inputs: GatherNdInputs\n  }): TensorInfo {\n    const { backend, inputs } = args;\n    const { params, indices } = inputs;\n\n    const [resultShape, numSlices, sliceSize, strides] =\n      gather_util.prepareAndValidate(params, indices);\n\n    const out = backend.makeOutput(resultShape, params.dtype);\n\n    if (numSlices === 0) {\n      return out;\n    }\n\n    const indicesShape = indices.shape;\n    const sliceRank = indicesShape[indicesShape.length - 1];\n    const xData = backend.dataIdMap.get(params.dataId);\n    const xId = xData.id;\n\n    const indicesData = backend.dataIdMap.get(indices.dataId);\n    const indicesId = indicesData.id;\n    const stridesBytes = new Uint8Array(new Int32Array(strides).buffer);\n    const outId = backend.dataIdMap.get(out.dataId).id;\n\n    wasmGatherNd(xId, CppDType[params.dtype], indicesId, numSlices, sliceRank, sliceSize, stridesBytes, outId);\n\n    return out;\n  }\n\n  export const gatherNdConfig: KernelConfig = {\n    kernelName: GatherNd,\n    backendName: 'wasm',\n    setupFunc: setup,\n    kernelFunc: gatherNd\n  };\n\n  "/*\n   * @license\n   * Copyright 2019 Google LLC. All Rights Reserved.\n   * Licensed under the\n   * Apache License, Version 2.0 (the \"License\");\n   * you may not use this file except in compliance with the\n   * License.\n   * You may obtain a copy of the License at\n   * http://www.apache.org/licenses/LICENSE-2.0\n   * Unless required by applicable law or agreed to in writing, software\n   * distributed under the License is distributed\n   * on an \"AS IS\" BASIS,\n   * WITHOUT WARRANTIES\n   * OR CONDITIONS OF ANY KIND, either express or implied.\n   * See the License for the specific language\n   * governing permissions and\n   * limitations under the License.\n   *\n
```

```
=====\n\n*\n\nimport { backend_util, GatherV2, GatherV2Attrs, GatherV2Inputs, KernelConfig, KernelFunc, Tensor, TensorInfo, TypedArray, util } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from\n '../backend_wasm';\nimport { reshape } from './Reshape';\nimport { CppDType } from './types';\n\nlet\nwasmGather: (\n  xId: number, dtype: CppDType, xStrides: Uint8Array, stridesSize: number,\n  indicesId: number, batchSize: number, outStrides: Uint8Array,\n  outId: number) => void;\n\nfunction\nsetup(backend: BackendWasm): void {\n  wasmGather = backend.wasm.cwrap('Gather', null /*void*/, [\n    'number', // xId\n    'number', // dtype\n    'array', // xStrides\n    'number', // stridesSize\n    'number', // indicesId\n    'number', // batchSize\n    'array', // outStrides\n    'number', // outId\n  ]);\n\n  function gatherV2(\n    args: {\n      backend: BackendWasm, inputs: GatherV2Inputs, attrs: GatherV2Attrs\n    }): TensorInfo {\n    const { backend, inputs, attrs } = args;\n    const { x, indices } = inputs;\n    const { axis, batchDims } = attrs;\n\n    // Throw error when any index is out of bound.\n    const parsedAxis = util.parseAxisParam(axis, x.shape)[0];\n    const indicesVals = backend.readSync(indices.dataId) as TypedArray;\n    const axisDim = x.shape[parsedAxis];\n    for (let i = 0; i < indicesVals.length; ++i) {\n      const index = indicesVals[i];\n      util.assert(\n        index <= axisDim - 1 && index >= 0,\n        () => {\n          `GatherV2: the index value ${index} is not in [0, ${axisDim - 1}]`;\n        }\n      );\n    }\n\n    const shapeInfo =\n
```



```
'./tensorflow/tfjs-core';\n\nimport { BackendWasm } from './wasm_wasm';\n\nimport { CppDType } from  
'.types';\n\nlet wasmFunc: (\n  xId: number, dtype: number, leakyreluAlpha: number, outId: number) =>  
void;\n\nfunction setupFunc(backend: BackendWasm): void {\n  wasmFunc = backend.wasm.cwrap(LeakyRelu,  
null /* void */, [\n    'number', // x_id\n    'number', // dtype\n    'number', // leakyrelu_alpha\n    'number', //  
out_id\n  ]);\n}\n\nexport function leakyRelu(\n  args:\n    { inputs: LeakyReluInputs, attrs: LeakyReluAttrs,  
backend: BackendWasm }):\n  TensorInfo {\n    const { inputs: { x }, attrs: { alpha }, backend } = args;\n    const xId =  
backend.dataIdMap.get(x.dataId).id;\n    // According to TF API, LeakyRelu returns float32 when input is either  
float32\n    // or int32.\n    const out = backend.makeOutput(x.shape, 'float32');\n    if (util.sizeFromShape(x.shape)  
!= 0) {\n      const outId = backend.dataIdMap.get(out.dataId).id;\n      wasmFunc(xId, CppDType[x.dtype], alpha,  
outId);\n    }\n    return out;\n  }\n}\n\nexport const leakyReluConfig: KernelConfig = {\n  kernelName: LeakyRelu,\n  backendName: 'wasm',\n  setupFunc,\n  kernelFunc: leakyRelu as {} as KernelFunc,\n};\n";\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the  
"\License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the  
License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable  
law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for  
the specific language governing permissions and\n * limitations under the License.\n */\n=====\n*/\nimport { KernelConfig, Less } from '@tensorflow/tfjs-core';\nimport { createBinaryKernelConfig } from  
'.binary_kernel';\nconst supportsFullBroadcast = false;\nexport const lessConfig: KernelConfig =\ncreateBinaryKernelConfig(Less, supportsFullBroadcast, 'bool');\n";\n"/**\n * @license\n * Copyright 2019 Google  
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "\License");\n * you may not  
use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law  
or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for  
the specific language governing permissions and\n * limitations under the License.\n */\n=====\n*/\nimport { KernelConfig, LessEqual } from '@tensorflow/tfjs-core';\nimport { createBinaryKernelConfig } from  
'.binary_kernel';\nconst supportsFullBroadcast = false;\nexport const lessEqualConfig: KernelConfig =\ncreateBinaryKernelConfig(LessEqual, supportsFullBroadcast, 'bool');\n";\n"/**\n * @license\n * Copyright 2019  
Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "\License");\n * you may  
not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable  
law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for  
the specific language governing permissions and\n * limitations under the License.\n */\n=====\n*/\nimport { KernelConfig, Log } from '@tensorflow/tfjs-core';\nimport { createUnaryKernelConfig } from  
'.unary_kernel';\nexport const logConfig: KernelConfig = createUnaryKernelConfig(Log);\n";\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the  
"\License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the  
License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or  
agreed to in writing, software\n * distributed under the License is distributed  
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or  
implied.\n * See the License for the specific language governing permissions and\n * limitations under the  
License.\n */
```



```

*\nimport {KernelConfig, LogicalAnd} from '@tensorflow/tfjs-core';\n\nimport {createBinaryKernelConfig} from
'./binary_kernel';\nconst supportsFullBroadcast = false;\nexport const logicalAndConfig: KernelConfig =\ncreateBinaryKernelConfig(LogicalAnd, supportsFullBroadcast, 'bool');\n"/**\n * @license\n * Copyright 2019
Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you
may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License
is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n *

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=====
*\n\nimport {backend_util, KernelConfig, KernelFunc, Max, MaxAttrs, MaxInputs, TensorInfo, util} from
'@tensorflow/tfjs-core';\n\nimport {BackendWasm} from './backend_wasm';\n\nimport
{permuteAxesAndTranspose} from './kernel_utils';\nimport {CppType} from './types';\n\nlet wasmMax: (xId:
number, dtype: number, reduceSize: number, outId: number) =>\n void;\n\nfunction setup(backend:
BackendWasm): void {\n  wasmMax = backend.wasm.cwrap(Max, null /*void*/, [\n    'number', // x_id\n
'number', // dtype\n    'number', // reduce_size\n    'number', // out_id\n  ]);\n\n  function max(args: {backend:
BackendWasm, inputs: MaxInputs, attrs: MaxAttrs}): \n    TensorInfo {\n    const
{backend, inputs, attrs} = args;\n    const {reductionIndices: axis, keepDims} = attrs;\n    const {x} = inputs;\n    const
xId = backend.dataIdMap.get(x.dataId).id;\n    let inputId = xId;\n    let input = x;\n\n    const {transposed, axes,
originalAxes, inputWasTransposed} =\n      permuteAxesAndTranspose(x, axis, backend);\n\n    if
(inputWasTransposed) {\n      const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n      input =
transposed;\n      inputId = transposedId;\n    }\n\n    const inputRank = input.shape.length;\n    backend_util.assertAxesAreInnerMostDims('max', axes, inputRank);\n    const [outShape, reduceShape] =\n      backend_util.computeOutAndReduceShapes(input.shape, axes);\n    const reduceSize =
util.sizeFromShape(reduceShape);\n\n    const out = backend.makeOutput(outShape, x.dtype);\n    if
(util.sizeFromShape(input.shape) !== 0) {\n      const outId = backend.dataIdMap.get(out.dataId).id;\n      wasmMax(inputId, CCppType[x.dtype], reduceSize, outId);\n    }\n\n    if (inputWasTransposed)
{\n      // dispose of the transposed tensor.\n      backend.disposeData(transposed.dataId);\n    }\n\n    if (keepDims) {\n
// reshape\n      const newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n      out.shape =
newShape;\n    }\n\n    return out;\n  }\n\n  export const maxConfig: KernelConfig = {\n    kernelName: Max,\n
backendName: 'wasm',\n    setupFunc: setup,\n    kernelFunc: max as {} as KernelFunc\n  };\n  "/**\n * @license\n *
Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
"License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing
permissions and\n * limitations under the License.\n *

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=====
*\n\nimport {KernelConfig, Maximum} from '@tensorflow/tfjs-core';\n\nimport {createBinaryKernelConfig} from
'./binary_kernel';\nconst supportsFullBroadcast = false;\nexport const maximumConfig: KernelConfig =\ncreateBinaryKernelConfig(Maximum, supportsFullBroadcast);\n"/**\n * @license\n * Copyright 2019 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not
use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language

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and\n * limitations under the License.\n *

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=====
*\n\nimport {backend_util, KernelConfig, KernelFunc, MaxPool, MaxPoolAttrs, MaxPoolInputs, Tensor4D, util}
from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nlet wasmMaxPool: (\n  xId:
number, batchSize: number, inputHeight: number, inputWidth: number,\n  filterHeight: number, filterWidth:
number, padTop: number, padRight: number,\n  padBottom: number, padLeft: number, dilationHeight: number,\n  dilationWidth: number, strideHeight: number, strideWidth: number,\n  inputChannels: number, outputChannels:
number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n  wasmMaxPool =
backend.wasm.cwrap(MaxPool, null /* void */, [\n    'number', // xId\n    'number', // batchSize\n    'number', //
inputHeight\n    'number', // inputWidth\n    'number', // filterHeight\n    'number', // filterWidth\n
    'number', // padTop\n    'number', // padRight\n    'number', // padBottom\n    'number', // padLeft\n    'number', //
dilationHeight\n    'number', // dilationWidth\n    'number', // strideHeight\n    'number', // strideWidth\n
    'number', // inputChannels\n    'number', // outputChannels\n    'number', // outId\n  ]);\n}\n\nfunction maxPool(\n  args:
{inputs: MaxPoolInputs, backend: BackendWasm, attrs: MaxPoolAttrs}) {\n  const {inputs, attrs, backend} =
args;\n\n  const x = inputs.x as Tensor4D;\n  const xId = backend.dataIdMap.get(x.dataId).id;\n\n  // TF API
supports int32 input. CPU and WebGL backend also support int32\n  // input. WASM backend doesn't support it
because it uses xnnpack which only\n  // supports float32.\n  // Add the following assert only for the WASM
backend instead of at core op\n  // level.\n  // TODO: add support for int32 input.\n  util.assert(\n    x.dtype
=== 'float32',\n    () =>\n      `Error in MaxPool: only float32 input
is supported. Got ${x.dtype}.`);\n\n  const {filterSize, strides, pad, dimRoundingMode} = attrs;\n  const convInfo =
backend_util.computePool2DInfo(\n    x.shape, filterSize, strides, 1 /* dilations */, pad, dimRoundingMode);\n\n  const filterHeight = convInfo.filterHeight;\n  const filterWidth = convInfo.filterWidth;\n  const padTop =
convInfo.padInfo.top;\n  const padRight = convInfo.padInfo.right;\n  const padBottom = convInfo.padInfo.bottom;\n  const padLeft = convInfo.padInfo.left;\n  const dilationHeight = convInfo.dilationHeight;\n  const dilationWidth =
convInfo.dilationWidth;\n  const strideHeight = convInfo.strideHeight;\n  const strideWidth =
convInfo.strideWidth;\n  const inputChannels = convInfo.inChannels;\n  const outputChannels =
convInfo.outChannels;\n\n  if (convInfo.dataFormat !== 'channelsLast') {\n    throw new Error(\n      `wasm
backend does not support dataFormat:` +\n      `${convInfo.dataFormat}`. Please use 'channelsLast'.`);\n  }\n\n  const out =
backend.makeOutput(convInfo.outShape, 'float32');\n  const outId = backend.dataIdMap.get(out.dataId).id;\n\n  wasmMaxPool(\n    xId, x.shape[0], x.shape[1], x.shape[2], filterHeight, filterWidth,\n    padTop, padRight,
padBottom, padLeft, dilationHeight, dilationWidth,\n    strideHeight, strideWidth, inputChannels, outputChannels,
outId);\n  return out;\n}\n\nexport const maxPoolConfig: KernelConfig = {\n  kernelName: MaxPool,\n  backendName: 'wasm',\n  setupFunc: setup,\n  kernelFunc: maxPool as { } as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
'License');\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *

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=====
*\n\nimport {backend_util, KernelConfig, KernelFunc, Mean, MeanAttrs, MeanInputs, TensorInfo, util} from
'@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport {cast} from './Cast';\n\nimport
{permuteAxesAndTranspose} from './kernel_utils';\n\nlet wasmMean: (xId: number, reduceSize: number, outId:
number) => void;\n\nfunction setup(backend: BackendWasm): void {\n  wasmMean =\n  backend.wasm.cwrap(Mean, null /*void*/, ['number, number, number']);\n}\n\nexport function mean(\n  args:
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{backend: BackendWasm, inputs: MeanInputs, attrs: MeanAttrs});\n  TensorInfo {\n  const {backend, inputs,
attrs} = args;\n  const {axis, keepDims} = attrs;\n  const {x} = inputs;\n  const xId =
backend.dataIdMap.get(x.dataId).id;\n
  let inputId = xId;\n  let input = x;\n\n  const {transposed, axes, originalAxes, inputWasTransposed} =\npermuteAxesAndTranspose(x, axis, backend);\n\n  let reductionAxes = axes;\n  if (inputWasTransposed) {\n    const
transposedId = backend.dataIdMap.get(transposed.dataId).id;\n    if (transposedId !== xId) {\n      // transpose was
not a no-op. We will need to dispose of this\n      // once we are done.\n      input = transposed;\n      inputId =
transposedId;\n      reductionAxes = backend_util.getInnerMostAxes(\n        reductionAxes.length,
input.shape.length);\n    }\n  }\n\n  backend_util.assertAxesAreInnerMostDims(\n    'mean', reductionAxes,
input.shape.length);\n  const [outShape, reduceShape] =\nbackend_util.computeOutAndReduceShapes(input.shape, reductionAxes);\n  const reduceSize =
util.sizeFromShape(reduceShape);\n  let castedInput = input;\n  if (input.dtype !== 'float32') {\n    castedInput =\n    cast({backend, inputs: {x: input}, attrs: {dtype:
'float32'}});\n    inputId = backend.dataIdMap.get(castedInput.dataId).id;\n  }\n\n  const out =
backend.makeOutput(outShape, 'float32');\n  if (util.sizeFromShape(input.shape) !== 0) {\n    const outId =
backend.dataIdMap.get(out.dataId).id;\n    wasmMean(inputId, reduceSize, outId);\n  }\n\n  if
(inputWasTransposed) {\n    // dispose of the transposed tensor.\n    backend.disposeData(transposed.dataId);\n  }\n\n  if (keepDims) {\n    // reshape\n    const newShape = backend_util.expandShapeToKeepDim(out.shape,
originalAxes);\n    out.shape = newShape;\n  }\n\n  if (input.dtype !== 'float32') {\n
backend.disposeData(castedInput.dataId);\n  }\n\n  return out;\n}\n\nexport const meanConfig: KernelConfig = {\n
kernelName: Mean,\n  backendName: 'wasm',\n  setupFunc: setup,\n  kernelFunc: mean as {} as
KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the "License");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*/\n\nimport {backend_util, KernelConfig, KernelFunc, Min, MinAttrs, MinInputs, TensorInfo, util} from
'@tensorflow/tfjs-core';\n\nimport {BackendWasm} from './backend_wasm';\n\nimport
{permuteAxesAndTranspose} from './kernel_utils';\n\nimport {CppType} from './types';\n\nlet wasmMin: (xId:
number, dtype: number, reduceSize: number, outId: number) =>\n  void;\n\nfunction setup(backend:
BackendWasm): void {\n  wasmMin = backend.wasm.cwrap(Min,
null/*void*/, [\n    'number', // x_id\n    'number', // dtype\n    'number', // reduce_size\n    'number', // out_id\n  ]);\n\n  function min(args: {backend: BackendWasm, inputs: MinInputs, attrs: MinAttrs}): TensorInfo {\n
const {backend, inputs, attrs} = args;\n  const {axis, keepDims} = attrs;\n  const {x} = inputs;\n  const xId =
backend.dataIdMap.get(x.dataId).id;\n  let inputId = xId;\n  let input = x;\n\n  const {transposed, axes, originalAxes,
inputWasTransposed} =\n    permuteAxesAndTranspose(x, axis, backend);\n\n  if (inputWasTransposed) {\n
const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n    if (transposedId !== xId) {\n      // transpose
was not a no-op. We will need to dispose of this\n      // once we are done.\n      input = transposed;\n      inputId =
transposedId;\n    }\n  }\n\n  const inputRank = input.shape.length;\n\n  backend_util.assertAxesAreInnerMostDims('min', axes, inputRank);\n  const [outShape, reduceShape] =\n    backend_util.computeOutAndReduceShapes(input.shape, axes);\n  const reduceSize =
util.sizeFromShape(reduceShape);\n\n  const out = backend.makeOutput(outShape, input.dtype);\n  if
(util.sizeFromShape(input.shape) !== 0) {\n    const outId = backend.dataIdMap.get(out.dataId).id;\n
wasmMin(inputId, CCppType[x.dtype], reduceSize, outId);\n  }\n\n  if (inputWasTransposed) {\n    // dispose of the
transposed tensor.\n    backend.disposeData(transposed.dataId);\n  }\n\n  if (keepDims) {\n    // reshape\n    const

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newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n    out.shape = newShape;\n  }\n\n  return out;\n}\n\nexport const minConfig: KernelConfig = {\n  kernelName: Min,\n  backendName: 'wasm',\n  setupFunc: setup,\n  kernelFunc: min as {} as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n *\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an\n * \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n=====\n\n*/\nimport {KernelConfig, Minimum} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from './binary_kernel';\nconst supportsFullBroadcast = false;\nexport const minimumConfig: KernelConfig =\n  createBinaryKernelConfig(Minimum, supportsFullBroadcast);\n\n"/**\n * @license\n * Copyright 2021 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n *\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an\n * \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n=====\n\n*/\nimport {KernelConfig, KernelFunc, MirrorPad, MirrorPadAttrs, MirrorPadInputs} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nimport {CppType} from './types';\n\n// Must match enum in MirrorPad.cc\nenum MirrorPaddingMode {\n  reflect = 0,\n  symmetric = 1\n}\n\nlet wasmMirrorPad: (\n  xId: number, xShapeBytes: Uint8Array, xShapeLength: number, xDtype: number,\n  prePaddingsBytes: Uint8Array, postPaddingsBytes: Uint8Array, mode: number,\n  outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n  wasmMirrorPad =\n    backend.wasm.cwrap(MirrorPad, null /* void */, [\n      'number', // xId\n      'array', // x.shape\n      'number', // x.shape.length\n      'array', // x.dtype\n      'array', // pre-paddings\n      'number', // post-paddings\n      'number', // mode\n      'number', // outId\n    ]);\n\n  function mirrorPad(args: {\n    inputs: MirrorPadInputs,\n    backend: BackendWasm,\n    attrs: MirrorPadAttrs\n  }) {\n    const {inputs: {x}, backend, attrs: {paddings, mode}} = args;\n\n    const outShape = paddings.map((p, i) => p[0] /* beforePad */ + x.shape[i] + p[1] /* afterPad */);\n    const xId = backend.dataIdMap.get(x.dataId).id;\n    const out = backend.makeOutput(outShape, x.dtype);\n    const outId = backend.dataIdMap.get(out.dataId).id;\n    const xShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);\n    const prePaddingsFlat = paddings.map(padTuple => padTuple[0]);\n    const postPaddingsFlat = paddings.map(padTuple => padTuple[1]);\n    const prePaddingsBytes = new Uint8Array(new Int32Array(prePaddingsFlat).buffer);\n    const postPaddingsBytes = new Uint8Array(new Int32Array(postPaddingsFlat).buffer);\n\n    wasmMirrorPad(\n      xId, xShapeBytes, x.shape.length, CppDType[x.dtype], prePaddingsBytes,\n      postPaddingsBytes, MirrorPaddingMode[mode], outId);\n    return out;\n  }\n\n  export const mirrorPadConfig:\n    KernelConfig = {\n      kernelName: MirrorPad,\n      backendName: 'wasm',\n      kernelFunc: mirrorPad as {} as KernelFunc,\n      setupFunc: setup\n    };\n\n  /**\n   * @license\n   * Copyright 2019 Google LLC. All Rights Reserved.\n   * Licensed under the Apache License, Version 2.0 (the \"License\");\n   * you may not use this file except in compliance with the License.\n   * You may obtain a copy of the License at\n   * http://www.apache.org/licenses/LICENSE-2.0\n   * Unless required by applicable law or agreed to in writing, software\n   * distributed under the License is distributed on an \"AS IS\"\n   * BASIS,\n   * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n   * See the License for the specific language governing permissions and\n   * limitations under the License.\n   */
```

```

*\n\nimport { KernelConfig, Multiply } from '@tensorflow/tfjs-core';\n\nimport { createBinaryKernelConfig } from
'./binary_kernel';\n\nconst supportsFullBroadcast = true;\n\nexport const multiplyConfig: KernelConfig =\ncreateBinaryKernelConfig(Multiply, supportsFullBroadcast);\n\n"/**\n * @license\n * Copyright 2020 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not
use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS"
BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the
License for the specific language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport { KernelConfig, Neg } from '@tensorflow/tfjs-core';\n\nimport { createUnaryKernelConfig } from
'./unary_kernel';\n\nexport const negConfig: KernelConfig = createUnaryKernelConfig(Neg);\n\n"/**\n * @license\n
* Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
"License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific
language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport { BackendWasm } from './backend_wasm';\n\n// Analogous to `struct Result` in
`non_max_suppression_impl.h`\n\ninterface Result {\n  pSelectedIndices: number;\n  selectedSize: number;\n
pSelectedScores: number;\n  pValidOutputs: number;\n}\n\n/**\n * Parse the result of the c++ method, which has the
shape equivalent to\n * `Result`\n *\nexport function parseResultStruct(\n  backend: BackendWasm, resOffset:
number): Result {\n  const result = new Int32Array(backend.wasm.HEAPU8.buffer, resOffset, 4);\n  const
pSelectedIndices = result[0];\n  const selectedSize = result[1];\n  const pSelectedScores = result[2];\n  const
pValidOutputs = result[3];\n  // Since the result was allocated on the heap, we have to delete it.\n
backend.wasm._free(resOffset);\n  return {pSelectedIndices, selectedSize,\n    pSelectedScores, pValidOutputs};\n}\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport { KernelConfig, KernelFunc, NonMaxSuppressionV3, NonMaxSuppressionV3Attrs,
NonMaxSuppressionV3Inputs, TensorInfo } from '@tensorflow/tfjs-core';\n\nimport { BackendWasm } from
'./backend_wasm';\n\nimport { parseResultStruct } from
'./NonMaxSuppression_util';\n\nlet wasmFunc: (\n  boxesId: number, scoresId: number, maxOutputSize:
number,\n  iouThreshold: number, scoreThreshold: number) => number;\n\nfunction setup(backend:
BackendWasm): void {\n  wasmFunc = backend.wasm.cwrap(\n    NonMaxSuppressionV3,\n    'number', //
Result*\n    [\n      'number', // boxesId\n      'number', // scoresId\n      'number', // maxOutputSize\n
'number', // iouThreshold\n      'number', // scoreThreshold\n    ]);\n\n  function kernelFunc(args: {\n    backend:
BackendWasm,\n    inputs: NonMaxSuppressionV3Inputs,\n    attrs: NonMaxSuppressionV3Attrs\n  }): TensorInfo {\n
const {backend, inputs, attrs} = args;\n  const {iouThreshold, maxOutputSize, scoreThreshold} = attrs;\n  const
{boxes, scores} = inputs;\n\n  const boxesId = backend.dataIdMap.get(boxes.dataId).id;\n  const scoresId =
backend.dataIdMap.get(scores.dataId).id;\n\n  const resOffset =\n    wasmFunc(boxesId, scoresId, maxOutputSize,
iouThreshold,

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scoreThreshold);\n\n const {pSelectedIndices, selectedSize, pSelectedScores, pValidOutputs} =\n
parseResultStruct(backend, resOffset);\n\n // Since we are not using scores for V3, we have to delete it from the
heap.\n backend.wasm._free(pSelectedScores);\n backend.wasm._free(pValidOutputs);\n\n const
selectedIndicesTensor =\n    backend.makeOutput([selectedSize], 'int32', pSelectedIndices);\n\n return
selectedIndicesTensor;\n}\n\nexport const nonMaxSuppressionV3Config: KernelConfig = {\n kernelName:
NonMaxSuppressionV3,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: kernelFunc as { } as
KernelFunc,\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the
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WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific
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=====
*/\n\nimport { KernelConfig, KernelFunc, NonMaxSuppressionV4, NonMaxSuppressionV4Attrs,
NonMaxSuppressionV4Inputs, TensorInfo } from '@tensorflow/tfjs-core';\n\nimport { BackendWasm } from
'./backend_wasm';\n\nimport { parseResultStruct } from './NonMaxSuppression_util';\n\nlet wasmFunc: (\n
boxesId: number, scoresId: number, maxOutputSize: number,\n    iouThreshold: number, scoreThreshold: number,\n
padToMaxOutputSize: boolean) => number;\n\nfunction setup(backend: BackendWasm): void {\n    wasmFunc =
backend.wasm.cwrap(\n        NonMaxSuppressionV4,\n        'number', // Result*\n        [\n            'number', // boxesId\n
            'number',\n            // scoresId\n            'number', // maxOutputSize\n            'number', // iouThreshold\n
            'number', // scoreThreshold\n            'bool', // padToMaxOutputSize\n        ]);\n\n    function nonMaxSuppressionV4(args: {\n        backend:
BackendWasm,\n        inputs: NonMaxSuppressionV4Inputs,\n        attrs: NonMaxSuppressionV4Attrs\n    }): TensorInfo[]
{\n        const {backend, inputs, attrs} = args;\n        const {iouThreshold, maxOutputSize, scoreThreshold,
padToMaxOutputSize} =\n            attrs;\n        const {boxes, scores} = inputs;\n\n        const boxesId =
backend.dataIdMap.get(boxes.dataId).id;\n        const scoresId = backend.dataIdMap.get(scores.dataId).id;\n\n        const
resOffset = wasmFunc(\n            boxesId, scoresId, maxOutputSize, iouThreshold, scoreThreshold,\n            padToMaxOutputSize);\n\n        const {pSelectedIndices, selectedSize, pSelectedScores, pValidOutputs} =\n            parseResultStruct(backend, resOffset);\n\n        // Since we are not using scores for V4, we have to delete it from the
heap.\n        backend.wasm._free(pSelectedScores);\n\n        const selectedIndicesTensor =\n            backend.makeOutput([selectedSize], 'int32', pSelectedIndices);\n\n        const
validOutputsTensor = backend.makeOutput([], 'int32', pValidOutputs);\n\n        return [selectedIndicesTensor,
validOutputsTensor];\n    }\n\n    export const nonMaxSuppressionV4Config: KernelConfig = {\n        kernelName:
NonMaxSuppressionV4,\n        backendName: 'wasm',\n        setupFunc: setup,\n        kernelFunc: nonMaxSuppressionV4 as { }
as KernelFunc,\n    };\n\n    /**\n     * @license\n     * Copyright 2019 Google LLC. All Rights Reserved.\n     * Licensed under
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the License for the specific language governing permissions and\n     * limitations under the License.\n     *
=====
*/\n\nimport { KernelConfig, KernelFunc, NonMaxSuppressionV5, NonMaxSuppressionV5Attrs,
NonMaxSuppressionV5Inputs, TensorInfo } from '@tensorflow/tfjs-core';\n\nimport { BackendWasm } from
'./backend_wasm';\n\nimport { parseResultStruct } from './NonMaxSuppression_util';\n\nlet wasmFunc:\n    (\n        boxesId: number, scoresId: number, maxOutputSize: number,\n        iouThreshold: number, scoreThreshold: number,\n        softNmsSigma: number\n    ) =>\n        number;\n\nfunction setup(backend: BackendWasm): void {\n    wasmFunc =

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backend.wasm.cwrap(\n      NonMaxSuppressionV5,\n      'number', // Result*\n      [\n        'number', // boxesId\n        'number', // scoresId\n        'number', // maxOutputSize\n        'number', // iouThreshold\n        'number', // scoreThreshold\n        'number', // softNmsSigma\n      ]);\n)\n\nfunction\nkernelFunc(args: {\n  backend: BackendWasm,\n  inputs: NonMaxSuppressionV5Inputs,\n  attrs:\n    NonMaxSuppressionV5Attrs\n}): TensorInfo[] {\n  const {backend, inputs, attrs} = args;\n  const {iouThreshold,\n    maxOutputSize, scoreThreshold, softNmsSigma} = attrs;\n  const {boxes, scores} = inputs;\n  const boxesId =\n    backend.dataIdMap.get(boxes.dataId).id;\n  const scoresId = backend.dataIdMap.get(scores.dataId).id;\n  const\n    resOffset = wasmFunc(\n      boxesId, scoresId, maxOutputSize, iouThreshold, scoreThreshold,\n      softNmsSigma);\n  const {pSelectedIndices, selectedSize, pSelectedScores, pValidOutputs} =\n    parseResultStruct(backend, resOffset);\n  // Since we are not using validOutputs for V5, we have to delete it from\n  // heap.\n  backend.wasm._free(pValidOutputs);\n  const selectedIndicesTensor =\n    backend.makeOutput([selectedSize, 'int32', pSelectedIndices);\n  const selectedScoresTensor =\n    backend.makeOutput([selectedSize, 'float32', pSelectedScores);\n\n  return [selectedIndicesTensor, selectedScoresTensor];\n})\n\nexport const nonMaxSuppressionV5Config:\nKernelConfig = {\n  kernelName: NonMaxSuppressionV5,\n  backendName: 'wasm',\n  setupFunc: setup,\n  kernelFunc: kernelFunc as {} as KernelFunc,\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n\n=====\n*/\nimport\n{\n  KernelConfig, NotEqual\n} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from\n'./binary_kernel';\nconst supportsFullBroadcast = false;\nexport const notEqualConfig: KernelConfig =\ncreateBinaryKernelConfig(NotEqual, supportsFullBroadcast, 'bool');\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n\n=====\n\n*/\nimport\n{\n  KernelConfig, KernelFunc, OneHot, OneHotAttrs, OneHotInputs\n} from '@tensorflow/tfjs-core';\nimport\n{\n  BackendWasm\n} from '../backend_wasm';\nlet wasmOneHot: (\n  indicesId: number, depth: number, onValue:\n    number, offValue: number,\n  outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n  wasmOneHot = backend.wasm.cwrap(OneHot, null /* void */, [\n    'number', // indices_id\n    'number', // depth,\n    'number', // onValue\n    'number', // offValue\n    'number' // out_id\n  ]);\n\n  function oneHot(\n    args:\n      {\n        inputs: OneHotInputs,\n        attrs: OneHotAttrs,\n        backend: BackendWasm\n      }\n    ) {\n    const {inputs, backend, attrs} = args;\n    const {indices} = inputs;\n    const {depth, onValue, offValue} = attrs;\n    const out =\n      backend.makeOutput([\n        ...indices.shape, depth\n      ], 'int32');\n    const outId = backend.dataIdMap.get(out.dataId).id;\n    const indicesData = backend.dataIdMap.get(indices.dataId);\n    const indicesId = indicesData.id;\n\n    wasmOneHot(indicesId, depth,\n      onValue, offValue, outId);\n\n    return out;\n  }\n\n  export const oneHotConfig: KernelConfig = {\n    kernelName:\n      OneHot,\n    backendName: 'wasm',\n    setupFunc: setup,\n    kernelFunc: oneHot as {} as KernelFunc,\n  }; \n\n  "/**\n   * @license\n   * Copyright 2020 Google LLC. All Rights Reserved.\n   * Licensed under the Apache License, Version
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* \n \nimport { KernelConfig, KernelFunc, OnesLike, OnesLikeInputs } from
'@tensorflow/tfjs-core'; \n \nimport { BackendWasm } from '../backend_wasm'; \n \nfunction onesLike(args: { inputs:
OnesLikeInputs, backend: BackendWasm }) { \n  const { inputs: { x }, backend } = args; \n  const out =
backend.makeOutput(x.shape, x.dtype); \n  const outVals = backend.typedArrayFromHeap(out); \n  outVals.fill(1); \n
return out; \n } \n \nexport const onesLikeConfig: KernelConfig = { \n  kernelName: OnesLike, \n  backendName:
'wasm', \n  kernelFunc: onesLike as { } as KernelFunc, \n }; \n \n , "/* \n * @license \n * Copyright 2020 Google LLC.
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http://www.apache.org/licenses/LICENSE-2.0 \n * Unless required by applicable law or agreed to in writing,
software \n * distributed under the License is distributed on an "AS IS" BASIS, \n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express
or implied. \n * See the License for the specific language governing permissions and \n * limitations under the
License. \n *
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* \n \nimport { KernelConfig, KernelFunc, Pack, PackAttrs, PackInputs, TensorInfo, util } from '@tensorflow/tfjs-
core'; \n \nimport { BackendWasm } from '../backend_wasm'; \n \nimport { concat } from './Concat'; \n \nimport
{ expandDims } from './ExpandDims'; \n \nexport function pack( \n  args: { inputs: PackInputs, backend:
BackendWasm, attrs: PackAttrs }): \n  TensorInfo { \n  const { inputs, backend, attrs } = args; \n  const { axis } =
attrs; \n \n  if (inputs.length === 1) { \n    return expandDims( \n      { inputs: { input: inputs[0] }, backend, attrs: { dim:
axis } }); \n  } \n \n  const shape = inputs[0].shape; \n  const dtype = inputs[0].dtype; \n \n  inputs.forEach(t => { \n
util.assertShapesMatch( \n    shape, t.shape, \n    'All tensors passed to stack must have matching shapes' ); \n
util.assert( \n
    dtype === t.dtype, \n    () => 'All tensors passed to stack must have matching dtypes' ); \n  }); \n \n  const
intermediateTensorInfos: TensorInfo[] = []; \n  const expandedTensors = inputs.map(t => { \n    const expandedT = \n
expandDims({ inputs: { input: t }, backend, attrs: { dim: axis } }); \n    intermediateTensorInfos.push(expandedT); \n
return expandedT; \n  }); \n \n  const result = concat({ inputs: expandedTensors, backend, attrs: { axis } }); \n \n
intermediateTensorInfos.forEach(t => backend.disposeData(t.dataId)); \n \n  return result; \n } \n \nexport const
packConfig: KernelConfig = { \n  kernelName: Pack, \n  backendName: 'wasm', \n  kernelFunc: pack as { } as
KernelFunc \n }; \n \n , "/* \n * @license \n * Copyright 2019 Google LLC. All Rights Reserved. \n * Licensed under the
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* \n \nimport { KernelConfig, KernelFunc, PadV2, PadV2Attrs, PadV2Inputs, util } from '@tensorflow/tfjs-
core'; \n \nimport { BackendWasm } from '../backend_wasm'; \n \nimport { fill } from './Fill'; \n \nimport { CppDType }
from './types'; \n \nlet wasmPadV2: ( \n  xId: number, xShapeBytes: Uint8Array, xShapeLength: number, xDType:
number, \n  prePaddingsBytes: Uint8Array, postPaddingsBytes: Uint8Array, \n  constantValue: number, outId:
number ) => void; \n \nfunction setup(backend: BackendWasm) { \n  wasmPadV2 = backend.wasm.cwrap(PadV2, null
/* void */, [ \n    'number', // xId \n    'array', // x.shape \n
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'number', // x.shape.length\n 'number', // x.dtype\n 'array', // pre-paddings\n 'array', // post-paddings\n
'number', // constantValue\n 'number', // outId\n ]);\n\nfunction pad(\n  args: {inputs: PadV2Inputs, backend:
BackendWasm, attrs: PadV2Attrs}) {\n  const {inputs: {x}, backend, attrs: {paddings, constantValue}} = args;\n\n  const outShape = paddings.map(\n    (p, i) => p[0] /* beforePad */ + x.shape[i] + p[1] /* afterPad */);\n\n  if
(util.sizeFromShape(x.shape) === 0) {\n    // Short-circuit the computation, since x doesn't have value, only\n    //
the shape is used to compute output shape to pad.\n    return fill({\n      backend,\n      attrs: {shape: outShape, value:
constantValue, dtype: x.dtype}\n    });\n  }\n\n  const xId = backend.dataIdMap.get(x.dataId).id;\n  const out =
backend.makeOutput(outShape, x.dtype);\n  const outTensorData = backend.dataIdMap.get(out.dataId);\n  const
outId = outTensorData.id;\n\n  const xShapeBytes =
    new Uint8Array(new Int32Array(x.shape).buffer);\n\n  const prePaddingsFlat = paddings.map(padTuple =>
padTuple[0]);\n  const postPaddingsFlat = paddings.map(padTuple => padTuple[1]);\n  const prePaddingsBytes =\n    new
Uint8Array(new Int32Array(prePaddingsFlat).buffer);\n  const postPaddingsBytes =\n    new
    Uint8Array(new Int32Array(postPaddingsFlat).buffer);\n\n  wasmPadV2(\n    xId, xShapeBytes, x.shape.length,
    CppDType[x.dtype], prePaddingsBytes,\n    postPaddingsBytes, constantValue, outId);\n  return out;\n}\n\nexport
const padV2Config: KernelConfig = {\n  kernelName: PadV2,\n  backendName: 'wasm',\n  kernelFunc: pad as {\n\n  } as
    KernelFunc,\n  setupFunc: setup\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n
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on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
=====
*/\nimport {KernelConfig, Pow} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from
'./binary_kernel';\nconst supportsFullBroadcast = false;\nexport const powConfig: KernelConfig =\n  createBinaryKernelConfig(Pow, supportsFullBroadcast);\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All
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=====
*/\nimport {KernelConfig, KernelFunc, Prelu, PreluInputs} from '@tensorflow/tfjs-core';\nimport
{BackendWasm} from './backend_wasm';\nimport {cast} from './Cast';\n\nlet wasmPrelu: (xId: number,
weightsId: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n  wasmPrelu =
backend.wasm.cwrap(Prelu, null /* void */, [\n    'number', // x_id\n    'number', // weights_id\n    'number' //
out_id\n  ]);\n\n  function prelu(args: {inputs: PreluInputs, backend: BackendWasm}) {\n    const {inputs, backend}
= args;\n    const {x, alpha} = inputs;\n    const xId = backend.dataIdMap.get(x.dataId).id;\n\n    const
weightsId = backend.dataIdMap.get(alpha.dataId).id;\n    let inputId = xId;\n    const input = x;\n    let
castedInput = input;\n    if (input.dtype !== 'float32') {\n      castedInput = cast({backend, inputs: {x},
attrs: {dtype: 'float32'}});\n      inputId = backend.dataIdMap.get(castedInput.dataId).id;\n    }\n\n    const
out = backend.makeOutput(x.shape, 'float32');\n    const outId = backend.dataIdMap.get(out.dataId).id;\n\n   
wasmPrelu(inputId, weightsId, outId);\n\n    if (input.dtype !== 'float32') {\n      backend.disposeData(castedInput.dataId);\n    }\n\n    return out;\n  }\n\n  export const preluConfig: KernelConfig = {\n    kernelName: Prelu,\n    backendName: 'wasm',\n    setupFunc: setup,\n    kernelFunc: prelu as {\n\n    } as
      KernelFunc\n  ];\n\n  "/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the

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=====\n\n/*\n\nimport { KernelConfig, RealDiv } from '@tensorflow/tfjs-core';\nimport { createBinaryKernelConfig } from\n './binary_kernel';\n\nconst supportsFullBroadcast = true;\n\nexport const realDivConfig: KernelConfig =\n createBinaryKernelConfig(RealDiv, supportsFullBroadcast);\n\n", "/*\n\n * @license\n * Copyright 2019 Google LLC.  
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language  
governing permissions and\n * limitations under the License.\n *
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=====\n\n/*\n\nimport { KernelConfig, Relu } from '@tensorflow/tfjs-core';\nimport { createUnaryKernelConfig } from\n './unary_kernel';\n\nexport const reluConfig: KernelConfig = createUnaryKernelConfig(Relu);\n\n", "/*\n\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the  
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for  
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=====\n\n/*\n\nimport { KernelConfig, Relu6 } from '@tensorflow/tfjs-core';\nimport\n { createUnaryKernelConfig } from './unary_kernel';\n\nexport const relu6Config: KernelConfig =\n createUnaryKernelConfig(Relu6);\n\n", "/*\n\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in  
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language  
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```
=====\n\n/*\n\nimport { KernelConfig, KernelFunc, ResizeBilinear, ResizeBilinearAttrs, ResizeBilinearInputs, TensorInfo,\n util } from '@tensorflow/tfjs-core';\nimport\n { BackendWasm } from '../backend_wasm';\n\nimport { cast } from './Cast';\n\nlet wasmResizeBilinear: (\n xId:\n number, batch: number, oldHeight: number, oldWidth: number,\n numChannels: number, newHeight: number,\n newWidth: number,\n alignCorners: number, halfPixelCenters: number, outId: number) => void;\n\nfunction\n setup(backend: BackendWasm): void {\n wasmResizeBilinear = backend.wasm.cwrap(ResizeBilinear, null\n /*void*/, [\n 'number', // xId\n 'number', // batch\n 'number', // oldHeight\n 'number', // oldWidth\n 'number', // numChannels\n 'number', // newHeight\n 'number', // newWidth\n 'number', // alignCorners\n 'number', // halfPixelCenters\n 'number' // outId\n ]);\n\nfunction\n resizeBilinear(args: {\n backend:\n BackendWasm,\n inputs: ResizeBilinearInputs,\n attrs: ResizeBilinearAttrs\n }): TensorInfo {\n const { backend,\n inputs, attrs } = args;\n\n const { images } = inputs;\n const { alignCorners, halfPixelCenters, size }\n = attrs;\n\n const [newHeight, newWidth] = size;\n\n const [batch, oldHeight, oldWidth, numChannels] =\n images.shape;\n\n const outShape = [batch, newHeight, newWidth, numChannels];\n\n let xData =
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backend.dataIdMap.get(images.dataId);\n let castedData;\n if (xData.dtype !== 'float32') {\n   castedData =\ncast({backend, inputs: {x: images}, attrs: {dtype: 'float32'}});\n   xData =\nbackend.dataIdMap.get(castedData.dataId);\n }\n const xId = xData.id;\n\n const out =\nbackend.makeOutput(outShape, 'float32');\n if (util.sizeFromShape(images.shape) === 0) {\n   return out;\n }\nconst outId = backend.dataIdMap.get(out.dataId).id;\n\n wasmResizeBilinear(\n   xId, batch, oldHeight,\noldWidth, numChannels, newHeight, newWidth,\n   alignCorners ? 1 : 0, halfPixelCenters ? 1 : 0, outId);\n\n if\n(castedData != null) {\n   backend.disposeData(castedData.dataId);\n }\n\n return out;\n}\n\nexport const\nresizeBilinearConfig: KernelConfig = {\n kernelName: ResizeBilinear,\n\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: resizeBilinear as {} as KernelFunc\n};\n\n","/**\n *\n@license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version\n2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a\n copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable\n law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n the specific language governing permissions and\n * limitations under the License.\n *\n\n=====\n\n*/\n\nimport {KernelConfig, KernelFunc, Reverse, ReverseAttrs, ReverseInputs, TensorInfo, util} from\n '@tensorflow/tfjs-core';\n import {BackendWasm} from '../backend_wasm';\n import\n {identity} from './Identity';\n import {reshape} from './Reshape';\n\nlet wasmReverse: (\n   xId: number, axes:\n Uint8Array, axesLength: number, outShape: Uint8Array,\n   outShapeLength: number, outId: number) =>\n void;\n\nfunction setup(backend: BackendWasm) {\n   wasmReverse = backend.wasm.cwrap(Reverse, null, [\n'number', // x_id\n 'array', // axes\n 'number', // axes_length\n 'array', // out_shape\n 'number', //\nout_shape_length\n 'number' // out_id\n ]);\n\n\nexport function reverse(\n   args: {inputs: ReverseInputs,\nbackend: BackendWasm, attrs: ReverseAttrs});\n   TensorInfo {\n     const {inputs, backend, attrs} = args;\n     const\n{x} = inputs;\n     const {dims} = attrs;\n     const axes = util.parseAxisParam(dims, x.shape);\n     if (x.shape.length\n=== 0) {\n       return identity({inputs: {x}, backend});\n     }\n     const out = backend.makeOutput(x.shape, x.dtype);\n     const xId = backend.dataIdMap.get(x.dataId).id;\n     const outId = backend.dataIdMap.get(out.dataId).id;\n     \nconst axesBytes = new Uint8Array(new Int32Array(axes).buffer);\nconst outShapeBytes = new Uint8Array(new\nInt32Array(x.shape).buffer);\n     wasmReverse(\n       xId, axesBytes, axes.length, outShapeBytes, x.shape.length,\noutId);\n     const reshaped =\n       reshape({inputs: {x: out}, attrs: {shape: x.shape}, backend});\n     \nbackend.disposeData(out.dataId);\n     return reshaped;\n }\n\n\nexport const reverseConfig: KernelConfig = {\n\n kernelName: Reverse,\n backendName: 'wasm',\n kernelFunc: reverse as {} as KernelFunc,\n setupFunc:\nsetup\n};\n\n","/**\n *\n@license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the\nApache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the\nLicense.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless\nrequired by applicable law or agreed to in writing, software\n * distributed under the License is distributed\non an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or\nimplied.\n * See the License for the specific language governing permissions and\n * limitations under the\nLicense.\n *\n\n=====\n\n*/\n\nimport {KernelConfig, KernelFunc, RotateWithOffset, RotateWithOffsetAttrs, RotateWithOffsetInputs,\nTensorInfo} from '@tensorflow/tfjs-core';\n import {backend_util} from '@tensorflow/tfjs-core';\n import\n{BackendWasm} from '../backend_wasm';\n\nlet wasmRotate: (\n   xId: number, batch: number, imageHeight:\nnumber, imageWidth: number,\n   numChannels: number, radians: number, centerX: number, centerY: number,\nfillBytes: Uint8Array, fillLength: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n\nwasmRotate = backend.wasm.cwrap(RotateWithOffset, null /* void */, [\n 'number', // xId\n 'number', //\nbatch\n 'number', // imageHeight\n 'number', // imageWidth\n\n
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'number', // numChannels\n 'number', // radians\n 'number', // centerX\n 'number', // centerY\n 'array', // fillBytes\n 'number', // fillLength\n 'number', // outId\n ]);\n\nexport function rotateWithOffset(args: {\n  inputs: RotateWithOffsetInputs,\n  backend: BackendWasm,\n  attrs: RotateWithOffsetAttrs\n}): TensorInfo {\n  const {inputs, backend, attrs} = args;\n  const {image} = inputs;\n  const {radians, fillValue, center} = attrs;\n  const out = backend.makeOutput(image.shape, image.dtype);\n  const imageId = backend.dataIdMap.get(image.dataId).id;\n  const outId = backend.dataIdMap.get(out.dataId).id;\n  const [batch, imageHeight, imageWidth, numChannels] = image.shape;\n  const [centerX, centerY] = backend_util.getImageCenter(center, imageHeight, imageWidth);\n  const fillIsBlack = fillValue === 0;\n  const fullOpacityValue = 255;\n  const fillValues = typeof fillValue === 'number' ? [fillValue, fillValue, fillValue, fillIsBlack ? 0 : fullOpacityValue] : [...fillValue, fullOpacityValue];\n  const fillBytes = new Uint8Array(new Int32Array(fillValues).buffer);\n  wasmRotate(imageId, batch, imageHeight, imageWidth, numChannels, radians, centerX, centerY, fillBytes, fillValues.length, outId);\n  return out;\n}\n\nexport const rotateWithOffsetConfig: KernelConfig = {\n  kernelName: RotateWithOffset,\n  backendName: 'wasm',\n  kernelFunc: rotateWithOffset as {} as KernelFunc,\n  setupFunc: setup\n};\n\n"/**\n * @license\n * Copyright 2021 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS
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OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *

```
=====\n\n*/\nimport {KernelConfig, Round} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from './unary_kernel';\nexport const roundConfig: KernelConfig = createUnaryKernelConfig(Round);\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n\n*/\nimport {KernelConfig, Rsqrt} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from './unary_kernel';\nexport const rsqrtConfig: KernelConfig = createUnaryKernelConfig(Rsqrt);\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n\n*/\nimport {KernelConfig, KernelFunc, scatter_util, ScatterNd, ScatterNdAttrs, ScatterNdInputs, TensorInfo, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nimport {CppType} from './types';\n\nlet wasmScatterNd: (\n  indicesId: number, updatesId: number, dtype: CCppType, sliceRank: number,\n  numUpdates: number, sliceSize: number, strides: Uint8Array,\n  outputSize: number, outId: number\n) => void;\n\nfunction setup(backend: BackendWasm): void {\n  wasmScatterNd = backend.wasm.cwrap(ScatterNd, null /*void*/, [\n    'number', // indicesId\n    'number', // updatesId\n    'number', // dtype\n    'number', // sliceRank\n    'number', // numUpdates\n    'number', // sliceSize\n    'array', // strides\n    'number', // outputSize\n  ]\n
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'number' // outId\n ]);\n\nfunction scatterNd(\n  args:\n    { backend: BackendWasm, inputs:
ScatterNdInputs, attrs:
  ScatterNdAttrs }):\n  TensorInfo {\n    const { backend, inputs, attrs } = args;\n    const { indices, updates } = inputs;\n    const { shape } = attrs;\n\n    const out = backend.makeOutput(shape, updates.dtype);\n    if (util.sizeFromShape(shape)
=== 0) {\n      return out;\n    }\n\n    const { sliceRank, numUpdates, sliceSize, strides, outputSize } =\n    scatter_util.calculateShapes(updates, indices, shape);\n\n    const indicesData =
backend.dataIdMap.get(indices.dataId);\n    const indicesId = indicesData.id;\n\n    const updatesData =
backend.dataIdMap.get(updates.dataId);\n    const updatesId = updatesData.id;\n\n    const stridesBytes = new
Uint8Array(new Int32Array(strides).buffer);\n\n    const outId = backend.dataIdMap.get(out.dataId).id;\n\n    wasmScatterNd(\n      indicesId, updatesId, CppDType[updates.dtype], sliceRank, numUpdates,\n      sliceSize,
stridesBytes, outputSize, outId);\n\n    return out;\n  }\n\n  nexport const scatterNdConfig: KernelConfig = {\n
kernelName: ScatterNd,\n  backendName: 'wasm',\n
  setupFunc: setup,\n  kernelFunc: scatterNd as { } as KernelFunc\n};\n\n", "/*\n * @license\n * Copyright 2020
Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you
may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
\n
*/\n\nimport { KernelConfig, KernelFunc, Select, SelectInputs, util } from '@tensorflow/tfjs-core';\n\nimport
{ BackendWasm } from '../backend_wasm';\n\nlet wasmSelect: (\n  conditionId: number, tId: number, eId:
number, offset: number,\n  outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n  wasmSelect
= backend.wasm.cwrap('SelectV2', null, [\n    'number', // conditionId\n    'number', // tId\n    'number', // eId\n
'number', // offset\n    'number', // outId\n  ]);\n\n  function select(args: { inputs: SelectInputs, backend:
BackendWasm }) {\n    const { inputs, backend } = args;\n    const { condition, t, e } = inputs;\n\n    const conditionId =
backend.dataIdMap.get(condition.dataId).id;\n    const tId = backend.dataIdMap.get(t.dataId).id;\n    const eId =
backend.dataIdMap.get(e.dataId).id;\n    const out = backend.makeOutput(t.shape, t.dtype);\n    const outId =
backend.dataIdMap.get(out.dataId).id;\n\n    const cRank = condition.shape.length;\n    const tRank =
t.shape.length;\n\n    const offset = cRank === 0 || cRank > 1 || tRank === 1 ?\n      1 : \n    util.sizeFromShape(t.shape.slice(1));\n\n    wasmSelect(conditionId, tId, eId, offset, outId);\n    return out;\n  }\n\n  nexport
const selectConfig:
  KernelConfig = {\n    kernelName: Select,\n    backendName: 'wasm',\n    kernelFunc: select as { } as KernelFunc,\n
    setupFunc: setup\n};\n\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed
under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n
* distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND,
either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
=====
\n
*/\n\nimport { KernelConfig, KernelFunc, Sigmoid, SigmoidInputs, TensorInfo, util } from '@tensorflow/tfjs-
core';\n\nimport { BackendWasm }
from '../backend_wasm';\n\nlet wasmFunc: (xId: number, outId: number) => void;\n\nfunction setup(backend:
BackendWasm): void {\n  wasmFunc = backend.wasm.cwrap(Sigmoid, null /* void */, ['number',
'number']);\n\n  function sigmoid(args: { backend: BackendWasm, inputs: SigmoidInputs }):\n    TensorInfo {\n
const { backend, inputs: { x } } = args;\n    const xId = backend.dataIdMap.get(x.dataId).id;\n    const out =
backend.makeOutput(x.shape, x.dtype);\n    const outId = backend.dataIdMap.get(out.dataId).id;\n\n    // Short-circuit

```



```

completePaddings.push...(paddings as Array<[number, number]>));\n\n for (let i = 1 + blockShape.length; i <
x.shape.length; ++i) {\n  completePaddings.push([0, 0]);\n }\n\n const paddedX = padV2Config.kernelFunc({\n
inputs: {x},\n backend,\n attrs: {paddings: completePaddings, constantValue: 0}\n }) as TensorInfo;\n\n const
reshapedPaddedShape =\n  backend_util.getReshaped(paddedX.shape, blockShape, prod, false);\n\n const
permutedReshapedPaddedPermutation = backend_util.getPermuted(\n  reshapedPaddedShape.length,
blockShape.length, false);\n\n const flattenShape =\n  backend_util.getReshapedPermuted(paddedX.shape,
blockShape, prod, false);\n\n const reshapeInputs: ReshapeInputs = {x: paddedX};\n const reshapeAttrs:
ReshapeAttrs = {shape: reshapedPaddedShape};\n\n
const paddedXReshaped =\n  reshape({inputs: reshapeInputs, backend, attrs: reshapeAttrs});\n\n const
transposeInputs: TransposeInputs = {x: paddedXReshaped};\n const transposeAttrs:\n  TransposeAttrs = {perm:
permutedReshapedPaddedPermutation};\n const paddedXT =\n  transpose({inputs: transposeInputs, backend,
attrs: transposeAttrs});\n\n const resultReshapeInputs: ReshapeInputs = {x: paddedXT};\n const
resultReshapeAttrs: ReshapeAttrs = {shape: flattenShape};\n const result = reshape(\n  {inputs:
resultReshapeInputs, backend, attrs: resultReshapeAttrs});\n\n backend.disposeData(paddedX.dataId);\n
backend.disposeData(paddedXReshaped.dataId);\n backend.disposeData(paddedXT.dataId);\n\n return
result;\n}\n\nexport const spaceToBatchNDConfig: KernelConfig = {\n  kernelName: SpaceToBatchND,\n
backendName: 'wasm',\n kernelFunc: spaceToBatchND as { } as KernelFunc\n};\n\n"/**\n * @license\n *
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on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n */
=====
\n
*/\n\nimport {KernelConfig, KernelFunc, SplitV, SplitVAttrs, SplitVInputs, util} from '@tensorflow/tfjs-
core';\nimport {backend_util} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from
'./backend_wasm';\n\nimport {slice} from './Slice';\n\nexport function splitV(\n  args: {inputs: SplitVInputs, attrs:
SplitVAttrs, backend: BackendWasm}) {\n  const {inputs,
attrs, backend} = args;\n  const {x} = inputs;\n  const {numOrSizeSplits, axis} = attrs;\n\n  const $axis =
util.parseAxisParam(axis, x.shape)[0];\n\n  const splitSizes = backend_util.prepareSplitSize(x, numOrSizeSplits,
$axis);\n  const begin = new Array(x.shape.length).fill(0);\n  const size = x.shape.slice();\n  return splitSizes.map(s
=> {\n    const xSliceSize = [...size];\n    xSliceSize[$axis] = s;\n    const xSlice =\n      slice({inputs: {x}, attrs:
{begin, size: xSliceSize}, backend});\n    begin[$axis] += s;\n    return xSlice;\n  });\n}\n\nexport const
splitVConfig: KernelConfig = {\n  kernelName: SplitV,\n  backendName: 'wasm',\n  kernelFunc: splitV as { } as
KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the
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Unless required by applicable law or agreed to in writing, software\n * distributed under the License is
distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n */
=====
\n
*/\n\nimport {KernelConfig, Sqrt} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from
'./unary_kernel';\n\nexport const sqrtConfig: KernelConfig = createUnaryKernelConfig(Sqrt);\n\n"/**\n * @license\n *
Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
"License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
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```
=====\n\n*\nimport {KernelConfig, Square} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from\n './unary_kernel';\nexport const squareConfig: KernelConfig = createUnaryKernelConfig(Square);\n", "/*\n *\n @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version\n 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a\n copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable\n law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT
```

WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *

```
=====\n\n*\nimport {KernelConfig, SquaredDifference} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig}\n from './binary_kernel';\nconst supportsFullBroadcast = true;\nexport const squaredDifferenceConfig: KernelConfig\n =\n createBinaryKernelConfig(SquaredDifference, supportsFullBroadcast);\n", "/*\n *\n @license\n * Copyright\n 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,\n software\n * distributed under the License is distributed on an \"AS
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IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *

```
=====\n\n*\n\nimport {KernelConfig, KernelFunc, Step, StepAttrs, StepInputs, TensorInfo}\n from '@tensorflow/tfjs-\n core';\nimport {BackendWasm} from '../backend_wasm';\nimport {CppDType} from './types';\n\nlet wasmStep:\n (xId: number, alpha: number, dtype: number, outId: number) =>\n void;\n\nfunction setup(backend:\n BackendWasm): void {\n wasmStep = backend.wasm.cwrap(Step, null /*void*/, [\n 'number', // x_id\n 'number', // alpha\n 'number', // dtype\n 'number', // out_id\n ]);\n\nfunction step(\n args: {\n backend:\n BackendWasm,\n inputs: StepInputs,\n attrs: StepAttrs\n }):\n TensorInfo {\n const {backend, inputs, attrs} = args;\n const {alpha} = attrs;\n const {x} = inputs;\n const xId =\n backend.dataIdMap.get(x.dataId).id;\n const out = backend.makeOutput(x.shape, x.dtype);\n const outId =\n backend.dataIdMap.get(out.dataId).id;\n wasmStep(xId, alpha, CppDType[x.dtype], outId);\n return\n out;\n}\n\nexport const stepConfig: KernelConfig = {\n kernelName: Step,\n backendName: 'wasm',\n setupFunc:\n setup,\n kernelFunc: step as {\n } as KernelFunc\n};\n", "/*\n *\n @license\n * Copyright 2021 Google LLC. All\n Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this\n file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,\n software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\n OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n governing permissions and\n * limitations under the\n License.\n *
```

```
=====\n\n*\n\nimport {KernelConfig, KernelFunc, slice_util, StridedSlice, StridedSliceAttrs, StridedSliceInputs, TensorInfo,\n util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nimport {reshape} from\n './Reshape';\nimport {slice} from './Slice';\n\nlet wasmStridedSlice: (\n xId: number, xStridesBytes: Uint8Array,\n xRank: number,\n beginBytes: Uint8Array, endBytes: Uint8Array, stridesBytes: Uint8Array,\n outShapeBytes:
```

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uint8Array, outStridesBytes: Uint8Array,\n    outShapeLength: number, outId: number) => void;\n\nfunction  
setup(backend: BackendWasm): void {\n  wasmStridedSlice = backend.wasm.cwrap(StridedSlice, null /*void*/, [\n    'number', // xId\n    'array', // xStrides\n    'number', // xRank\n    'array', // beginBytes\n    'array', // endBytes\n    'array', // stridesBytes\n    'array', // outShapeBytes\n    'array', // outStridesBytes\n    'number',\n    // outShapeLength\n    'number', // outId\n  ]);\n}\n\nexport function stridedSlice(args: {\n  backend:  
BackendWasm,\n  inputs: StridedSliceInputs,\n  attrs: StridedSliceAttrs\n}): TensorInfo {\n  const {backend, inputs,  
attrs} = args;\n  const {x} = inputs;\n  const {\n    begin,\n    end,\n    strides,\n    beginMask,\n    endMask,\n    ellipsisMask,\n    newAxisMask,\n    shrinkAxisMask\n  } = attrs;\n  const {\n    finalShapeSparse,\n    finalShape,\n    isIdentity,\n    sliceDim0,\n    isSimpleSlice,\n    begin: $begin,\n    end: $end,\n    strides: $strides\n  } =\n    slice_util.sliceInfo(\n      x.shape, begin, end, strides, beginMask, endMask, ellipsisMask,\n      newAxisMask, shrinkAxisMask);\n  let result;\n  if (isIdentity) {\n    // Optimization #1, slice is a no-op plus  
reshape\n    result = reshape({inputs: {x}, backend, attrs: {shape: finalShape}});\n  } else if (sliceDim0 ||  
isSimpleSlice) {\n    // Optimization #2, slice is memory contiguous  
(only occurs in dim 0)\n    util.assert(x.shape.length >= 1, () => `Input must have rank at least 1, got:  
${x.shape.length}`);\n    const size = slice_util.computeOutShape($begin, $end, $strides);\n    // To tolerate  
begin[0] > end[0] (a 0-output slice), we min(begin, end).\n    const sliced = slice({inputs: {x}, backend, attrs:  
{begin: $begin, size}});\n    result =\n      reshape({inputs: {x: sliced}, backend, attrs: {shape: finalShape}});\n    backend.disposeData(sliced.dataId);\n  } else {\n    const out = backend.makeOutput(finalShapeSparse,  
'float32');\n    const xId = backend.dataIdMap.get(x.dataId).id;\n    const xStridesBytes =\n      new  
Uint8Array(new Int32Array(util.computeStrides(x.shape)).buffer);\n    const beginBytes = new Uint8Array(new  
Int32Array($begin).buffer);\n    const endBytes = new Uint8Array(new Int32Array($end).buffer);\n    const  
stridesBytes = new Uint8Array(new Int32Array($strides).buffer);\n    const outputShapeBytes =\n      new  
Uint8Array(new Int32Array(finalShapeSparse).buffer);\n    const outStridesBytes = new Uint8Array(\n      new  
Int32Array(util.computeStrides(finalShapeSparse)).buffer);\n    const outId =  
backend.dataIdMap.get(out.dataId).id;\n    wasmStridedSlice(\n      xId, xStridesBytes, x.shape.length,  
beginBytes, endBytes, stridesBytes,\n      outputShapeBytes, outStridesBytes, finalShapeSparse.length, outId);\n    result = reshape({inputs: {x: out}, backend, attrs: {shape: finalShape}});\n    backend.disposeData(out.dataId);\n  }\n  return result;\n}\n\nexport const stridedSliceConfig: KernelConfig = {\n  kernelName: StridedSlice,\n  backendName: 'wasm',\n  setupFunc: setup,\n  kernelFunc: stridedSlice as {} as KernelFunc\n};\n\n/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version  
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writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT  
WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific  
language governing permissions and\n * limitations under the License.\n */\n\n\n\nimport {KernelConfig, Sub} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from  
'.binary_kernel';\nconst supportsFullBroadcast = true;\nexport const subConfig: KernelConfig =\n  createBinaryKernelConfig(Sub, supportsFullBroadcast);\n\n/**\n * @license\n * Copyright 2019 Google LLC. All  
Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this  
file except in compliance with the License.\n * You may obtain a copy of the License at\n *  
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distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either  
express or implied.\n * See the License for the specific language governing permissions and\n * limitations under  
the License.\n */

```

```

*\n\nimport {backend_util, KernelConfig, KernelFunc, Sum, SumAttrs, SumInputs, TensorInfo, util} from
'@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport
{permuteAxesAndTranspose} from './kernel_utils';\nimport {CppType} from './types';\n\nlet wasmSum: (xId:
number, reduceSize: number, dtype: number, outId: number) =>\n  void;\n\nfunction setup(backend:
BackendWasm): void {\n  wasmSum = backend.wasm.cwrap(Sum, null /*void*/, [\n    'number', // input_id\n    'number', // reduce_size\n    'number', // dtype\n    'number', // out_id\n  ]);\n\n  function sum(args: {backend: BackendWasm, inputs: SumInputs, attrs:
SumAttrs}): \n    TensorInfo {\n    const {backend, inputs, attrs} = args;\n    const {axis, keepDims} = attrs;\n    const
{x} = inputs;\n    const xId = backend.dataIdMap.get(x.dataId).id;\n    let inputId = xId;\n    let input = x;\n\n    const
{transposed, axes, originalAxes, inputWasTransposed} =\n      permuteAxesAndTranspose(x, axis, backend);\n\n    let reductionAxes = axes;\n    if (inputWasTransposed) {\n      const transposedId =
backend.dataIdMap.get(transposed.dataId).id;\n      if (transposedId !== xId) {\n        // transpose was not a no-op. We
will need to dispose of this\n        // once we are done.\n        input = transposed;\n        inputId = transposedId;\n        reductionAxes = backend_util.getInnerMostAxes(\n          reductionAxes.length, input.shape.length);\n      }\n    }\n\n    backend_util.assertAxesAreInnerMostDims(\n      'sum', reductionAxes, input.shape.length);\n    const [outShape,
reduceShape]
    =\n      backend_util.computeOutAndReduceShapes(input.shape, reductionAxes);\n    const reduceSize =
util.sizeFromShape(reduceShape);\n\n    const out = backend.makeOutput(outShape, input.dtype);\n    if
(util.sizeFromShape(input.shape) !== 0) {\n      const outId = backend.dataIdMap.get(out.dataId).id;\n      wasmSum(inputId, reduceSize, CppDType[out.dtype], outId);\n    }\n\n    if (inputWasTransposed) {\n      // dispose of
the transposed tensor.\n      backend.disposeData(transposed.dataId);\n    }\n\n    if (keepDims) {\n      // reshape\n      const
newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n      out.shape = newShape;\n    }\n\n    return out;\n  }\n\n  export const sumConfig: KernelConfig = {\n    kernelName: Sum,\n    backendName: 'wasm',\n    setupFunc: setup,\n    kernelFunc: sum as {} as KernelFunc\n  };
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LLC. All Rights Reserved.\n   * Licensed under the Apache License, Version 2.0 (the "License");\n   * you may not
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OR CONDITIONS OF ANY KIND, either express or implied.\n   * See the License for the specific language
governing permissions and\n   * limitations under the License.\n   *
=====
*\n\nimport {KernelConfig, Tan} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from
'/unary_kernel';\n\nexport const tanConfig: KernelConfig = createUnaryKernelConfig(Tan);\n\n/**\n   * @license\n   *
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OR CONDITIONS OF ANY KIND, either express or implied.\n   * See the License for the specific language
governing permissions and\n   * limitations under the License.\n   *
=====
*\n\nimport {KernelConfig, Tanh} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from
'/unary_kernel';\n\nexport const tanhConfig: KernelConfig = createUnaryKernelConfig(Tanh);\n\n/**\n   * @license\n   *
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=====\n
*\n\nimport { KernelConfig, KernelFunc, Tile, TileAttrs, TileInputs } from '@tensorflow/tfjs-core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nimport { CppDType } from './types';\n\nlet wasmTile: (\n  xId: number, xShape: Uint8Array, xShapeSize: number, newShape: Uint8Array,\n  newShapeSize: number, dtype: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n  wasmTile = backend.wasm.cwrap(Tile, null /* void */, [\n    'number', // x_id\n    'array', // x_shape\n    'number', // x_shape.length\n    'array', // new_shape\n    'number', // new_shape.length\n    'number' // out_id\n  ]);\n\n  function tile(\n    args: { inputs: TileInputs, backend: BackendWasm, attrs: TileAttrs }) {\n    const { inputs, backend, attrs } = args;\n    const { x } = inputs;\n    const xId = backend.dataIdMap.get(x.dataId).id;\n    const { reps } = attrs;\n\n    const newShape: number[] = new Array(x.shape.length);\n    for (let i = 0; i < newShape.length; i++) {\n      newShape[i] = x.shape[i] * reps[i];\n    }\n    const xShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);\n    const newShapeBytes = new Uint8Array(new Int32Array(newShape).buffer);\n\n    const out = backend.makeOutput(newShape, x.dtype);\n    const outId = backend.dataIdMap.get(out.dataId).id;\n    wasmTile(xId, xShapeBytes, x.shape.length, newShapeBytes, newShape.length,\n      CppDType[out.dtype], outId);\n    return out;\n  }\n\n  export const tileConfig: KernelConfig = {\n    kernelName: Tile,\n    backendName: 'wasm',\n    setupFunc: setup,\n    kernelFunc: tile as { } as KernelFunc\n  };
  "\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
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=====\n
*\n\nimport { KernelConfig, KernelFunc, TensorInfo, TopK, TopKAttrs, TopKInputs } from '@tensorflow/tfjs-core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nimport { CppDType } from './types';\n\nlet wasmTopK: (\n  xId: number, xShapeBytes: Uint8Array, xShapeLength: number,\n  xDtype: CppDType, k: number, sorted: boolean, outValuesId: number,\n  outIndicesId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n  wasmTopK = backend.wasm.cwrap(TopK, null /* void */, [\n    'number', // xId\n    'array', // x_shape\n    'number', // x_shape.length\n    'number', // x_dtype\n    'number', // k\n    'bool', // sorted\n    'number', // outValuesId\n    'number', // outIndicesId\n  ]);\n\n  export const topk: (\n    args: { inputs: TopKInputs, backend: BackendWasm, attrs: TopKAttrs }) =>\n    TensorInfo[] | TensorInfo = ({ inputs, backend, attrs }) => {\n    const { x } = inputs;\n    const { k, sorted } = attrs;\n    const xId = backend.dataIdMap.get(x.dataId).id;\n    const xShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);\n    const outputShape = x.shape.slice();\n    outputShape[outputShape.length - 1] = k;\n    const outValues = backend.makeOutput(outputShape, x.dtype);\n    const outValuesId = backend.dataIdMap.get(outValues.dataId).id;\n\n    const outIndices = backend.makeOutput(outputShape, 'int32');\n    const outIndicesId = backend.dataIdMap.get(outIndices.dataId).id;\n\n    wasmTopK(xId, xShapeBytes, x.shape.length, CppDType[x.dtype], k, sorted,\n      outValuesId, outIndicesId);\n    return [outValues, outIndices];\n  };\n\n  export const topKConfig: KernelConfig = {\n    kernelName: TopK,\n    backendName: 'wasm',\n    setupFunc: setup,\n    kernelFunc: topk as { } as KernelFunc\n  };
  "\n", "/*\n * @license\n * Copyright 2021 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
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OR CONDITIONS

OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *

```
=====\\n
*\\n\\nimport { KernelConfig, KernelFunc, TensorInfo, Transform, TransformAttrs, TransformInputs, util } from
'@tensorflow/tfjs-core';\\n\\nimport { BackendWasm } from '../backend_wasm';\\n\\nlet wasmTransform: (\\n  imageId:
number, transformsId: number, isBatchTransform: boolean,\\n  batch: number, outHeight: number, outWidth:
number, numChannels: number,\\n  imageWidth: number, imageHeight: number, strides: Uint8Array,\\n
stridesLength: number, interpolationModeId: number, fillModeId: number,\\n  fillValue: number, outId: number)
=> void;\\n\\nfunction setup(backend: BackendWasm): void {\\n  wasmTransform = backend.wasm.cwrap(Transform,
null /*void*/, [\\n  'number', // imageId\\n  'number', // transformsId\\n  'bool', // isBatchTransform\\n  'number',
// batch\\n  'number', // outHeight\\n  'number', // outWidth\\n  'number', // numChannels\\n  'number', //
imageWidth\\n  'number', // imageHeight\\n  'array', // strides\\n  'number', // stridesLength\\n  'number', //
interpolationModeId\\n  'number', // fillModeId\\n  'number', // fillValue\\n  'number' // outId\\n
]);\\n}\\n\\nfunction transform(\\n  args:\\n    { backend: BackendWasm, inputs: TransformInputs, attrs:
TransformAttrs }):\\n  TensorInfo {\\n  const { backend, inputs, attrs } = args;\\n  const { image, transforms } = inputs;\\n
const { interpolation, fillMode, fillValue, outputShape } = attrs;\\n\\n  const [batch, imageHeight, imageWidth,
numChannels] = image.shape;\\n  const [outHeight, outWidth] =\\n    outputShape != null ? outputShape :
[imageHeight, imageWidth];\\n  const outShape =\\n    [batch, outHeight, outWidth,\\n    numChannels] as
[number, number, number, number];\\n  const strides =\\n    new Uint8Array(new
Int32Array(util.computeStrides(image.shape)).buffer);\\n\\n
  const out = backend.makeOutput(outShape, image.dtype);\\n  const outId =
backend.dataIdMap.get(out.dataId).id;\\n\\n  const imageData = backend.dataIdMap.get(image.dataId);\\n  const
imageId = imageData.id;\\n\\n  const transformsData = backend.dataIdMap.get(transforms.dataId);\\n  const
transformsId = transformsData.id;\\n\\n  const interpolationModeId = interpolation === 'nearest' ? 1 : 2;\\n  let
fillModeId;\\n  switch (fillMode) {\\n  case 'constant':\\n    fillModeId = 1;\\n    break;\\n  case 'reflect':\\n
fillModeId = 2;\\n    break;\\n  case 'wrap':\\n    fillModeId = 3;\\n    break;\\n  case 'nearest':\\n    fillModeId =
4;\\n    break;\\n  default:\\n    fillModeId = 1;\\n    break;\\n  }\\n\\n  wasmTransform(\\n    imageId, transformsId,
(transforms.shape[0] > 1), batch, outHeight,\\n    outWidth, numChannels, imageWidth, imageHeight, strides,\\n
image.shape.length - 1, interpolationModeId, fillModeId, fillValue,\\n    outId);\\n\\n
  return out;\\n}\\n\\n\\nexport const transformConfig: KernelConfig = {\\n  kernelName: Transform,\\n  backendName:
'wasm',\\n  setupFunc: setup,\\n  kernelFunc: transform as { } as KernelFunc\\n};\\n", "/*\\n * @license\\n * Copyright
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http://www.apache.org/licenses/LICENSE-2.0\\n *\\n * Unless required by applicable law or agreed to in writing,
software\\n * distributed under the License is distributed on an \"AS IS\" BASIS,\\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\\n * See the License for the specific language
governing permissions and\\n * limitations under the License.\\n *
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```
*\\n\\nimport { KernelConfig, KernelFunc, TensorInfo, Unpack, UnpackAttrs, UnpackInputs }
from '@tensorflow/tfjs-core';\\n\\nimport { BackendWasm } from '../backend_wasm';\\n\\nimport { slice } from
'./Slice';\\n\\nfunction unpack(\\n  args: { inputs: UnpackInputs, backend: BackendWasm, attrs: UnpackAttrs }):\\n
TensorInfo[] {\\n  const { inputs, backend, attrs } = args;\\n  const { value } = inputs;\\n  let { axis } = attrs;\\n  if (axis <
0) {\\n    axis += value.shape.length;\\n  }\\n\\n  const numOutputs = value.shape[axis];\\n  const rank =
value.shape.length;\\n  const outShape: number[] = new Array(rank - 1);\\n  let outIndex = 0;\\n  for (let i = 0; i < rank;
i++) {\\n    if (i !== axis) {\\n      outShape[outIndex++] = value.shape[i];\\n    }\\n  }\\n  const outs: TensorInfo[] = new
Array(numOutputs);\\n  const begin = new Array(rank).fill(0);\\n  const size = value.shape.slice();\\n  size[axis] = 1;\\n
for (let i = 0; i < outs.length; i++) {\\n    begin[axis] = i;\\n    outs[i] = slice({ inputs: { x: value }, attrs: { begin, size },
=====\\n
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backend});\n }\n return outs.map(({dataId, dtype}) => ({dataId, dtype,
  shape: outShape}));\n}\n\nexport const unpackConfig: KernelConfig = {\n  kernelName: Unpack,\n  backendName:
'wasm',\n  kernelFunc: unpack as { } as KernelFunc,\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All
Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport { KernelConfig, KernelFunc, ZerosLike, ZerosLikeInputs } from '@tensorflow/tfjs-core';\nimport
{ BackendWasm }
from './backend_wasm';\n\nfunction zerosLike(args: { inputs: ZerosLikeInputs, backend: BackendWasm }) {\n
const { inputs: { x }, backend } = args;\n const out = backend.makeOutput(x.shape, x.dtype);\n const outVals =
backendtypedArrayFromHeap(out);\n outVals.fill(0);\n return out;\n}\n\nexport const zerosLikeConfig:
KernelConfig = {\n  kernelName: ZerosLike,\n  backendName: 'wasm',\n  kernelFunc: zerosLike as { } as
KernelFunc,\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the
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Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====
*\n\n//
We explicitly import the modular kernels so they get registered in the\n// global registry when we compile the
library. A modular build would replace\n// the contents of this file and import only the kernels that are
needed.\nimport { KernelConfig, registerKernel } from '@tensorflow/tfjs-core';\nimport { fusedMatMulConfig }
from './kernels/_FusedMatMul';\nimport { absConfig } from './kernels/Abs';\nimport { addConfig } from
'./kernels/Add';\nimport { addNConfig } from './kernels/AddN';\nimport { allConfig } from './kernels/All';\nimport
{ anyConfig } from './kernels/Any';\nimport { argMaxConfig } from './kernels/ArgMax';\nimport { avgPoolConfig }
from './kernels/AvgPool';\nimport { batchMatMulConfig } from './kernels/BatchMatMul';\nimport
{ batchToSpaceNDConfig } from './kernels/BatchToSpaceND';\nimport { castConfig } from './kernels/Cast';\nimport
{ ceilConfig } from './kernels/Ceil';\nimport { clipByValueConfig } from './kernels/ClipByValue';\nimport
{ concatConfig } from './kernels/Concat';\nimport { conv2DConfig } from './kernels/Conv2D';\nimport
{ conv2DBackpropInputConfig } from './kernels/Conv2DBackpropInput';\nimport { cosConfig } from
'./kernels/Cos';\nimport { coshConfig } from './kernels/Cosh';\nimport { cropAndResizeConfig } from
'./kernels/CropAndResize';\nimport { cumsumConfig } from './kernels/Cumsum';\nimport { depthToSpaceConfig }
from './kernels/DepthToSpace';\nimport { depthwiseConv2dNativeConfig } from
'./kernels/DepthwiseConv2dNative';\nimport { eluConfig } from './kernels/Elu';\nimport { equalConfig } from
'./kernels/Equal';\nimport { expConfig } from './kernels/Exp';\nimport { expandDimsConfig } from
'./kernels/ExpandDims';\nimport { fillConfig } from './kernels/Fill';\nimport { flipLeftRightConfig } from
'./kernels/FlipLeftRight';\nimport { floorConfig } from './kernels/Floor';\nimport { floorDivConfig } from
'./kernels/FloorDiv';\nimport
{ fusedBatchNormConfig } from './kernels/FusedBatchNorm';\nimport { fusedConv2DConfig } from
'./kernels/FusedConv2D';\nimport { fusedDepthwiseConv2DConfig } from
'./kernels/FusedDepthwiseConv2D';\nimport { gatherNdConfig } from './kernels/GatherNd';\nimport
{ gatherV2Config } from './kernels/GatherV2';\nimport { greaterConfig } from './kernels/Greater';\nimport
{ greaterEqualConfig } from './kernels/GreaterEqual';\nimport { identityConfig } from './kernels/Identity';\nimport

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{leakyReluConfig} from './kernels/LeakyRelu';\nimport {lessConfig} from './kernels/Less';\nimport
{lessEqualConfig} from './kernels/LessEqual';\nimport {logConfig} from './kernels/Log';\nimport
{logicalAndConfig} from './kernels/LogicalAnd';\nimport {maxConfig} from './kernels/Max';\nimport
{maximumConfig} from './kernels/Maximum';\nimport {maxPoolConfig} from './kernels/MaxPool';\nimport
{meanConfig} from './kernels/Mean';\nimport {minConfig} from './kernels/Min';\nimport {minimumConfig} from
 './kernels/Minimum';\nimport
{mirrorPadConfig} from './kernels/MirrorPad';\nimport {multiplyConfig} from './kernels/Multiply';\nimport
{negConfig} from './kernels/Neg';\nimport {nonMaxSuppressionV3Config} from
 './kernels/NonMaxSuppressionV3';\nimport {nonMaxSuppressionV4Config} from
 './kernels/NonMaxSuppressionV4';\nimport {nonMaxSuppressionV5Config} from
 './kernels/NonMaxSuppressionV5';\nimport {notEqualConfig} from './kernels/NotEqual';\nimport {oneHotConfig}
from './kernels/OneHot';\nimport {onesLikeConfig} from './kernels/OnesLike';\nimport {packConfig} from
 './kernels/Pack';\nimport {padV2Config} from './kernels/PadV2';\nimport {powConfig} from
 './kernels/Pow';\nimport {preluConfig} from './kernels/Prelu';\nimport {prodConfig} from './kernels/Prod';\nimport
{rangeConfig} from './kernels/Range';\nimport {realDivConfig} from './kernels/RealDiv';\nimport {reluConfig}
from './kernels/Relu';\nimport {relu6Config} from './kernels/Relu6';\nimport {reshapeConfig} from
 './kernels/Reshape';\nimport {resizeBilinearConfig}
from './kernels/ResizeBilinear';\nimport {reverseConfig} from './kernels/Reverse';\nimport
{rotateWithOffsetConfig} from './kernels/RotateWithOffset';\nimport {roundConfig} from
 './kernels/Round';\nimport {rsqrtConfig} from './kernels/Rsqrt';\nimport {scatterNdConfig} from
 './kernels/ScatterNd';\nimport {selectConfig} from './kernels/Select';\nimport {sigmoidConfig} from
 './kernels/Sigmoid';\nimport {sinConfig} from './kernels/Sin';\nimport {sliceConfig} from './kernels/Slice';\nimport
{softmaxConfig} from './kernels/Softmax';\nimport {spaceToBatchNDConfig} from
 './kernels/SpaceToBatchND';\nimport {splitVConfig} from './kernels/SplitV';\nimport {sqrtConfig} from
 './kernels/Sqrt';\nimport {squareConfig} from './kernels/Square';\nimport {squaredDifferenceConfig} from
 './kernels/SquaredDifference';\nimport {stepConfig} from './kernels/Step';\nimport {stridedSliceConfig} from
 './kernels/StridedSlice';\nimport {subConfig} from './kernels/Sub';\nimport {sumConfig} from
 './kernels/Sum';\nimport
{tanConfig} from './kernels/Tan';\nimport {tanhConfig} from './kernels/Tanh';\nimport {tileConfig} from
 './kernels/Tile';\nimport {topKConfig} from './kernels/TopK';\nimport {transformConfig} from
 './kernels/Transform';\nimport {transposeConfig} from './kernels/Transpose';\nimport {unpackConfig} from
 './kernels/Unpack';\nimport {zerosLikeConfig} from './kernels/ZerosLike';\n\n// List all kernel configs here\nconst
kernelConfigs: KernelConfig[] = [\n  \n  absConfig,\n  addConfig,\n  addNConfig,\n  allConfig,\n  anyConfig,\n  \n
  argMaxConfig,\n  avgPoolConfig,\n  batchMatMulConfig,\n  batchToSpaceNDConfig,\n  castConfig,\n  \n
  ceilConfig,\n  clipByValueConfig,\n  concatConfig,\n  conv2DConfig,\n  conv2DBackpropInputConfig,\n  \n
  cosConfig,\n  coshConfig,\n  cropAndResizeConfig,\n  cumsumConfig,\n  depthToSpaceConfig,\n  \n
  depthwiseConv2dNativeConfig,\n  eluConfig,\n  equalConfig,\n  expConfig,\n  expandDimsConfig,\n  fillConfig,\n  \n
  flipLeftRightConfig,\n  floorConfig,\n  floorDivConfig,\n  fusedMatMulConfig,\n  \n
  fusedBatchNormConfig,\n  fusedConv2DConfig,\n  fusedDepthwiseConv2DConfig,\n  gatherNdConfig,\n  \n
  gatherV2Config,\n  greaterConfig,\n  greaterEqualConfig,\n  identityConfig,\n  leakyReluConfig,\n  lessConfig,\n  \n
  lessEqualConfig,\n  logConfig,\n  logicalAndConfig,\n  maxConfig,\n  maximumConfig,\n  maxPoolConfig,\n  \n
  meanConfig,\n  minConfig,\n  minimumConfig,\n  mirrorPadConfig,\n  multiplyConfig,\n  negConfig,\n  \n
  nonMaxSuppressionV3Config,\n  nonMaxSuppressionV4Config,\n  nonMaxSuppressionV5Config,\n  \n
  notEqualConfig,\n  oneHotConfig,\n  onesLikeConfig,\n  packConfig,\n  padV2Config,\n  powConfig,\n  \n
  preluConfig,\n  prodConfig,\n  rangeConfig,\n  realDivConfig,\n  reluConfig,\n  relu6Config,\n  reshapeConfig,\n  \n
  resizeBilinearConfig,\n  reverseConfig,\n  rotateWithOffsetConfig,\n  rsqrtConfig,\n  roundConfig,\n  \n
  scatterNdConfig,\n  selectConfig,\n  sigmoidConfig,\n  sinConfig,\n  sliceConfig,\n  softmaxConfig,\n  \n
  spaceToBatchNDConfig,\n  splitVConfig,\n  sqrtConfig,\n  \n

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squareConfig,\n squaredDifferenceConfig,\n stepConfig,\n stridedSliceConfig,\n subConfig,\n sumConfig,\n
tanConfig,\n tanhConfig,\n tileConfig,\n topKConfig,\n transformConfig,\n transposeConfig,\n unpackConfig,\n
zerosLikeConfig\n];\n\nfor (const kernelConfig of kernelConfigs) {\n  registerKernel(kernelConfig);\n}\n", "/*\n *
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the specific language governing permissions and\n * limitations under the License.\n *

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=====
*\n\nimport {env} from 'tensorflow/tfjs-core';\n\nconst ENV = env();\n\n/*\n * True if SIMD is supported.\n
*\n// From: https://github.com/GoogleChromeLabs/wasm-feature-detect\nENV.registerFlag(\n  // This typed array
passed in to WebAssembly.validate is WebAssembly binary\n  // code. In this case it is a small program that
contains SIMD\n  // instructions.\n  'WASM_HAS_SIMD_SUPPORT', async () => WebAssembly.validate(new
Uint8Array([\n    0, 97, 115, 109, 1, 0, 0, 0, 1, 4, 1, 96, 0, 0, 3,\n    2, 1, 0, 10, 9, 1, 7, 0, 65, 0, 253, 15, 26,
11\n  ]));\n\n/*\n * True if threads are supported.\n
*\n// From: https://github.com/GoogleChromeLabs/wasm-
feature-detect\nENV.registerFlag('WASM_HAS_MULTITHREAD_SUPPORT', async () => {\n  //
TODO(annxingyuan): Enable node support once this is resolved:\n  //
https://github.com/tensorflow/tfjs/issues/3830\n  if (ENV.get('IS_NODE')) {\n    return false;\n  }\n\n  try {\n
    // Test for transferability of SABs (needed for Firefox)\n    //
https://groups.google.com/forum/#!msg/mozilla.dev.platform/IHkBZIHETpA/dwsMNchWEQAJ\n    new
MessageChannel().port1.postMessage(new SharedArrayBuffer(1));\n    // This typed array is a WebAssembly
program containing threaded\n    // instructions.\n    return WebAssembly.validate(new Uint8Array([\n    0, 97,
115, 109, 1, 0, 0, 0, 1, 4, 1, 96, 0, 0, 3, 2, 1, 0, 5,\n    4, 1, 3, 1, 1, 10, 11, 1, 9, 0, 65, 0, 254, 16, 2, 0, 26,
11\n  ]));\n  } catch (e) {\n    return false;\n  }\n});\n\n", "\n\nvar WasmBackendModuleThreadedSimd = (function() {\n
var _scriptDir = typeof document !== 'undefined' && document.currentScript ? document.currentScript.src :
undefined;\n  if (typeof __filename !== 'undefined') _scriptDir = _scriptDir || __filename;\n  return
(function(WasmBackendModuleThreadedSimd) {\n    WasmBackendModuleThreadedSimd =
WasmBackendModuleThreadedSimd || {};\n\n    function
GROWABLE_HEAP_I8(){if(wasmMemory.buffer!==buffer){updateGlobalBufferAndViews(wasmMemory.buffer)}
return
HEAP8}function
GROWABLE_HEAP_U8(){if(wasmMemory.buffer!==buffer){updateGlobalBufferAndViews(wasmMemory.buffer)}
return HEAPU8}function
GROWABLE_HEAP_I32(){if(wasmMemory.buffer!==buffer){updateGlobalBufferAndViews(wasmMemory.buffer)}
return HEAP32}function
GROWABLE_HEAP_U32(){if(wasmMemory.buffer!==buffer){updateGlobalBufferAndViews(wasmMemory.buffer)}
return HEAPU32}function
GROWABLE_HEAP_F64(){if(wasmMemory.buffer!==buffer){updateGlobalBufferAndViews(wasmMemory.buffer)}
return HEAPF64}var Module=typeof
WasmBackendModuleThreadedSimd!=="undefined"?WasmBackendModuleThreadedSimd:{};var
readyPromiseResolve,readyPromiseReject;Module["ready"]=new
Promise(function(resolve,reject){readyPromiseResolve=resolve;readyPromiseReject=reject});var
moduleOverrides={};var key;for(key in
Module){if(Module.hasOwnProperty(key)){moduleOverrides[key]=Module[key]}}var arguments_=[];var
thisProgram=\.\/this.program\";var quit_=function(status,toThrow){throw
toThrow};var ENVIRONMENT_IS_WEB=false;var ENVIRONMENT_IS_WORKER=false;var
ENVIRONMENT_IS_NODE=false;var ENVIRONMENT_IS_SHELL=false;ENVIRONMENT_IS_WEB=typeof

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window===\"object\";ENVIRONMENT_IS_WORKER=typeof
importScripts===\"function\";ENVIRONMENT_IS_NODE=typeof process===\"object\"&&typeof
process.versions===\"object\"&&typeof
process.versions.node===\"string\";ENVIRONMENT_IS_SHELL=!ENVIRONMENT_IS_WEB&&!ENVIRONM
ENT_IS_NODE&&!ENVIRONMENT_IS_WORKER;var
ENVIRONMENT_IS_PTHREAD=Module[\"ENVIRONMENT_IS_PTHREAD\"]||false;if(ENVIRONMENT_IS_P
THREAD){buffer=Module[\"buffer\"]}var scriptDirectory=\"\";function
locateFile(path){if(Module[\"locateFile\"]){return Module[\"locateFile\"](path,scriptDirectory)}return
scriptDirectory+path}var read_,readAsync,readBinary,setWindowTitle;var nodeFS;var
nodePath;if(ENVIRONMENT_IS_NODE){if(ENVIRONMENT_IS_WORKER){scriptDirectory=require(\"path\").
dirname(scriptDirectory)+\"/\"}else{scriptDirectory=__dirname+\"/\"}read_=function
shell_read(filename,binary){if(!nodeFS)nodeFS=require(\"fs\");if(!nodePath)nodePath=require(\"path\");filename=n
odePath[\"normalize\"](filename);return
nodeFS[\"readFileSync\"](filename,binary?null:\"utf8\");readBinary=function readBinary(filename){var
ret=read_(filename,true);if(!ret.buffer){ret=new Uint8Array(ret)}assert(ret.buffer);return
ret};if(process[\"argv\"].length>1){thisProgram=process[\"argv\"][1].replace(/\\\\\\\\g,\"/\"))arguments_=process[\"arg
v\"].slice(2);process[\"on\"](\"uncaughtException\",function(ex){if(!(ex instanceof ExitStatus)){throw
ex}});process[\"on\"](\"unhandledRejection\",abort);quit_=function(status){process[\"exit\"](status)};Module[\"insp
ect\"]=function(){return\"[Emscripten Module object]\";}var
nodeWorkerThreads;try{nodeWorkerThreads=require(\"worker_threads\")}catch(e){console.error(\"The
\\\"worker_threads\\\" module is not supported in this node.js build - perhaps a newer version is needed?\");throw
e}global.Worker=nodeWorkerThreads.Worker}else if(ENVIRONMENT_IS_SHELL){if(typeof
read!=\"undefined\"){read_=function shell_read(f){return read(f)}readBinary=function readBinary(f){var
data;if(typeof readbuffer===\"function\"){return new
Uint8Array(readbuffer(f))}data=read(f,\"binary\");assert(typeof data===\"object\");return data};if(typeof
scriptArgs!=\"undefined\"){arguments_=scriptArgs}else if(typeof
arguments!=\"undefined\"){arguments_=arguments}if(typeof
quit===\"function\"){quit_=function(status){quit(status)}}if(typeof print!=\"undefined\"){if(typeof
console===\"undefined\")console={};console.log=print;console.warn=console.error=typeof
printErr!=\"undefined\"?printErr:print}}else
if(ENVIRONMENT_IS_WEB||ENVIRONMENT_IS_WORKER){if(ENVIRONMENT_IS_WORKER){scriptDire
ctory=self.location.href}else if(typeof
document!=\"undefined\"&&document.currentScript){scriptDirectory=document.currentScript.src}if(typeof
_scriptDir !=\"undefined\" &&
_scriptDir){scriptDirectory=_scriptDir}if(scriptDirectory.indexOf(\"blob:\")!=0){scriptDirectory=scriptDirectory.s
ubstr(0,scriptDirectory.lastIndexOf(\"/\")+1)}else{scriptDirectory=\"\"}if(ENVIRONMENT_IS_NODE){read_=fun
ction
shell_read(filename,binary){if(!nodeFS)nodeFS=require(\"fs\");if(!nodePath)nodePath=require(\"path\");filename=n
odePath[\"normalize\"](filename);return
nodeFS[\"readFileSync\"](filename,binary?null:\"utf8\");readBinary=function readBinary(filename){var
ret=read_(filename,true);if(!ret.buffer){ret=new Uint8Array(ret)}assert(ret.buffer);return
ret}}else{read_=function(url){var xhr=new XMLHttpRequest;xhr.open(\"GET\",url,false);xhr.send(null);return
xhr.responseText};if(ENVIRONMENT_IS_WORKER){readBinary=function(url){var xhr=new
XMLHttpRequest;xhr.open(\"GET\",url,false);xhr.responseType=\"arraybuffer\";xhr.send(null);return new
Uint8Array(xhr.response)}}readAsync=function(url,onload,onerror){var xhr=new
XMLHttpRequest;xhr.open(\"GET\",url,true);xhr.responseType=\"arraybuffer\";xhr.onload=function(){if(xhr.status
==200||xhr.status==0&&xhr.response){onload(xhr.response);return}onerror();}xhr.onerror=onerror;xhr.send(null)}
}setWindowTitle=function(title){document.title=title}}else{if(ENVIRONMENT_IS_NODE){if(typeof

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performance===\"undefined\"){ global.performance=require(\"perf_hooks\").performance } } var
out=Module[\"print\"]||console.log.bind(console);var err=Module[\"printErr\"]||console.warn.bind(console);for(key
in
moduleOverrides){ if(moduleOverrides.hasOwnProperty(key)){ Module[key]=moduleOverrides[key] } } moduleOverr
ides=null;if(Module[\"arguments\"]arguments_=Module[\"arguments\"];if(Module[\"thisProgram\"]thisProgram=
Module[\"thisProgram\"];if(Module[\"quit\"]quit_=Module[\"quit\"]);function
warnOnce(text){ if(!warnOnce.shown)warnOnce.shown={ };if(!warnOnce.shown[text]){ warnOnce.shown[text]=1;er
r(text) } } var Atomics_load=Atomics.load;var Atomics_store=Atomics.store;var
Atomics_compareExchange=Atomics.compareExchange;var
wasmBinary;if(Module[\"wasmBinary\"]wasmBinary=Module[\"wasmBinary\"];var
noExitRuntime=Module[\"noExitRuntime\"]||true;if(typeof WebAssembly!=\"object\"){ abort(\"no
native wasm support detected\") } var wasmMemory;var wasmModule;var ABORT=false;var
EXITSTATUS;function assert(condition,text){ if(!condition){ abort(\"Assertion failed: \" +text) } } function
getCFunc(ident){ var func=Module[\"_\"+ident];assert(func,\"Cannot call unknown function \" +ident+\", make sure
it is exported\");return func } function ccall(ident,returnType,argTypes,args,opts){ var
toC={\"string\":function(str){ var ret=0;if(str!==null&&str!==undefined&&str!==0){ var
len=(str.length<<2)+1;ret=stackAlloc(len);stringToUTF8(str,ret,len) } return ret },\"array\":function(arr){ var
ret=stackAlloc(arr.length);writeArrayToMemory(arr,ret);return ret } };function
convertReturnValue(ret){ if(returnType===\"string\")return UTF8ToString(ret);if(returnType===\"boolean\")return
Boolean(ret);return ret } var func=getCFunc(ident);var cArgs=[];var stack=0;if(args){ for(var
i=0;i<args.length;i++){ var
converter=toC[argTypes[i]];if(converter){ if(stack===0)stack=stackSave();cArgs[i]=converter(args[i]) } else { cArgs[i
]=args[i] } } } var
ret=func.apply(null,cArgs);ret=convertReturnValue(ret);if(stack!==0)stackRestore(stack);return ret } function
cwrap(ident,returnType,argTypes,opts){ argTypes=argTypes||[];var
numericArgs=argTypes.every(function(type){ return type===\"number\" });var
numericRet=returnType!=\"string\";if(numericRet&&numericArgs&&!opts){ return getCFunc(ident) } return
function(){ return ccall(ident,returnType,argTypes,arguments,opts) } } function
UTF8ArrayToString(heap,idx,maxBytesToRead){ var endIdx=idx+maxBytesToRead;var
str=\"\";while(!(idx>=endIdx)){ var u0=heap[idx++];if(!u0)return
str;if(!(u0&128)){ str+=String.fromCharCode(u0);continue } var
u1=heap[idx++]&63;if((u0&224)===192){ str+=String.fromCharCode((u0&31)<<6|u1);continue } var
u2=heap[idx++]&63;if((u0&240)===224){ u0=(u0&15)<<12|u1<<6|u2 } else { u0=(u0&7)<<18|u1<<12|u2<<6|heap[id
x++]&63 } if(u0<65536){ str+=String.fromCharCode(u0) } else { var ch=u0-
65536;str+=String.fromCharCode(55296|ch>>10,56320|ch&1023) } } return str } function
UTF8ToString(ptr,maxBytesToRead){ return
ptr?UTF8ArrayToString(GROWABLE_HEAP_U8(),ptr,maxBytesToRead):\"\" } function
stringToUTF8Array(str,heap,outIdx,maxBytesToWrite){ if(!(maxBytesToWrite>0))return 0;var startIdx=outIdx;var
endIdx=outIdx+maxBytesToWrite-1;for(var i=0;i<str.length;++i){ var
u=str.charCodeAtAt(i);if(u>=55296&&u<=57343){ var
u1=str.charCodeAtAt(++i);u=65536+((u&1023)<<10|u1&1023) } if(u<=127){ if(outIdx>=endIdx)break;heap[outIdx++]
=u } else if(u<=2047){ if(outIdx+1>=endIdx)break;heap[outIdx++]=(192|u>>6);heap[outIdx++]=(128|u&63) } else
if(u<=65535){ if(outIdx+2>=endIdx)break;heap[outIdx++]=(224|u>>12);heap[outIdx++]=(128|u>>6&63);heap[outIdx
++]=(128|u&63) } else { if(outIdx+3>=endIdx)break;heap[outIdx++]=(240|u>>18);heap[outIdx++]=(128|u>>12&63);heap[
outIdx++]=(128|u>>6&63);heap[outIdx++]=(128|u&63) } heap[outIdx]=0;return outIdx-startIdx } function
stringToUTF8(str,outPtr,maxBytesToWrite){ return
stringToUTF8Array(str,GROWABLE_HEAP_U8(),outPtr,maxBytesToWrite) } function lengthBytesUTF8(str){ var
len=0;for(var i=0;i<str.length;++i){ var

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u=str.charCodeAtAt(i);if(u>=55296&&u<=57343)u=65536+((u&1023)<<10)|str.charCodeAtAt(++i)&1023;if(u<=127)+
+len;else if(u<=2047)len+=2;else if(u<=65535)len+=3;else len+=4}return len}function
writeArrayToMemory(array,buffer){GROWABLE_HEAP_I8().set(array,buffer)}function
alignUp(x,multiple){if(x%multiple>0){x+=multiple-x%multiple}return x}var
buffer,HEAP8,HEAPU8,HEAP16,HEAPU16,HEAP32,HEAPU32,HEAPF32,HEAPF64;function
updateGlobalBufferAndViews(buf){buffer=buf;Module["HEAP8"]=HEAP8=new
Int8Array(buf);Module["HEAP16"]=HEAP16=new Int16Array(buf);Module["HEAP32"]=HEAP32=new
Int32Array(buf);Module["HEAPU8"]=HEAPU8=new Uint8Array(buf);Module["HEAPU16"]=HEAPU16=new
Uint16Array(buf);Module["HEAPU32"]=HEAPU32=new
Uint32Array(buf);Module["HEAPF32"]=HEAPF32=new
Float32Array(buf);Module["HEAPF64"]=HEAPF64=new Float64Array(buf)}var
INITIAL_MEMORY=Module["INITIAL_MEMORY"]||16777216;if(ENVIRONMENT_IS_PTHREAD){wasmMem
ory=Module["wasmMemory"];buffer=Module["buffer"]}else{if(Module["wasmMemory"]){wasmMemory=
Module["wasmMemory"]}else{wasmMemory=new
WebAssembly.Memory({\"initial\":INITIAL_MEMORY/65536,\"maximum\":2147483648/65536,\"shared\":true});
if(!(wasmMemory.buffer instanceof SharedArrayBuffer)){err(\"requested a shared WebAssembly.Memory but the
returned buffer is not a SharedArrayBuffer, indicating that while the browser has SharedArrayBuffer it does not
have WebAssembly threads support - you may need to set a
flag\");if(ENVIRONMENT_IS_NODE){console.log(\"(on node you may need: --experimental-wasm-threads --
experimental-wasm-bulk-memory and also use a recent version)\")}throw Error(\"bad
memory\")}}if(wasmMemory){buffer=wasmMemory.buffer}INITIAL_MEMORY=buffer.byteLength;updateGlob
alBufferAndViews(buffer);var wasmTable;var __ATPRERUN__=[];var __ATINIT__=[];var __ATMAIN__=[];var
__ATEXIT__=[];var __ATPOSTRUN__=[];var runtimeInitialized=false;var
runtimeExited=false;if(!ENVIRONMENT_IS_PTHREAD)__ATINIT__.push({func:function(){__wasm_call_ctor
s()}});function
preRun(){if(ENVIRONMENT_IS_PTHREAD)return;if(Module["preRun"]){if(typeof
Module["preRun"]=="function")Module["preRun"]=[Module["preRun"]];while(Module["preRun"].length){a
ddOnPreRun(Module["preRun"].shift())}callRuntimeCallbacks(__ATPRERUN__)}function
initRuntime(){runtimeInitialized=true;if(ENVIRONMENT_IS_PTHREAD)return;callRuntimeCallbacks(__ATINIT
__)}function
preMain(){if(ENVIRONMENT_IS_PTHREAD)return;callRuntimeCallbacks(__ATMAIN__)}function
exitRuntime(){if(ENVIRONMENT_IS_PTHREAD)return;runtimeExited=true}function
postRun(){if(ENVIRONMENT_IS_PTHREAD)return;if(Module["postRun"]){if(typeof
Module["postRun"]=="function")Module["postRun"]=[Module["postRun"]];while(Module["postRun"].lengt
h){addOnPostRun(Module["postRun"].shift())}callRuntimeCallbacks(__ATPOSTRUN__)}function
addOnPreRun(cb){__ATPRERUN__.unshift(cb)}function addOnPostRun(cb){__ATPOSTRUN__.unshift(cb)}var
runDependencies=0;var runDependencyWatcher=null;var dependenciesFulfilled=null;function
addRunDependency(id){assert(!ENVIRONMENT_IS_PTHREAD,\"addRunDependency cannot be used in a
pthread
worker\");runDependencies++;if(Module["monitorRunDependencies"]){Module["monitorRunDependencies"]((ru
nDependencies))}function removeRunDependency(id){runDependencies--
;if(Module["monitorRunDependencies"]){Module["monitorRunDependencies"]((runDependencies))if(runDepend
encies==0){if(runDependencyWatcher!=null){clearInterval(runDependencyWatcher);runDependencyWatcher=null}
if(dependenciesFulfilled){var
callback=dependenciesFulfilled;dependenciesFulfilled=null;callback()}}Module["preloadedImages"]={};Module
["preloadedAudios"]={};function
abort(what){if(Module["onAbort"]){Module["onAbort"](what)}if(ENVIRONMENT_IS_PTHREAD)console.err
or(\"Pthread aborting at \"+(new

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Error).stack);what+="\n";err(what);ABORT=true;EXITSTATUS=1;what="\abort(\n"+what+"\n). Build with -s
ASSERTIONS=1 for more info.\n";var e=new WebAssembly.RuntimeError(what);readyPromiseReject(e);throw
e}function hasPrefix(str,prefix){return
String.prototype.startsWith?str.startsWith(prefix):str.indexOf(prefix)===0}var
dataURIPrefix="\data:application/octet-stream;base64,\n";function isDataURI(filename){return
hasPrefix(filename,dataURIPrefix)}var fileURIPrefix="\file://\n";function isFileURI(filename){return
hasPrefix(filename,fileURIPrefix)}var wasmBinaryFile="\tfjs-backend-wasm-threaded-
simd.wasm\n";if(!isDataURI(wasmBinaryFile)){wasmBinaryFile=locateFile(wasmBinaryFile)}function
getBinary(file){try{if(file===wasmBinaryFile&&wasmBinary){return new
Uint8Array(wasmBinary)}if(readBinary){return readBinary(file)}else{throw\n"both async and sync fetching of the
wasm failed\n"}}catch(err){abort(err)}}function
getBinaryPromise(){if(!wasmBinary&&(ENVIRONMENT_IS_WEB||ENVIRONMENT_IS_WORKER)){if(typeof
fetch===\function\&&!isFileURI(wasmBinaryFile)){return fetch(wasmBinaryFile,{credentials:\same-
origin\n}).then(function(response){if(!response["ok"]){throw\n"failed to load wasm binary file at
\n"+wasmBinaryFile+"\n"}return
response["arrayBuffer"]()).catch(function(){return getBinary(wasmBinaryFile)}})}else{if(readAsync){return new
Promise(function(resolve,reject){readAsync(wasmBinaryFile,function(response){resolve(new
Uint8Array(response)),reject})))}}return Promise.resolve().then(function(){return
getBinary(wasmBinaryFile)})}function createWasm(){var info={\a":asmLibraryArg};function
receiveInstance(instance,module){var
exports=instance.exports;Module["asm"]=exports;wasmTable=Module["asm"][\I"];wasmModule=module;if(!E
NVIRONMENT_IS_PTHREAD){var
numWorkersToLoad=PThread.unusedWorkers.length;PThread.unusedWorkers.forEach(function(w){PThread.load
WasmModuleToWorker(w,function(){if(!--numWorkersToLoad)removeRunDependency(\wasm-
instantiate\n)}))}if(!ENVIRONMENT_IS_PTHREAD){addRunDependency(\wasm-instantiate\n)}function
receiveInstantiatedSource(output){receiveInstance(output["instance\n"],output["module\n"])}function
instantiateArrayBuffer(receiver){return getBinaryPromise().then(function(binary){return
WebAssembly.instantiate(binary,info)}).then(receiver,function(reason){err(\failed to asynchronously prepare
wasm: \"+reason);abort(reason)}))}function instantiateAsync(){if(!wasmBinary&&typeof
WebAssembly.instantiateStreaming===\function\&&!isDataURI(wasmBinaryFile)&&!isFileURI(wasmBinaryFil
e)&&typeof fetch===\function\){return fetch(wasmBinaryFile,{credentials:\same-
origin\n}).then(function(response){var result=WebAssembly.instantiateStreaming(response,info);return
result.then(receiveInstantiatedSource,function(reason){err(\wasm streaming compile failed: \"+reason);err(\falling
back to ArrayBuffer instantiation\n");return instantiateArrayBuffer(receiveInstantiatedSource)}))}else{return
instantiateArrayBuffer(receiveInstantiatedSource)}if(Module["instantiateWasm"]){try{var
exports=Module["instantiateWasm"](info,receiveInstance);return exports}catch(e){err(\Module.instantiateWasm
callback failed with error: \"+e);return false}}instantiateAsync().catch(readyPromiseReject);return{}}var
ASM_CONSTS={10520:function(){throw\nCanceled!\n},10538:function($0,$1){setTimeout(function(){__emscript
en_do_dispatch_to_thread($0,$1),0}});function initPthreadsJS(){PThread.initRuntime()}function
callRuntimeCallbacks(callbacks){while(callbacks.length>0){var callback=callbacks.shift();if(typeof
callback===\function\){callback(Module);continue}var func=callback.func;if(typeof
func===\number\){if(callback.arg===undefined){wasmTable.get(func)()}else{wasmTable.get(func)(callback.arg)
}}else{func(callback.arg===undefined?null:callback.arg)}}}var
ERRNO_CODES={EPERM:63,ENOENT:44,ESRCH:71,EINTR:27,EIO:29,ENXIO:60,E2BIG:1,ENOEXEC:45,E
BADF:8,ECHILD:12,EAGAIN:6,EWOULDBLOCK:6,ENOMEM:48,EACCES:2,EFAULT:21,ENOTBLK:105,EB
USY:10,EEXIST:20,EXDEV:75,ENODEV:43,ENOTDIR:54,EISDIR:31,EINVAL:28,ENFILE:41,EMFILE:33,EN
OTTY:59,ETXTBSY:74,EFBIG:22,ENOSPC:51,ESPIPE:70,EROFS:69,EMLINK:34,EPIPE:64,EDOM:18,ERAN
GE:68,ENOMSG:49,EIDRM:24,ECHRNG:106,EL2NSYNC:156,EL3HLT:107,EL3RST:108,ELNRNG:109,EUNA

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TCH:110,ENOCSE:111,EL2HLT:112,EDEADLK:16,ENOLCK:46,EBADE:113,EBADR:114,EXFULL:115,ENOAN
NO:104,EBADRQC:103,EBADSLT:102,EDEADLOCK:16,EBFONT:101,ENOSTR:100,ENODATA:116,ETIME:
117,ENOSR:118,ENONET:119,ENOPKG:120,EREMOTE:121,ENOLINK:47,EADV:122,ESRMNT:123,ECOMM
:124,EPROTO:65,EMULTIHOP:36,EDOTDOT:125,EBADMSG:9,ENOTUNIQ:126,EBADFD:127,EREMCHG:1
28,ELIBACC:129,ELIBBAD:130,ELIBSCN:131,ELIBMAX:132,ELIBEXEC:133,ENOSYS:52,ENOTEMPTY:55,
ENAMETOOLONG:37,ELOOP:32,EOPNOTSUPP:138,EPFNOSUPPORT:139,ECONNRESET:15,ENOBUFFS:42,
EAFNOSUPPORT:5,EPROTOTYPE:67,ENOTSOK:57,ENOPROTOOPT:50,ESHUTDOWN:140,ECONNREFU
SED:14,EADDRINUSE:3,ECONNABORTED:13,ENETUNREACH:40,ENETDOWN:38,ETIMEDOUT:73,EHOS
TDOWN:142,EHOSTUNREACH:23,EINPROGRESS:26,EALREADY:7,EDESTADDRREQ:17,EMSGSIZE:35,E
PROTONOSUPPORT:66,ESOCKTNOSUPPORT:137,EADDRNOTAVAIL:4,ENETRESET:39,EISCONN:30,EN
OTCONN:53,ETOOMANYREFS:141,EUSERS:136,EDQUOT:19,ESTALE:72,ENOTSUP:138,ENOMEDIUM:14
8,EILSEQ:25,E_OVERFLOW:61,ECANCELED:11,ENOTRECOVERABLE:56,EOWNERDEAD:62,ESTRPIPE:13
5};function
_emsripten_futex_wake(addr,count){if(addr<=0||addr>GROWABLE_HEAP_I32().length||addr&3!=0||count<0)retu
rn-28;if(count==0)return 0;if(count>=2147483647)count=Infinity;var
mainThreadWaitAddress=Atomics.load(GROWABLE_HEAP_I32(),_emsripten_main_thread_futex>>2);var
mainThreadWoken=0;if(mainThreadWaitAddress==addr){var
loadedAddr=Atomics.compareExchange(GROWABLE_HEAP_I32(),_emsripten_main_thread_futex>>2,mainTh
readWaitAddress,0);if(loadedAddr==mainThreadWaitAddress){--count;mainThreadWoken=1;if(count<=0)return
1}}var ret=Atomics.notify(GROWABLE_HEAP_I32(),addr>>2,count);if(ret>=0)return
ret+mainThreadWoken;throw\"Atomics.notify returned an unexpected value
\"+ret}Module[\"_emsripten_futex_wake\"]=_emsripten_futex_wake;function
killThread(pthread_ptr){if(ENVIRONMENT_IS_PTHREAD)throw\"Internal Error! killThread() can only ever be
called from main application thread!\";if(!pthread_ptr)throw\"Internal Error! Null pthread_ptr in
killThread!\";GROWABLE_HEAP_I32()[pthread_ptr+12>>2]=0;var
pthread=PThread.threads[pthread_ptr];pthread.worker.terminate();PThread.freeThreadData(pthread);PThread.runni
ngWorkers.splice(PThread.runningWorkers.indexOf(pthread.worker),1);pthread.worker.pthread=undefined}functio
n cancelThread(pthread_ptr){if(ENVIRONMENT_IS_PTHREAD)throw\"Internal Error! cancelThread() can only
ever be called from main application thread!\";if(!pthread_ptr)throw\"Internal Error! Null pthread_ptr in
cancelThread!\";var
pthread=PThread.threads[pthread_ptr];pthread.worker.postMessage({\"cmd\": \"cancel\"})}function
cleanupThread(pthread_ptr){if(ENVIRONMENT_IS_PTHREAD)throw\"Internal Error! cleanupThread() can only
ever be called from main application thread!\";if(!pthread_ptr)throw\"Internal Error! Null pthread_ptr in
cleanupThread!\";var
pthread=PThread.threads[pthread_ptr];if(pthread){GROWABLE_HEAP_I32()[pthread_ptr+12>>2]=0;var
worker=pthread.worker;PThread.returnWorkerToPool(worker)}}var
PThread={unusedWorkers:[],runningWorkers:[],initMainThreadBlock:function(){var
pthreadPoolSize=8;for(var
i=0;i<pthreadPoolSize;++i){PThread.allocateUnusedWorker()}},.initRuntime:function(){var
tb=_malloc(228);for(var
i=0;i<228/4;++i)GROWABLE_HEAP_U32()[tb/4+i]=0;GROWABLE_HEAP_I32()[tb+12>>2]=tb;var
headPtr=tb+152;GROWABLE_HEAP_I32()[headPtr>>2]=headPtr;var tlsMemory=_malloc(512);for(var
i=0;i<128;++i)GROWABLE_HEAP_U32()[tlsMemory/4+i]=0;Atomics.store(GROWABLE_HEAP_U32(),tb+100
>>2,tlsMemory);Atomics.store(GROWABLE_HEAP_U32(),tb+40>>2,tb);_emsripten_thread_init(tb,!ENVIRON
MENT_IS_WORKER,1);_emsripten_register_main_browser_thread_id(tb);initWorker:function(){},threads:{},t
hreadExitHandlers:[],setThreadStatus:function(){},runExitHandlers:function(){while(PThread.threadExitHandlers.l
ength>0){PThread.threadExitHandlers.pop()}if(ENVIRONMENT_IS_PTHREAD&&_pthread_self())__pthread
_tsd_run_dtors()},runExitHandlersAndDeinitThread:function(tb,exitCode){Atomics.store(GROWABLE_HEAP_U

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32(),tb+56>>2,1);Atomics.store(GROWABLE_HEAP_U32(),tb+60>>2,0);PThread.runExitHandlers();Atomics.stor
e(GROWABLE_HEAP_U32(),tb+4>>2,exitCode);Atomics.store(GROWABLE_HEAP_U32(),tb+0>>2,1);_emscri
pten_futex_wake(tb+0,2147483647);__emscripten_thread_init(0,0,0)},threadExit:function(exitCode){var
tb=_pthread_self();if(tb){PThread.runExitHandlersAndDeinitThread(tb,exitCode);if(ENVIRONMENT_IS_PTHRE
AD){postMessage({"cmd\":"exit\"})}}},threadCancel:function(){PThread.runExitHandlersAndDeinitThread(_pthr
ead_self(),-1);postMessage({"cmd\":"cancelDone\"})},terminateAllThreads:function(){for(var t in
PThread.threads){var
pthread=PThread.threads[t];if(pthread&&pthread.worker){PThread.returnWorkerToPool(pthread.worker)}PThre
ad.threads={};for(var i=0;i<PThread.unusedWorkers.length;++i){var
worker=PThread.unusedWorkers[i];worker.terminate()}PThread.unusedWorkers=[];for(var
i=0;i<PThread.runningWorkers.length;++i){var worker=PThread.runningWorkers[i];var
pthread=worker.pthread;PThread.freeThreadData(pthread);worker.terminate()}PThread.runningWorkers=[]},freeTh
readData:function(pthread){if(!pthread)return;if(pthread.threadInfoStruct){var
tlsMemory=GROWABLE_HEAP_I32()[pthread.threadInfoStruct+100>>2];GROWABLE_HEAP_I32()[pthread.thr
eadInfoStruct+100>>2]=0;_free(tlsMemory);_free(pthread.threadInfoStruct)}pthread.threadInfoStruct=0;if(pthread.
allocatedOwnStack&&pthread.stackBase)_free(pthread.stackBase);pthread.stackBase=0;if(pthread.worker)pthread.
worker.pthread=null},returnWorkerToPool:function(worker){PThread.runWithoutMainThreadQueuedCalls(funcio
n){delete
PThread.threads[worker.pthread.threadInfoStruct];PThread.unusedWorkers.push(worker);PThread.runningWorker
s.splice(PThread.runningWorkers.indexOf(worker),1);PThread.freeThreadData(worker.pthread);worker.pthread=un
defined}},runWithoutMainThreadQueuedCalls:function(func){GROWABLE_HEAP_I32()[__emscripten_allow_m
ain_runtime_queued_calls>>2]=0;try{func()}finally{GROWABLE_HEAP_I32()[__emscripten_allow_main_runti
me_queued_calls>>2]=1}},receiveObjectTransfer:function(data){},loadWasmModuleToWorker:function(worker,o
nFinishedLoading){worker.onmessage=function(e){var
d=e["data"];var
cmd=d["cmd"];if(worker.pthread)PThread.currentProxiedOperationCallerThread=worker.pthread.threadInfoStruct;
if(d["targetThread"]&&d["targetThread"]!=_pthread_self()){var
thread=PThread.threads[d.targetThread];if(thread){thread.worker.postMessage(e.data,d["transferList"])}else{con
sole.error('Internal error! Worker sent a message \''+cmd+'\" to target pthread '+d["targetThread"]+', but that
thread no longer
exists!')}PThread.currentProxiedOperationCallerThread=undefined;return}if(cmd===\"processQueuedMainThread
Work\"){_emscripten_main_thread_process_queued_calls()}else
if(cmd===\"spawnThread\"){spawnThread(e.data)}else
if(cmd===\"cleanupThread\"){cleanupThread(d["thread"])}else
if(cmd===\"killThread\"){killThread(d["thread"])}else
if(cmd===\"cancelThread\"){cancelThread(d["thread"])}else
if(cmd===\"loaded\"){worker.loaded=true;if(onFinishedLoading)onFinishedLoading(worker);if(worker.runPthread)
{worker.runPthread();delete
worker.runPthread}}else if(cmd===\"print\"){out(\"Thread \"+d["threadId"]+\": \"+d["text"])}else
if(cmd===\"printErr\"){err(\"Thread \"+d["threadId"]+\": \"+d["text"])}else if(cmd===\"alert\"){alert(\"Thread
\"+d["threadId"]+\": \"+d["text"])}else if(cmd===\"exit\"){var
detached=worker.pthread&&Atomics.load(GROWABLE_HEAP_U32(),worker.pthread.threadInfoStruct+64>>2);if
(detached){PThread.returnWorkerToPool(worker)}else
if(cmd===\"exitProcess\"){try{exit(d["returnCode"])}catch(e){if(e instanceof ExitStatus)return;throw e}}else
if(cmd===\"cancelDone\"){PThread.returnWorkerToPool(worker)}else
if(cmd===\"objectTransfer\"){PThread.receiveObjectTransfer(e.data)}else
if(e.data.target===\"setimmediate\"){worker.postMessage(e.data)}else{err(\"worker sent an unknown command
\"+cmd)}PThread.currentProxiedOperationCallerThread=undefined};worker.onerror=function(e){err(\"pthread sent

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an error!\"+e.filename+\":\"+e.lineno+\":
\"+e.message));if(ENVIRONMENT_IS_NODE){worker.on(\"message\",function(data){worker.onmessage({data:d
ata}});worker.on(\"error\",function(data){worker.onerror(data)});worker.on(\"exit\",function(data){})}worker.post
Message({\"cmd\": \"load\", \"urlOrBlob\": Module[\"mainScriptUrlOrBlob\"]|_scriptDir, \"wasmMemory\": wasmMe
memory, \"wasmModule\": wasmModule}),allocateUnusedWorker:function(){var
pthreadMainJs=locateFile(\"tfjs-backend-wasm-threaded-simd.worker.js\");PThread.unusedWorkers.push(new
Worker(pthreadMainJs)),getNewWorker:function(){if(PThread.unusedWorkers.length==0){PThread.allocateUnus
edWorker();PThread.loadWasmModuleToWorker(PThread.unusedWorkers[0])}if(PThread.unusedWorkers.length>
0)return PThread.unusedWorkers.pop();else return null},busySpinWait:function(msecs){var
t=performance.now()+msecs;while(performance.now()<t){}}};function
establishStackSpace(stackTop,stackMax){_emscripten_stack_set_limits(stackTop,stackMax);stackRestore(stackTop
)}Module[\"establishStackSpace\"]=establishStackSpace;function getNoExitRuntime(){return
noExitRuntime}Module[\"getNoExitRuntime\"]=getNoExitRuntime;function invokeEntryPoint(ptr,arg){return
wasmTable.get(ptr)(arg)}Module[\"invokeEntryPoint\"]=invokeEntryPoint;function
__assert_fail(condition,filename,line,func){abort(\"Assertion failed: \"+UTF8ToString(condition)+\", at:
\"+[filename?UTF8ToString(filename):\"unknown filename\",line,func?UTF8ToString(func):\"unknown
function\"])}function __call_main(argc,argv){var returnCode=__main(argc,argv)}var
_emscripten_get_now;if(ENVIRONMENT_IS_NODE){_emscripten_get_now=function(){var
t=process[\"hrtime\"]();return t[0]*1e3+t[1]/1e6}}else
if(ENVIRONMENT_IS_PTHREAD){_emscripten_get_now=function(){return performance.now()-
Module[\"__performance_now_clock_drift\"]}}else if(typeof
dateNow!=\"undefined"){_emscripten_get_now=dateNow}else _emscripten_get_now=function(){return
performance.now()};function setErrNo(value){GROWABLE_HEAP_I32()[__errno_location()>>2]=value;return
value}function _atexit(func,arg){if(ENVIRONMENT_IS_PTHREAD)return
_emscripten_proxy_to_main_thread_js(1,1,func,arg)}function
_emscripten_notify_thread_queue(targetThreadId,mainThreadId){if(targetThreadId==mainThreadId){postMessag
e({\"cmd\": \"processQueuedMainThreadWork\"})}else
if(ENVIRONMENT_IS_PTHREAD){postMessage({\"targetThread\":targetThreadId,\"cmd\": \"processThreadQueu
e\"})}else{var pthread=PThread.threads[targetThreadId];var
worker=pthread&&pthread.worker;if(!worker){return}worker.postMessage({\"cmd\": \"processThreadQueue\"})}ret
urn 1}function _abort(){abort()}function _emscripten_asm_const_int(code,sigPtr,argbuf){var
args=readAsmConstArgs(sigPtr,argbuf);return ASM_CONSTS[code].apply(null,args)}function
_emscripten_conditional_set_current_thread_status(expectedStatus,newStatus){function
_emscripten_futex_wait(addr,val,timeout){if(addr<=0||addr>GROWABLE_HEAP_I8().length||addr&3!=0)return-
28;if(!ENVIRONMENT_IS_WEB){var
ret=Atomics.wait(GROWABLE_HEAP_I32(),addr>>2,val,timeout);if(ret===\"timed-out\")return-
73;if(ret===\"not-equal\")return-6;if(ret===\"ok\")return
0;throw\"Atomics.wait returned an unexpected value
\"+ret}else{if(Atomics.load(GROWABLE_HEAP_I32(),addr>>2)!=val){return-6}var
tNow=performance.now();var tEnd=tNow+timeout;var
lastAddr=Atomics.exchange(GROWABLE_HEAP_I32(),_emscripten_main_thread_futex>>2,addr);while(1){tNo
w=performance.now();if(tNow>tEnd){lastAddr=Atomics.exchange(GROWABLE_HEAP_I32(),_emscripten_mai
n_thread_futex>>2,0);return-
73}lastAddr=Atomics.exchange(GROWABLE_HEAP_I32(),_emscripten_main_thread_futex>>2,0);if(lastAddr==
0){break}_emscripten_main_thread_process_queued_calls();if(Atomics.load(GROWABLE_HEAP_I32(),addr>>2)!
=val){return-
6}lastAddr=Atomics.exchange(GROWABLE_HEAP_I32(),_emscripten_main_thread_futex>>2,addr)}return
0}}function

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_emsripten_memcpy_big(dest,src,num){ GROWABLE_HEAP_U8().copyWithin(dest,src,src+num)}function
_emsripten_num_logical_cores(){if(ENVIRONMENT_IS_NODE)return require("\os").cpus().length;return
navigator["hardwareConcurrency"]}function
_emsripten_proxy_to_main_thread_js(index,sync){ var numCallArgs=arguments.length-2;var
stack=stackSave();var serializedNumCallArgs=numCallArgs;var args=stackAlloc(serializedNumCallArgs*8);var
b=args>>3;for(var i=0;i<numCallArgs;i++){ var arg=arguments[2+i];GROWABLE_HEAP_F64()[b+i]=arg}var
ret=_emsripten_run_in_main_runtime_thread_js(index,serializedNumCallArgs,args,sync);stackRestore(stack);return
ret}var _emsripten_receive_on_main_thread_js_callArgs=[];var readAsmConstArgsArray=[];function
readAsmConstArgs(sigPtr,buf){ readAsmConstArgsArray.length=0;var
ch;buf>>=2;while(ch=GROWABLE_HEAP_U8()[sigPtr++){ var
double=ch<105;if(double&&buf&1)buf++;readAsmConstArgsArray.push(double?GROWABLE_HEAP_F64()[buf
++>>1]:GROWABLE_HEAP_I32()[buf]);++buf}return readAsmConstArgsArray}function
_emsripten_receive_on_main_thread_js(index,numCallArgs,args){ _emsripten_receive_on_main_thread_js_callA
rgs.length=numCallArgs;var b=args>>3;for(var
i=0;i<numCallArgs;i++){ _emsripten_receive_on_main_thread_js_callArgs[i]=GROWABLE_HEAP_F64()[b+i]}v
ar
isEmAsmConst=index<0;var func=!isEmAsmConst?proxiedFunctionTable[index]:ASM_CONSTS[-index-
1];return func.apply(null,_emsripten_receive_on_main_thread_js_callArgs)}function
_emsripten_get_heap_size(){return GROWABLE_HEAP_U8().length}function
emsripten_realloc_buffer(size){try{wasmmMemory.grow(size-
buffer.byteLength+65535>>>16);updateGlobalBufferAndViews(wasmmMemory.buffer);return
1}catch(e){}}function _emsripten_resize_heap(requestedSize){ var
oldSize=_emsripten_get_heap_size();if(requestedSize<=oldSize){return false}var
maxHeapSize=2147483648;if(requestedSize>maxHeapSize){return false}for(var
cutDown=1;cutDown<=4;cutDown*=2){ var
overGrownHeapSize=oldSize*(1+.2/cutDown);overGrownHeapSize=Math.min(overGrownHeapSize,requestedSize
+100663296);var
newSize=Math.min(maxHeapSize,alignUp(Math.max(requestedSize,overGrownHeapSize),65536));var
replacement=emsripten_realloc_buffer(newSize);if(replacement){return true}}return false}var
JSEvents={inEventHandler:0,removeAllEventListeners:function(){for(var
i=JSEvents.eventHandlers.length-1;i>=0;--
i){JSEvents._removeHandler(i)}JSEvents.eventHandlers=[];JSEvents.deferredCalls=[]},registerRemoveEventListen
ers:function(){if(!JSEvents.removeEventListenersRegistered){__ATEXIT__.push(JSEvents.removeAllEventListene
rs);JSEvents.removeEventListenersRegistered=true}},deferredCalls:[],deferCall:function(targetFunction,precedence
,argsList){function arraysHaveEqualContent(arrA,arrB){if(arrA.length!=arrB.length)return false;for(var i in
arrA){if(arrA[i]!=arrB[i])return false}return true}for(var i in JSEvents.deferredCalls){var
call=JSEvents.deferredCalls[i];if(call.targetFunction==targetFunction&&arraysHaveEqualContent(call.argsList,args
List))return}}JSEvents.deferredCalls.push({targetFunction:targetFunction,precedence:precedence,argsList:argsList
});JSEvents.deferredCalls.sort(function(x,y){return
x.precedence<y.precedence}),removeDeferredCalls:function(targetFunction){for(var
i=0;i<JSEvents.deferredCalls.length;++i){if(JSEvents.deferredCalls[i].targetFunction==targetFunction){JSEvents.d
eferredCalls.splice(i,1);--i}},canPerformEventHandlerRequests:function(){return
JSEvents.inEventHandler&&JSEvents.currentEventHandler.allowsDeferredCalls},runDeferredCalls:function(){if(!J
SEvents.canPerformEventHandlerRequests()){return}for(var i=0;i<JSEvents.deferredCalls.length;++i){var
call=JSEvents.deferredCalls[i];JSEvents.deferredCalls.splice(i,1);--
i;call.targetFunction.apply(null,call.argsList)},eventHandlers:[],removeAllHandlersOnTarget:function(target,event
TypeString){for(var
i=0;i<JSEvents.eventHandlers.length;++i){if(JSEvents.eventHandlers[i].target==target&&(!eventTypeString||event

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TypeString==JSEvents.eventHandlers[i].eventTypeString)){JSEvents._removeHandler(i--
)}}},_removeHandler:function(i){var
h=JSEvents.eventHandlers[i];h.target.removeEventListener(h.eventTypeString,h.eventListenerFunc,h.useCapture);J
SEvents.eventHandlers.splice(i,1)},registerOrRemoveHandler:function(eventHandler){var
jsEventHandler=function
jsEventHandler(event){++JSEvents.inEventHandler;JSEvents.currentEventHandler=eventHandler;JSEvents.runDef
erredCalls();eventHandler.handlerFunc(event);JSEvents.runDeferredCalls();--
JSEvents.inEventHandler;if(eventHandler.callbackfunc){eventHandler.eventListenerFunc=jsEventHandler;eventH
andler.target.addEventListener(eventHandler.eventTypeString,jsEventHandler,eventHandler.useCapture);JSEvents.e
ventHandlers.push(eventHandler);JSEvents.registerRemoveEventListeners()}else{for(var
i=0;i<JSEvents.eventHandlers.length;++i){if(JSEvents.eventHandlers[i].target==eventHandler.target&&JSEvents.e
ventHandlers[i].eventTypeString==eventHandler.eventTypeString){JSEvents._removeHandler(i--
)}}}},queueEventHandlerOnThread_iiii:function(targetThread,eventHandlerFunc,eventTypeId,eventData,userData)
{var stackTop=stackSave();var
varargs=stackAlloc(12);GROWABLE_HEAP_I32()[varargs>>2]=eventTypeId;GROWABLE_HEAP_I32()[varargs
+4>>2]=eventData;GROWABLE_HEAP_I32()[varargs+8>>2]=userData;__emscripten_call_on_thread(0,targetThr
ead,637534208,eventHandlerFunc,eventData,varargs);stackRestore(stackTop)},getTargetThreadForEventCallback:f
unction(targetThread){switch(targetThread){case
1:return 0;case 2:return PThread.currentProxiedOperationCallerThread;default:return
targetThread}},getNodeNameForTarget:function(target){if(!target)return\"\";if(target==window)return\"#window\";
if(target==screen)return\"#screen\";return
target&&target.nodeName?target.nodeName:\"\"},fullscreenEnabled:function(){return
document.fullscreenEnabled||document.webkitFullscreenEnabled}};function stringToNewUTF8(jsString){var
length=lengthBytesUTF8(jsString)+1;var cString=_malloc(length);stringToUTF8(jsString,cString,length);return
cString}function
_emsripten_set_offscreenCanvas_size_on_target_thread_js(targetThread,targetCanvas,width,height){var
stackTop=stackSave();var varargs=stackAlloc(12);var
targetCanvasPtr=0;if(targetCanvas){targetCanvasPtr=stringToNewUTF8(targetCanvas)}GROWABLE_HEAP_I32(
)[varargs>>2]=targetCanvasPtr;GROWABLE_HEAP_I32()[varargs+4>>2]=width;GROWABLE_HEAP_I32()[var
args+8>>2]=height;__emscripten_call_on_thread(0,targetThread,657457152,0,targetCanvasPtr,varargs);stackRestor
e(stackTop)}function
_emsripten_set_offscreenCanvas_size_on_target_thread(targetThread,targetCanvas,width,height){targetCanvas=tar
getCanvas?UTF8ToString(targetCanvas):\"\";_emsripten_set_offscreenCanvas_size_on_target_thread_js(targetThr
ead,targetCanvas,width,height)}function maybeCStringToJsString(cString){return
cString>2?UTF8ToString(cString):cString}var specialHTMLTargets=[0,typeof
document!=="undefined"?document:0,typeof window!=="undefined"?window:0];function
findEventTarget(target){target=maybeCStringToJsString(target);var
domElement=specialHTMLTargets[target]||(typeof
document!=="undefined"?document.querySelector(target):undefined);return domElement}function
findCanvasEventTarget(target){return findEventTarget(target)}function
_emsripten_set_canvas_element_size_calling_thread(target,width,height){var
canvas=findCanvasEventTarget(target);if(!canvas)return-
4;if(canvas.canvasSharedPtr){GROWABLE_HEAP_I32()[canvas.canvasSharedPtr>>2]=width;GROWABLE_HEA
P_I32()[canvas.canvasSharedPtr+4>>2]=height}if(canvas.offscreenCanvas||!canvas.controlTransferredOffscreen){if
(canvas.offscreenCanvas)canvas=canvas.offscreenCanvas;var
autoResizeViewport=false;if(canvas.GLctxObject&&canvas.GLctxObject.GLctx){var
prevViewport=canvas.GLctxObject.GLctx.getParameter(2978);autoResizeViewport=prevViewport[0]==0&&prev
Viewport[1]==0&&prevViewport[2]==canvas.width&&prevViewport[3]==canvas.height}canvas.width=width;

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canvas.height=height;if(autoResizeViewport){ canvas.GLctxObject.GLctx.viewport(0,0,width,height) } } else
if(canvas.canvasSharedPtr){ var
targetThread=GROWABLE_HEAP_I32()[canvas.canvasSharedPtr+8>>2];_emscripten_set_offscreencanvas_size_o
n_target_thread(targetThread,target,width,height);return 1 } else { return -4 } return 0 } function
_emscripten_set_canvas_element_size_main_thread(target,width,height) { if(ENVIRONMENT_IS_PTHREAD)retur
n
_emscripten_proxy_to_main_thread_js(2,1,target,width,height);return
_emscripten_set_canvas_element_size_calling_thread(target,width,height) } function
_emscripten_set_canvas_element_size(target,width,height) { var
canvas=findCanvasEventTarget(target);if(canvas){ return
_emscripten_set_canvas_element_size_calling_thread(target,width,height) } else { return
_emscripten_set_canvas_element_size_main_thread(target,width,height) } } function
_emscripten_set_current_thread_status(newStatus) { } function
_emscripten_set_thread_name(threadId,name) { } function __webgl_enable_ANGLE_instanced_arrays(ctx){ var
ext=ctx.getExtension("\ANGLE_instanced_arrays");if(ext){ ctx["vertexAttribDivisor"]=function(index,divisor){ ex
t["vertexAttribDivisorANGLE"](index,divisor);};ctx["drawArraysInstanced"]=function(mode,first,count,primcou
nt){ ext["drawArraysInstancedANGLE"](mode,first,count,primcount);};ctx["drawElementsInstanced"]=function(
mode,count,type,indices,primcount){ ext["drawElementsInstancedANGLE"](mode,count,type,indices,primcount);};
return
1 } } function __webgl_enable_OES_vertex_array_object(ctx){ var
ext=ctx.getExtension("\OES_vertex_array_object");if(ext){ ctx["createVertexArray"]=function(){ return
ext["createVertexArrayOES"]();};ctx["deleteVertexArray"]=function(vao){ ext["deleteVertexArrayOES"](vao);};
ctx["bindVertexArray"]=function(vao){ ext["bindVertexArrayOES"](vao);};ctx["isVertexArray"]=function(vao)
{ return ext["isVertexArrayOES"](vao);};return 1 } } function __webgl_enable_WEBGL_draw_buffers(ctx){ var
ext=ctx.getExtension("\WEBGL_draw_buffers");if(ext){ ctx["drawBuffers"]=function(n,bufs){ ext["drawBuffers
WEBGL"](n,bufs);};return 1 } } function
__webgl_enable_WEBGL_multi_draw(ctx){ return!!(ctx.multiDrawWebgl=ctx.getExtension("\WEBGL_multi_dra
w")) } var
GL={ counter:1,buffers:[],programs:[],framebuffers:[],renderbuffers:[],textures:[],uniforms:[],shaders:[],vaos:[],cont
exts:{ },offscreenCanvases:{ },timerQueriesEXT:[],programInfos:{ },stringCache:{ },unpackAlignment:4,recordError:
function
recordError(errorCode){ if(!GL.lastError){ GL.lastError=errorCode } },getNewId:function(table){ var
ret=GL.counter++;for(var i=table.length;i<ret;i++){ table[i]=null } return
ret},getSource:function(shader,count,string,length){ var source="\ ";for(var i=0;i<count;++i){ var
len=length?GROWABLE_HEAP_I32()[length+i*4>>2]:-
1;source+=UTF8ToString(GROWABLE_HEAP_I32()[string+i*4>>2],len<0?undefined:len) } return
source},createContext:function(canvas,webGLContextAttributes){ var
ctx=canvas.getContext("\webgl",webGLContextAttributes);if(!ctx) return 0;var
handle=GL.registerContext(ctx,webGLContextAttributes);return
handle},registerContext:function(ctx,webGLContextAttributes){ var
handle=_malloc(8);GROWABLE_HEAP_I32()[handle+4>>2]=_pthread_self();var
context={ handle:handle,attributes:webGLContextAttributes,version:webGLContextAttributes.majorVersion,GLctx:
ctx };if(ctx.canvas)ctx.canvas.GLctxObject=context;GL.contexts[handle]=context;if(typeof
webGLContextAttributes.enableExtensionsByDefault===\undefined\||webGLContextAttributes.enableExtensions
ByDefault){ GL.initExtensions(context) } return
handle},makeContextCurrent:function(contextHandle){ GL.currentContext=GL.contexts[contextHandle];Module.ctx
=GLctx=GL.currentContext&&GL.currentContext.GLctx;return!(contextHandle&&!GLctx)},getContext:function(c
ontextHandle){ return

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GL.contexts[contextHandle]},deleteContext:function(contextHandle){if(GL.currentContext===GL.contexts[context
Handle])GL.currentContext=null;if(typeof
JSEvents===\"object\")JSEvents.removeAllHandlersOnTarget(GL.contexts[contextHandle].GLctx.canvas);if(GL.co
ntexts[contextHandle]&&GL.contexts[contextHandle].GLctx.canvas)GL.contexts[contextHandle].GLctx.canvas.GL
ctxObject=undefined;_free(GL.contexts[contextHandle].handle);GL.contexts[contextHandle]=null},initExtensions:f
unction(context){if(!context)context=GL.currentContext;if(context.initExtensionsDone)return;context.initExtension
sDone=true;var
GLctx=context.GLctx;__webgl_enable_ANGLE_instanced_arrays(GLctx);__webgl_enable_OES_vertex_array_obj
ect(GLctx);__webgl_enable_WEBGL_draw_buffers(GLctx);GLctx.disjointTimerQueryExt=GLctx.getExtension(\"
EXT_disjoint_timer_query\");__webgl_enable_WEBGL_multi_draw(GLctx);var
exts=GLctx.getSupportedExtensions()||[];exts.forEach(function(ext){if(ext.indexOf(\"lose_context\")<0&&ext.inde
xOf(\"debug\")<0){GLctx.getExtension(ext)}}),populateUniformTable:function(program){var
p=GL.programs[program];var
ptable=GL.programInfos[program]={uniforms:{},maxUniformLength:0,maxAttributeLength:-
1,maxUniformBlockNameLength:-1};var utable=ptable.uniforms;var
numUniforms=GLctx.getProgramParameter(p,35718);for(var i=0;i<numUniforms;++i){var
u=GLctx.getActiveUniform(p,i);var
name=u.name;ptable.maxUniformLength=Math.max(ptable.maxUniformLength,name.length+1);if(name.slice(-
1)===\"\\\"){name=name.slice(0,name.lastIndexOf(\"\\\"))}var loc=GLctx.getUniformLocation(p,name);if(loc){var
id=GL.getNewId(GL.uniforms);utable[name]=[u.size,id];GL.uniforms[id]=loc;for(var
j=1;j<u.size;++j){var
n=name+\"[\"+j+\"\\\"]\";loc=GLctx.getUniformLocation(p,n);id=GL.getNewId(GL.uniforms);GL.uniforms[id]=loc}}
}};var __emscripten_webgl_power_preferences=[\"default\",\"low-power\",\"high-performance\"];function
__emscripten_webgl_do_create_context(target,attributes){var a=attributes>>2;var
powerPreference=GROWABLE_HEAP_I32()[a+(24>>2)];var
contextAttributes={\"alpha\":!!GROWABLE_HEAP_I32()[a+(0>>2)],\"depth\":!!GROWABLE_HEAP_I32()[a+(4
>>2)],\"stencil\":!!GROWABLE_HEAP_I32()[a+(8>>2)],\"antialias\":!!GROWABLE_HEAP_I32()[a+(12>>2)],\"p
remultipliedAlpha\":!!GROWABLE_HEAP_I32()[a+(16>>2)],\"preserveDrawingBuffer\":!!GROWABLE_HEAP_
I32()[a+(20>>2)],\"powerPreference\":__emscripten_webgl_power_preferences[powerPreference],\"failIfMajorPerf
ormanceCaveat\":!!GROWABLE_HEAP_I32()[a+(28>>2)],majorVersion:GROWABLE_HEAP_I32()[a+(32>>2)],
minorVersion:GROWABLE_HEAP_I32()[a+(36>>2)],enableExtensionsByDefault:GROWABLE_HEAP_I32()[a+(
40>>2)],explicitSwapControl:GROWABLE_HEAP_I32()[a+(44>>2)],proxyContextToMainThread:GROWABLE_
HEAP_I32()[a+(48>>2)],renderViaOffscreenBackBuffer:GROWABLE_HEAP_I32()[a+(52>>2)]};var
canvas=findCanvasEventTarget(target);if(!canvas){return 0}if(contextAttributes.explicitSwapControl){return
0}var contextHandle=GL.createContext(canvas,contextAttributes);return contextHandle}function
__emscripten_webgl_create_context(a0,a1){return __emscripten_webgl_do_create_context(a0,a1)}var
SYSCALLS={mappings:{},buffers:[null,[],[]],printChar:function(stream,curr){var
buffer=SYSCALLS.buffers[stream];if(curr===0||curr===10){stream===1?out:err)(UTF8ArrayToString(buffer,0));
buffer.length=0}else{buffer.push(curr)}},varargs:undefined,get:function(){SYSCALLS.varargs+=4;var
ret=GROWABLE_HEAP_I32()[SYSCALLS.varargs-4>>2];return ret},getStr:function(ptr){var
ret=UTF8ToString(ptr);return ret},get64:function(low,high){return low}};function
__fd_close(fd){if(ENVIRONMENT_IS_PTHREAD)return __emscripten_proxy_to_main_thread_js(3,1,fd);return
0}function __fd_seek(fd,offset_low,offset_high,whence,newOffset){if(ENVIRONMENT_IS_PTHREAD)return
__emscripten_proxy_to_main_thread_js(4,1,fd,offset_low,offset_high,whence,newOffset)}function
__fd_write(fd,iov,iovcnt,pnum){if(ENVIRONMENT_IS_PTHREAD)return
__emscripten_proxy_to_main_thread_js(5,1,fd,iov,iovcnt,pnum);var num=0;for(var i=0;i<iovcnt;i++){var
ptr=GROWABLE_HEAP_I32()[iov+i*8>>2];var len=GROWABLE_HEAP_I32()[iov+(i*8+4)>>2];for(var
j=0;j<len;j++){SYSCALLS.printChar(fd,GROWABLE_HEAP_U8()[ptr+j])}num+=len}GROWABLE_HEAP_I32

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0)[pnum>>2]=num;return 0}function _pthread_cleanup_pop(execute){ var
routine=PThread.threadExitHandlers.pop();if(execute)routine()}function
_pthread_cleanup_push(routine,arg){PThread.threadExitHandlers.push(function(){ wasmTable.get(routine)(arg))}}f
unction spawnThread(threadParams){if(ENVIRONMENT_IS_PTHREAD)throw\`"Internal Error! spawnThread()
can only ever be called from main application thread!\`;var
worker=PThread.getNewWorker();if(worker.pthread!==undefined)throw\`"Internal
error!\`;if(!threadParams.pthread_ptr)throw\`"Internal
error, no pthread ptr!\`;PThread.runningWorkers.push(worker);var tlsMemory=_malloc(128*4);for(var
i=0;i<128;++i){ GROWABLE_HEAP_I32()(tlsMemory+i*4>>2)=0} var
stackHigh=threadParams.stackBase+threadParams.stackSize;var
pthread=PThread.pthreads[threadParams.pthread_ptr]={ worker:worker,stackBase:threadParams.stackBase,stackSize
:threadParams.stackSize,allocatedOwnStack:threadParams.allocatedOwnStack,threadInfoStruct:threadParams.pthread
_ptr};var
tis=pthread.threadInfoStruct>>2;Atomics.store(GROWABLE_HEAP_U32(),tis+(64>>2),threadParams.detached);A
tomics.store(GROWABLE_HEAP_U32(),tis+(100>>2),tlsMemory);Atomics.store(GROWABLE_HEAP_U32(),tis
+(40>>2),pthread.threadInfoStruct);Atomics.store(GROWABLE_HEAP_U32(),tis+(80>>2),threadParams.stackSiz
e);Atomics.store(GROWABLE_HEAP_U32(),tis+(76>>2),stackHigh);Atomics.store(GROWABLE_HEAP_U32(),t
is+(104>>2),threadParams.stackSize);Atomics.store(GROWABLE_HEAP_U32(),tis+(104+8>>2),stackHigh);Atom
ics.store(GROWABLE_HEAP_U32(),tis+(104+12>>2),threadParams.detached);var
global_libc=_emscripten_get_global_libc();var
global_locale=global_libc+40;Atomics.store(GROWABLE_HEAP_U32(),tis+(172>>2),global_locale);worker.pthr
ead=pthread;var
msg={\`"cmd\`:\`"run\`,`"start_routine\`:threadParams.startRoutine,\`"arg\`:threadParams.arg,\`"threadInfoStruct\`:thre
adParams.pthread_ptr,\`"stackBase\`:threadParams.stackBase,\`"stackSize\`:threadParams.stackSize`;worker.runPthre
ad=function(){ msg.time=performance.now();worker.postMessage(msg,threadParams.transferList)};if(worker.loaded
){ worker.runPthread();delete worker.runPthread}}function
_pthread_create(pthread_ptr,attr,start_routine,arg){if(typeof SharedArrayBuffer===\`"undefined\`"){err(\`"Current
environment does not support SharedArrayBuffer, pthreads are not available!\`");return
6}if(!pthread_ptr){err(\`"pthread_create called with a null thread pointer!\`");return 28} var transferList=[];var
error=0;if(ENVIRONMENT_IS_PTHREAD&&(transferList.length===0||error)){ return
_emscripten_sync_run_in_main_thread_4(687865856,pthread_ptr,attr,start_routine,arg)}if(error)return
error;var stackSize=0;var stackBase=0;var detached=0;if(attr&&attr!=
1){ stackSize=GROWABLE_HEAP_I32()[attr>>2];stackSize+=81920;stackBase=GROWABLE_HEAP_I32()[attr+
8>>2];detached=GROWABLE_HEAP_I32()[attr+12>>2]!==0}else{ stackSize=2097152} var
allocatedOwnStack=stackBase===0;if(allocatedOwnStack){stackBase=_memalign(16,stackSize)}else{stackBase=
stackSize;assert(stackBase>0)} var threadInfoStruct=_malloc(228);for(var
i=0;i<228>>2;++i)GROWABLE_HEAP_U32()[threadInfoStruct>>2+i]=0;GROWABLE_HEAP_I32()[pthread_p
tr>>2]=threadInfoStruct;GROWABLE_HEAP_I32()[threadInfoStruct+12>>2]=threadInfoStruct;var
headPtr=threadInfoStruct+152;GROWABLE_HEAP_I32()[headPtr>>2]=headPtr;var
threadParams={ stackBase:stackBase,stackSize:stackSize,allocatedOwnStack:allocatedOwnStack,detached:detached
,startRoutine:start_routine,pthread_ptr:threadInfoStruct,arg:arg,transferList:transferList};if(ENVIRONMENT_IS_P
THREAD){ threadParams.cmd=\`"spawnThread\`;postMessage(threadParams,transferList)}else{ spawnThread(thread
Params)}return
0}function __pthread_testcancel_js(){if(!ENVIRONMENT_IS_PTHREAD)return;var
tb=_pthread_self();if(!tb)return;var
cancelDisabled=Atomics.load(GROWABLE_HEAP_U32(),tb+56>>2);if(cancelDisabled)return;var
canceled=Atomics.load(GROWABLE_HEAP_U32(),tb+0>>2);if(canceled===2)throw\`"Canceled!\`"}function
_emscripten_check_blocking_allowed(){if(ENVIRONMENT_IS_NODE)return;if(ENVIRONMENT_IS_WORKE

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R)return;warnOnce("\Blocking on the main thread is very dangerous, see
https://emscripten.org/docs/porting/pthreads.html#blocking-on-the-main-browser-thread"))}function
__emscripten_do_pthread_join(thread,status,block){if(!thread){err("\pthread_join attempted on a null thread
pointer!");return
ERRNO_CODES.ESRCH}if(ENVIRONMENT_IS_PTHREAD&&_pthread_self()==thread){err("\PThread
\"+thread+\" is attempting to join to itself!");return ERRNO_CODES.EDEADLK}else
if(!ENVIRONMENT_IS_PTHREAD&&_emscripten_main_browser_thread_id()==thread){err("\Main
thread \"+thread+\" is attempting to join to itself!");return ERRNO_CODES.EDEADLK}var
self=GROWABLE_HEAP_I32()[thread+12>>2];if(self!==thread){err("\pthread_join attempted on thread
\"+thread+\", which does not point to a valid thread, or does not exist anymore!");return
ERRNO_CODES.ESRCH}var
detached=Atomics.load(GROWABLE_HEAP_U32(),thread+64>>2);if(detached){err("\Attempted to join thread
\"+thread+\", which was already detached!");return
ERRNO_CODES.EINVAL}if(block){_emscripten_check_blocking_allowed()}for(;;){var
threadStatus=Atomics.load(GROWABLE_HEAP_U32(),thread+0>>2);if(threadStatus==1){var
threadExitCode=Atomics.load(GROWABLE_HEAP_U32(),thread+4>>2);if(status)GROWABLE_HEAP_I32()[sta
tus>>2]=threadExitCode;Atomics.store(GROWABLE_HEAP_U32(),thread+64>>2,1);if(!ENVIRONMENT_IS_PT
HREAD)cleanupThread(thread);else postMessage({"cmd":"cleanupThread","thread":thread});return
0}if(!block){return
ERRNO_CODES.EBUSY}}__pthread_testcancel_js();if(!ENVIRONMENT_IS_PTHREAD)_emscripten_main_thre
ad_process_queued_calls();_emscripten_futex_wait(thread+0,threadStatus,ENVIRONMENT_IS_PTHREAD?100:1
)}}function
_pthread_join(thread,status){return __emscripten_do_pthread_join(thread,status,true)}function
_sysconf(name){if(ENVIRONMENT_IS_PTHREAD)return
_emscripten_proxy_to_main_thread_js(6,1,name);switch(name){case 30:return 16384;case 85:var
maxHeapSize=2147483648;return maxHeapSize/16384;case 132:case 133:case 12:case 137:case 138:case 15:case
235:case 16:case 17:case 18:case 19:case 20:case 149:case 13:case 10:case 236:case 153:case 9:case 21:case 22:case
159:case 154:case 14:case 77:case 78:case 139:case 82:case 68:case 67:case 164:case 11:case 29:case 47:case
48:case 95:case 52:case 51:case 46:return 200809;case 27:case 246:case 127:case 128:case 23:case 24:case 160:case
161:case 181:case 182:case 242:case 183:case 184:case 243:case 244:case 245:case 165:case 178:case 179:case
49:case 50:case 168:case 169:case 175:case 170:case 171:case 172:case
97:case 76:case 32:case 173:case 35:case 80:case 81:case 79:return-1;case 176:case 177:case 7:case 155:case 8:case
157:case 125:case 126:case 92:case 93:case 129:case 130:case 131:case 94:case 91:return 1;case 74:case 60:case
69:case 70:case 4:return 1024;case 31:case 42:case 72:return 32;case 87:case 26:case 33:return 2147483647;case
34:case 1:return 47839;case 38:case 36:return 99;case 43:case 37:return 2048;case 0:return 2097152;case 3:return
65536;case 28:return 32768;case 44:return 32767;case 75:return 16384;case 39:return 1e3;case 89:return 700;case
71:return 256;case 40:return 255;case 2:return 100;case 180:return 64;case 25:return 20;case 5:return 16;case
6:return 6;case 73:return 4;case 84:{if(typeof navigator===\"object\")return
navigator[\"hardwareConcurrency\"]||1;return 1}}setErrNo(28);return-
1}if(!ENVIRONMENT_IS_PTHREAD)PThread.initMainThreadBlock();var GLctx;var
proxiedFunctionTable=[null,_atexit,_emscripten_set_canvas_element_size_main_thread,_fd_close,_fd_seek,_fd_wr
ite,_sysconf];var
asmLibraryArg={\"e\":__assert_fail,\"r\":__call_main,\"x\":_emscripten_notify_thread_queue,\"b\":_abort,\"y\":
_emscripten_asm_const_int,\"j\":_emscripten_conditional_set_current_thread_status,\"d\":_emscripten_futex_wait,\"c\":_emscripten_futex_wake,\"f\":_emscripten_get_now,\"p\":_emscripten_memcpy_big,\"A\":_emscripten_num_l
ogical_cores,\"u\":_emscripten_receive_on_main_thread_js,\"q\":_emscripten_resize_heap,\"v\":_emscripten_set_ca
nvas_element_size,\"i\":_emscripten_set_current_thread_status,\"s\":_emscripten_set_thread_name,\"w\":_emscript
en_webgl_create_context,\"l\":_fd_close,\"n\":_fd_seek,\"g\":_fd_write,\"o\":initPthreadsJS,\"a\":wasmMemory||Mo

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dule["wasmMemory"],"z":_pthread_cleanup_pop,"k":_pthread_cleanup_push,"h":_pthread_create,"m":_pthread_join,"t":_sysconf);var asm=createWasm();var
__wasm_call_ctors=Module["__wasm_call_ctors"]=function(){return(__wasm_call_ctors=Module["__wasm_call_ctors"]=Module["asm"])[["B"]].apply(null,arguments)};var
_init=Module["_init"]=function(){return(_init=Module["_init"]=Module["asm"])[["C"]].apply(null,arguments)};
var
_init_with_threads_count=Module["_init_with_threads_count"]=function(){return(_init_with_threads_count=Module["_init_with_threads_count"]=Module["asm"])[["D"]].apply(null,arguments)};var
_get_threads_count=Module["_get_threads_count"]=function(){return(_get_threads_count=Module["_get_threads_count"]=Module["asm"])[["E"]].apply(null,arguments)};var
_register_tensor=Module["_register_tensor"]=function(){return(_register_tensor=Module["_register_tensor"]=Module["asm"])[["F"]].apply(null,arguments)};var
_dispose_data=Module["_dispose_data"]=function(){return(_dispose_data=Module["_dispose_data"]=Module["asm"])[["G"]].apply(null,arguments)};var
_dispose=Module["_dispose"]=function(){return(_dispose=Module["_dispose"]=Module["asm"])[["H"]].apply(null,arguments)};var
_Abs=Module["_Abs"]=function(){return(_Abs=Module["_Abs"]=Module["asm"])[["J"]].apply(null,arguments)};var
_Add=Module["_Add"]=function(){return(_Add=Module["_Add"]=Module["asm"])[["K"]].apply(null,arguments)};var
_AddN=Module["_AddN"]=function(){return(_AddN=Module["_AddN"]=Module["asm"])[["L"]].apply(null,arguments)};var
_All=Module["_All"]=function(){return(_All=Module["_All"]=Module["asm"])[["M"]].apply(null,arguments)};var
_Any=Module["_Any"]=function(){return(_Any=Module["_Any"]=Module["asm"])[["N"]].apply(null,arguments)};var
_ArgMax=Module["_ArgMax"]=function(){return(_ArgMax=Module["_ArgMax"]=Module["asm"])[["O"]].apply(null,arguments)};var
_AvgPool=Module["_AvgPool"]=function(){return(_AvgPool=Module["_AvgPool"]=Module["asm"])[["P"]].apply(null,arguments)};var
_BatchMatMul=Module["_BatchMatMul"]=function(){return(_BatchMatMul=Module["_BatchMatMul"]=Module["asm"])[["Q"]].apply(null,arguments)};var
_Ceil=Module["_Ceil"]=function(){return(_Ceil=Module["_Ceil"]=Module["asm"])[["R"]].apply(null,arguments)};var
_ClipByValue=Module["_ClipByValue"]=function(){return(_ClipByValue=Module["_ClipByValue"]=Module["asm"])[["S"]].apply(null,arguments)};var
_Conv2D=Module["_Conv2D"]=function(){return(_Conv2D=Module["_Conv2D"]=Module["asm"])[["T"]].apply(null,arguments)};var
_Conv2DBackpropInput=Module["_Conv2DBackpropInput"]=function(){return(_Conv2DBackpropInput=Module["_Conv2DBackpropInput"]=Module["asm"])[["U"]].apply(null,arguments)};var
_Cos=Module["_Cos"]=function(){return(_Cos=Module["_Cos"]=Module["asm"])[["V"]].apply(null,arguments)};var
_Cosh=Module["_Cosh"]=function(){return(_Cosh=Module["_Cosh"]=Module["asm"])[["W"]].apply(null,arguments)};var
_CropAndResize=Module["_CropAndResize"]=function(){return(_CropAndResize=Module["_CropAndResize"]=Module["asm"])[["X"]].apply(null,arguments)};var
_Cumsum=Module["_Cumsum"]=function(){return(_Cumsum=Module["_Cumsum"]=Module["asm"])[["Y"]].apply(null,arguments)};var

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_DepthToSpace=Module["_DepthToSpace"]=function(){return(_DepthToSpace=Module["_DepthToSpace"]=Module["_asm"][_"Z"]).apply(null,arguments)};var
_DepthwiseConv2dNative=Module["_DepthwiseConv2dNative"]=function(){return(_DepthwiseConv2dNative=Module["_DepthwiseConv2dNative"]=Module["_asm"][_" _"]).apply(null,arguments)};var
_Elu=Module["_Elu"]=function(){return(_Elu=Module["_Elu"]=Module["_asm"][_"$"]).apply(null,arguments)};var
_Equal=Module["_Equal"]=function(){return(_Equal=Module["_Equal"]=Module["_asm"][_"aa"]).apply(null,arguments)};var
_Exp=Module["_Exp"]=function(){return(_Exp=Module["_Exp"]=Module["_asm"][_"ba"]).apply(null,arguments)};var
_FlipLeftRight=Module["_FlipLeftRight"]=function(){return(_FlipLeftRight=Module["_FlipLeftRight"]=Module["_asm"][_"ca"]).apply(null,arguments)};var
_Floor=Module["_Floor"]=function(){return(_Floor=Module["_Floor"]=Module["_asm"][_"da"]).apply(null,arguments)};var
_FloorDiv=Module["_FloorDiv"]=function(){return(_FloorDiv=Module["_FloorDiv"]=Module["_asm"][_"ea"]).apply(null,arguments)};var
_FusedBatchNorm=Module["_FusedBatchNorm"]=function(){return(_FusedBatchNorm=Module["_FusedBatchNorm"]=Module["_asm"][_"fa"]).apply(null,arguments)};var
_FusedConv2D=Module["_FusedConv2D"]=function(){return(_FusedConv2D=Module["_FusedConv2D"]=Module["_asm"][_"ga"]).apply(null,arguments)};var
_FusedDepthwiseConv2D=Module["_FusedDepthwiseConv2D"]=function(){return(_FusedDepthwiseConv2D=Module["_FusedDepthwiseConv2D"]=Module["_asm"][_"ha"]).apply(null,arguments)};var
_Gather=Module["_Gather"]=function(){return(_Gather=Module["_Gather"]=Module["_asm"][_"ia"]).apply(null,arguments)};var
_GatherNd=Module["_GatherNd"]=function(){return(_GatherNd=Module["_GatherNd"]=Module["_asm"][_"ja"]).apply(null,arguments)};var
_Greater=Module["_Greater"]=function(){return(_Greater=Module["_Greater"]=Module["_asm"][_"ka"]).apply(null,arguments)};var
_GreaterEqual=Module["_GreaterEqual"]=function(){return(_GreaterEqual=Module["_GreaterEqual"]=Module["_asm"][_"la"]).apply(null,arguments)};var
_LeakyRelu=Module["_LeakyRelu"]=function(){return(_LeakyRelu=Module["_LeakyRelu"]=Module["_asm"][_"ma"]).apply(null,arguments)};var
_Less=Module["_Less"]=function(){return(_Less=Module["_Less"]=Module["_asm"][_"na"]).apply(null,arguments)};var
_LessEqual=Module["_LessEqual"]=function(){return(_LessEqual=Module["_LessEqual"]=Module["_asm"][_"oa"]).apply(null,arguments)};var
_Log=Module["_Log"]=function(){return(_Log=Module["_Log"]=Module["_asm"][_"pa"]).apply(null,arguments)};var
_LogicalAnd=Module["_LogicalAnd"]=function(){return(_LogicalAnd=Module["_LogicalAnd"]=Module["_asm"][_"qa"]).apply(null,arguments)};var
_Max=Module["_Max"]=function(){return(_Max=Module["_Max"]=Module["_asm"][_"ra"]).apply(null,arguments)};var
_MaxPool=Module["_MaxPool"]=function(){return(_MaxPool=Module["_MaxPool"]=Module["_asm"][_"sa"]).apply(null,arguments)};var
_Maximum=Module["_Maximum"]=function(){return(_Maximum=Module["_Maximum"]=Module["_asm"][_"ta"]).apply(null,arguments)};var
_Mean=Module["_Mean"]=function(){return(_Mean=Module["_Mean"]=Module["_asm"][_"ua"]).apply(null,arguments)};var

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_Min=Module["_Min"]=function(){return(_Min=Module["_Min"]=Module["asm"]()["va"]).apply(null,arguments)};var
_Minimum=Module["_Minimum"]=function(){return(_Minimum=Module["_Minimum"]=Module["asm"]()["wa"]()).apply(null,arguments)};var
_MirrorPad=Module["_MirrorPad"]=function(){return(_MirrorPad=Module["_MirrorPad"]=Module["asm"]()["xa"]()).apply(null,arguments)};var
_Multiply=Module["_Multiply"]=function(){return(_Multiply=Module["_Multiply"]=Module["asm"]()["ya"]()).apply(null,arguments)};var
_Neg=Module["_Neg"]=function(){return(_Neg=Module["_Neg"]=Module["asm"]()["za"]()).apply(null,arguments)};var
_NonMaxSuppressionV3=Module["_NonMaxSuppressionV3"]=function(){return(_NonMaxSuppressionV3=Module["_NonMaxSuppressionV3"]=Module["asm"]()["Aa"]()).apply(null,arguments)};var
_NonMaxSuppressionV4=Module["_NonMaxSuppressionV4"]=function(){return(_NonMaxSuppressionV4=Module["_NonMaxSuppressionV4"]=Module["asm"]()["Ba"]()).apply(null,arguments)};var
_NonMaxSuppressionV5=Module["_NonMaxSuppressionV5"]=function(){return(_NonMaxSuppressionV5=Module["_NonMaxSuppressionV5"]=Module["asm"]()["Ca"]()).apply(null,arguments)};var
_NotEqual=Module["_NotEqual"]=function(){return(_NotEqual=Module["_NotEqual"]=Module["asm"]()["Da"]()).apply(null,arguments)};var
_OneHot=Module["_OneHot"]=function(){return(_OneHot=Module["_OneHot"]=Module["asm"]()["Ea"]()).apply(null,arguments)};var
_PadV2=Module["_PadV2"]=function(){return(_PadV2=Module["_PadV2"]=Module["asm"]()["Fa"]()).apply(null,arguments)};var
_Pow=Module["_Pow"]=function(){return(_Pow=Module["_Pow"]=Module["asm"]()["Ga"]()).apply(null,arguments)};var
_Prelu=Module["_Prelu"]=function(){return(_Prelu=Module["_Prelu"]=Module["asm"]()["Ha"]()).apply(null,arguments)};var
_Prod=Module["_Prod"]=function(){return(_Prod=Module["_Prod"]=Module["asm"]()["Ia"]()).apply(null,arguments)};var
_RealDiv=Module["_RealDiv"]=function(){return(_RealDiv=Module["_RealDiv"]=Module["asm"]()["Ja"]()).apply(null,arguments)};var
_Relu=Module["_Relu"]=function(){return(_Relu=Module["_Relu"]=Module["asm"]()["Ka"]()).apply(null,arguments)};var
_Relu6=Module["_Relu6"]=function(){return(_Relu6=Module["_Relu6"]=Module["asm"]()["La"]()).apply(null,arguments)};var
_ResizeBilinear=Module["_ResizeBilinear"]=function(){return(_ResizeBilinear=Module["_ResizeBilinear"]=Module["asm"]()["Ma"]()).apply(null,arguments)};var
_Reverse=Module["_Reverse"]=function(){return(_Reverse=Module["_Reverse"]=Module["asm"]()["Na"]()).apply(null,arguments)};var
_RotateWithOffset=Module["_RotateWithOffset"]=function(){return(_RotateWithOffset=Module["_RotateWithOffset"]=Module["asm"]()["Oa"]()).apply(null,arguments)};var
_Round=Module["_Round"]=function(){return(_Round=Module["_Round"]=Module["asm"]()["Pa"]()).apply(null,arguments)};var
_Rsqrt=Module["_Rsqrt"]=function(){return(_Rsqrt=Module["_Rsqrt"]=Module["asm"]()["Qa"]()).apply(null,arguments)};var
_ScatterNd=Module["_ScatterNd"]=function(){return(_ScatterNd=Module["_ScatterNd"]=Module["asm"]()["Ra"]()).apply(null,arguments)};var
_SelectV2=Module["_SelectV2"]=function(){return(_SelectV2=Module["_SelectV2"]=Module["asm"]()["Sa"]()).apply(null,arguments)};var

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_Sigmoid=Module["_Sigmoid"]=function(){return(_Sigmoid=Module["_Sigmoid"]=Module["asm"][_"Ta"]).apply(null,arguments)};var
_Sin=Module["_Sin"]=function(){return(_Sin=Module["_Sin"]=Module["asm"][_"Ua"]).apply(null,arguments)};var
_Softmax=Module["_Softmax"]=function(){return(_Softmax=Module["_Softmax"]=Module["asm"][_"Va"]).apply(null,arguments)};var
_Sqrt=Module["_Sqrt"]=function(){return(_Sqrt=Module["_Sqrt"]=Module["asm"][_"Wa"]).apply(null,arguments)};var
_Square=Module["_Square"]=function(){return(_Square=Module["_Square"]=Module["asm"][_"Xa"]).apply(null,arguments)};var
_SquaredDifference=Module["_SquaredDifference"]=function(){return(_SquaredDifference=Module["_SquaredDifference"]=Module["asm"][_"Ya"]).apply(null,arguments)};var
_Step=Module["_Step"]=function(){return(_Step=Module["_Step"]=Module["asm"][_"Za"]).apply(null,arguments)};var
_StridedSlice=Module["_StridedSlice"]=function(){return(_StridedSlice=Module["_StridedSlice"]=Module["asm"][_"a"]).apply(null,arguments)};var
_Sub=Module["_Sub"]=function(){return(_Sub=Module["_Sub"]=Module["asm"][_"Sa"]).apply(null,arguments)};var
_Sum=Module["_Sum"]=function(){return(_Sum=Module["_Sum"]=Module["asm"][_"ab"]).apply(null,arguments)};var
_Tan=Module["_Tan"]=function(){return(_Tan=Module["_Tan"]=Module["asm"][_"bb"]).apply(null,arguments)};var
_Tanh=Module["_Tanh"]=function(){return(_Tanh=Module["_Tanh"]=Module["asm"][_"cb"]).apply(null,arguments)};var
_Tile=Module["_Tile"]=function(){return(_Tile=Module["_Tile"]=Module["asm"][_"db"]).apply(null,arguments)};var
_TopK=Module["_TopK"]=function(){return(_TopK=Module["_TopK"]=Module["asm"][_"eb"]).apply(null,arguments)};var
_Transform=Module["_Transform"]=function(){return(_Transform=Module["_Transform"]=Module["asm"][_"fb"]).apply(null,arguments)};var
_Transpose=Module["_Transpose"]=function(){return(_Transpose=Module["_Transpose"]=Module["asm"][_"gb"]).apply(null,arguments)};var
__FusedMatMul=Module["__FusedMatMul"]=function(){return(__FusedMatMul=Module["__FusedMatMul"]=Module["asm"][_"hb"]).apply(null,arguments)};var
_malloc=Module["_malloc"]=function(){return(_malloc=Module["_malloc"]=Module["asm"][_"ib"]).apply(null,arguments)};var
_free=Module["_free"]=function(){return(_free=Module["_free"]=Module["asm"][_"jb"]).apply(null,arguments)};var
__errno_location=Module["__errno_location"]=function(){return(__errno_location=Module["__errno_location"]=Module["asm"][_"kb"]).apply(null,arguments)};var
_emscripten_get_global_libc=Module["_emscripten_get_global_libc"]=function(){return(_emscripten_get_global_libc=Module["_emscripten_get_global_libc"]=Module["asm"][_"lb"]).apply(null,arguments)};var
_thread_self=Module["_thread_self"]=function(){return(_thread_self=Module["_thread_self"]=Module["asm"][_"mb"]).apply(null,arguments)};var
__pthread_tsd_run_dtors=Module["__pthread_tsd_run_dtors"]=function(){return(__pthread_tsd_run_dtors=Module["__pthread_tsd_run_dtors"]=Module["asm"][_"nb"]).apply(null,arguments)};var
_emscripten_main_thread_process_queued_calls=Module["_emscripten_main_thread_process_queued_calls"]=function(){return(_emscripten_main_thread_process_queued_calls=Module["_emscripten_main_thread_process_queued_calls"]=Module["asm"][_"ob"]).apply(null,arguments)};var

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ued_calls"]=Module["asm"]["ob"].apply(null,arguments));var
_emsripten_current_thread_process_queued_calls=Module["_emsripten_current_thread_process_queued_calls"]=function(){return(_emsripten_current_thread_process_queued_calls=Module["_emsripten_current_thread_process_queued_calls"]=Module["asm"]["pb"].apply(null,arguments));var
_emsripten_register_main_browser_thread_id=Module["_emsripten_register_main_browser_thread_id"]=function(){return(_emsripten_register_main_browser_thread_id=Module["_emsripten_register_main_browser_thread_id"]=Module["asm"]["qb"].apply(null,arguments));var
_emsripten_main_browser_thread_id=Module["_emsripten_main_browser_thread_id"]=function(){return(_emsripten_main_browser_thread_id=Module["_emsripten_main_browser_thread_id"]=Module["asm"]["rb"].apply(null,arguments));var
__emsripten_do_dispatch_to_thread=Module["__emsripten_do_dispatch_to_thread"]=function(){return(__emsripten_do_dispatch_to_thread=Module["__emsripten_do_dispatch_to_thread"]=Module["asm"]["sb"].apply(null,arguments));var
_emsripten_sync_run_in_main_thread_4=Module["_emsripten_sync_run_in_main_thread_4"]=function(){return(_emsripten_sync_run_in_main_thread_4=Module["_emsripten_sync_run_in_main_thread_4"]=Module["asm"]["tb"].apply(null,arguments));var
_emsripten_run_in_main_runtime_thread_js=Module["_emsripten_run_in_main_runtime_thread_js"]=function(){return(_emsripten_run_in_main_runtime_thread_js=Module["_emsripten_run_in_main_runtime_thread_js"]=Module["asm"]["ub"].apply(null,arguments));var
__emsripten_call_on_thread=Module["__emsripten_call_on_thread"]=function(){return(__emsripten_call_on_thread=Module["__emsripten_call_on_thread"]=Module["asm"]["vb"].apply(null,arguments));var
_emsripten_tls_init=Module["_emsripten_tls_init"]=function(){return(_emsripten_tls_init=Module["_emsripten_tls_init"]=Module["asm"]["wb"].apply(null,arguments));var
__emsripten_thread_init=Module["__emsripten_thread_init"]=function(){return(__emsripten_thread_init=Module["__emsripten_thread_init"]=Module["asm"]["xb"].apply(null,arguments));var
stackSave=Module["stackSave"]=function(){return(stackSave=Module["stackSave"]=Module["asm"]["yb"].apply(null,arguments));var
stackRestore=Module["stackRestore"]=function(){return(stackRestore=Module["stackRestore"]=Module["asm"]["zb"].apply(null,arguments));var
stackAlloc=Module["stackAlloc"]=function(){return(stackAlloc=Module["stackAlloc"]=Module["asm"]["Ab"].apply(null,arguments));var
_emsripten_stack_set_limits=Module["_emsripten_stack_set_limits"]=function(){return(_emsripten_stack_set_limits=Module["_emsripten_stack_set_limits"]=Module["asm"]["Bb"].apply(null,arguments));var
_memalign=Module["_memalign"]=function(){return(_memalign=Module["_memalign"]=Module["asm"]["Cb"].apply(null,arguments));var
__emsripten_allow_main_runtime_queued_calls=Module["__emsripten_allow_main_runtime_queued_calls"]=10512;var
__emsripten_main_thread_futex=Module["__emsripten_main_thread_futex"]=12148;Module["cwrap"]=cwrap;Module["PThread"]=PThread;Module["PThread"]=PThread;Module["wasmMemory"]=wasmMemory;Module["ExitStatus"]=ExitStatus;var
calledRun;function ExitStatus(status){this.name="ExitStatus";this.message="Program terminated with exit("+status+")";this.status=status}dependenciesFulfilled=function
runCaller(){if(!calledRun)run();if(!calledRun)dependenciesFulfilled=runCaller};function
run(args){args=args||arguments;if(runDependencies>0){return}if(ENVIRONMENT_IS_PTHREAD){readyPromiseResolve(Module);initRuntime();postMessage({"cmd":"loaded"});return}preRun();if(runDependencies>0){return}function
doRun(){if(calledRun)return;calledRun=true;Module["calledRun"]=true;if(ABORT)return;initRuntime();preMain();readyPromiseResolve(Module);if(Module["onRuntimeInitialized"])Module["onRuntimeInitialized"]();postRun(

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})if(Module["setStatus"]){}Module["setStatus"]("Running...");setTimeout(function(){Module["setStatus"]("setStatus\\\"(\\\"\\\"\\\"),1);doRun(),1)}else{doRun()}Module["run"]=run;function
exit(status,implicit){if(implicit&&noExitRuntime&&status===0){return}if(!implicit){if(ENVIRONMENT_IS_PTH
HREAD){postMessage({"cmd":"exitProcess","returnCode":status});throw
new
ExitStatus(status)}else{}}if(noExitRuntime){}else{PThread.terminateAllThreads();EXITSTATUS=status;exitRunti
me();if(Module["onExit"]){Module["onExit"](status);ABORT=true}quit_(status,new
ExitStatus(status))}if(Module["preInit"]){if(typeof
Module["preInit"]=="function")Module["preInit"]=[Module["preInit"]];while(Module["preInit"].length>0){
Module["preInit"].pop()}if(ENVIRONMENT_IS_PTHREAD){noExitRuntime=false;PThread.initWorker()}run
();\n\n\n return WasmBackendModuleThreadedSimd.ready\n\n\n\n);nif (typeof exports === 'object' && typeof
module === 'object')\n module.exports = WasmBackendModuleThreadedSimd;\nelse if (typeof define ===
'function' && define['amd'])\n define([], function() { return WasmBackendModuleThreadedSimd; });\nelse if
(typeof exports === 'object')\n exports["WasmBackendModuleThreadedSimd"]
= WasmBackendModuleThreadedSimd;\n","export const wasmWorkerContents = 'var Module={};function
threadPrintErr({ var text=Array.prototype.slice.call(arguments).join(" ");console.error(text)}function
threadAlert({ var text=Array.prototype.slice.call(arguments).join("
");postMessage({ cmd:"alert",text:text,threadId:Module["_pthread_self"]()})})var
err=threadPrintErr,this.alert=threadAlert;Module["instantiateWasm"]=function(info,receiveInstance){ var
instance=new
WebAssembly.Instance(Module["wasmModule"],info);Module["wasmModule"]=null;receiveInstance(instance);r
eturn instance.exports};function
moduleLoaded(){ this.onmessage=function(e){try{if(e.data.cmd==="load"){Module["wasmModule"]=e.data.wa
smModule;Module["wasmMemory"]=e.data.wasmMemory;Module["buffer"]=Module["wasmMemory"].buffer;
Module["ENVIRONMENT_IS_PTHREAD"]=true;if(typeof
e.data.urlOrBlob==="string"){importScripts(e.data.urlOrBlob)}else{ var
objectUrl=URL.createObjectURL(e.data.urlOrBlob);importScripts(objectUrl);URL.revokeObjectURL(objectUrl)}
WasmBackendModuleThreadedSimd(Module).then(function(instance){ Module=instance;moduleLoaded()})}else
if(e.data.cmd==="objectTransfer"){Module["PThread"].receiveObjectTransfer(e.data)}else
if(e.data.cmd==="run"){Module["__performance_now_clock_drift"]=performance.now()-
e.data.time;Module["__emscripten_thread_init"](e.data.threadInfoStruct,0,0);var max=e.data.stackBase;var
top=e.data.stackBase+e.data.stackSize;Module["establishStackSpace"](top,max);Module["_emscripten_tls_init"](
);Module["PThread"].receiveObjectTransfer(e.data);Module["PThread"].setThreadStatus(Module["_pthread_self
"](),1);try{ var
result=Module["invokeEntryPoint"](e.data.start_routine,e.data.arg);if(!Module["getNoExitRuntime"]())Module["
PThread"].threadExit(result)}catch(ex){if(ex==="Canceled!"){Module["PThread"].threadCancel()}else
if(ex!="unwind"){if(ex instanceof
Module["ExitStatus"]){if(Module["getNoExitRuntime"]()){}else{Module["PThread"].threadExit(ex.status)}}el
se{Module["PThread"].threadExit(-2);throw
ex}}}}else
if(e.data.cmd==="cancel"){if(Module["_pthread_self"]()){Module["PThread"].threadCancel()}else
if(e.data.target==="setimmediate"){}else
if(e.data.cmd==="processThreadQueue"){if(Module["_pthread_self"]()){Module["_emscripten_current_thread_
process_queued_calls"]()}else{err("worker.js received unknown command
"+e.data.cmd);err(e.data)}}catch(ex){err("worker.js onmessage() captured an uncaught exception:
"+ex);if(ex&&ex.stack)err(ex.stack);throw ex}};if(typeof process==="object"&&typeof
process.versions==="object"&&typeof process.versions.node==="string"){self={location:{href:__filename}};var
onmessage=this.onmessage;var

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nodeWorkerThreads=require("\worker_threads");global.Worker=nodeWorkerThreads.Worker;var
parentPort=nodeWorkerThreads.parentPort;parentPort.on("\message",function(data){ onmessage({ data:data })});var
nodeFS=require("\fs");var nodeRead=function(filename){ return
  nodeFS.readFileSync(filename,"\utf8");};function
globalEval(x){ global.require=require;global.Module=Module;eval.call(null,x)}importScripts=function(f){ globalEva
l(nodeRead(f));postMessage=function(msg){ parentPort.postMessage(msg)};if(typeof
performance===\undefined){performance={now:function(){return Date.now()}}};";\nvar
WasmBackendModule = (function() {\n  var _scriptDir = typeof document !== 'undefined' &&
document.currentScript ? document.currentScript.src : undefined;\n  if (typeof __filename !== 'undefined')
__scriptDir = _scriptDir || __filename;\n  return (\nfunction(WasmBackendModule) {\n    WasmBackendModule =
WasmBackendModule || {};\n\nvar Module=typeof
WasmBackendModule!==\undefined"?WasmBackendModule:{ };var
readyPromiseResolve,readyPromiseReject;Module["ready"]=new
Promise(function(resolve,reject){ readyPromiseResolve=resolve;readyPromiseReject=reject});var
moduleOverrides={ };var key;for(key in
Module){ if(Module.hasOwnProperty(key)){ moduleOverrides[key]=Module[key] }}var
arguments_=[];var thisProgram=\nthis.program";var quit_=function(status,toThrow){throw toThrow};var
ENVIRONMENT_IS_WEB=false;var ENVIRONMENT_IS_WORKER=false;var
ENVIRONMENT_IS_NODE=false;var ENVIRONMENT_IS_SHELL=false;ENVIRONMENT_IS_WEB=typeof
window===\object";ENVIRONMENT_IS_WORKER=typeof
importScripts===\function";ENVIRONMENT_IS_NODE=typeof process===\object"&&typeof
process.versions===\object"&&typeof
process.versions.node===\string";ENVIRONMENT_IS_SHELL=!ENVIRONMENT_IS_WEB&&!ENVIRONM
ENT_IS_NODE&&!ENVIRONMENT_IS_WORKER;var scriptDirectory=\n";function
locateFile(path){ if(Module["locateFile"]){ return Module["locateFile"](path,scriptDirectory)}return
scriptDirectory+path}var read_,readAsync,readBinary,setWindowTitle;var nodeFS;var
nodePath;if(ENVIRONMENT_IS_NODE){ if(ENVIRONMENT_IS_WORKER){ scriptDirectory=require("\path").
dirname(scriptDirectory)+\^"} else{ scriptDirectory=__dirname+\^"} read_=function
shell_read(filename,binary){ if(!nodeFS)nodeFS=require("\fs");if(!nodePath)nodePath=require("\path");filename=n
odePath["normalize"](filename);return
  nodeFS["readFileSync"](filename,binary?null:\utf8");};readBinary=function readBinary(filename){ var
ret=read_(filename,true);if(!ret.buffer){ ret=new Uint8Array(ret)} assert(ret.buffer);return
ret};if(process["argv"].length>1){ thisProgram=process["argv"][1].replace(/\\/g,\^")}arguments_=process["arg
v"].slice(2);process["on"]("\uncaughtException",function(ex){ if(!(ex instanceof ExitStatus)){ throw
ex }});process["on"]("\unhandledRejection",abort);quit_=function(status){ process["exit"](status)};Module["insp
ect"]=function(){ return "[Emscripten Module object]"} } else if(ENVIRONMENT_IS_SHELL){ if(typeof
read!=\undefined){ read_=function shell_read(f){ return read(f) }}readBinary=function readBinary(f){ var
data;if(typeof readbuffer===\function"){ return new
  Uint8Array(readbuffer(f))}data=read(f,\binary");assert(typeof data===\object");return data};if(typeof
scriptArgs!=\undefined){ arguments_=scriptArgs} else
  if(typeof arguments!=\undefined){ arguments_=arguments}if(typeof
quit===\function"){ quit_=function(status){ quit(status) }}if(typeof print!=\undefined){ if(typeof
console===\undefined)console={ };console.log=print;console.warn=console.error=typeof
printErr!=\undefined"?printErr:print } else
  if(ENVIRONMENT_IS_WEB||ENVIRONMENT_IS_WORKER){ if(ENVIRONMENT_IS_WORKER){ scriptDire
ctory=self.location.href} else if(typeof
document!=\undefined"&&document.currentScript){ scriptDirectory=document.currentScript.src} if(_scriptDir){ s
criptDirectory=_scriptDir} if(scriptDirectory.indexOf(\blob:\")!=0){ scriptDirectory=scriptDirectory.substr(0,script

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Directory.lastIndexOf("\^")+1))else{scriptDirectory=""}{read_=function(url){var xhr=new
XMLHttpRequest;xhr.open("GET",url,false);xhr.send(null);return
xhr.responseText};if(ENVIRONMENT_IS_WORKER){readBinary=function(url){var xhr=new
XMLHttpRequest;xhr.open("GET",url,false);xhr.responseType="arraybuffer";xhr.send(null);return
new Uint8Array(xhr.response)}}readAsync=function(url,onload,onerror){var xhr=new
XMLHttpRequest;xhr.open("GET",url,true);xhr.responseType="arraybuffer";xhr.onload=function(){if(xhr.status
==200||xhr.status==0&&xhr.response){onload(xhr.response);return}onerror();xhr.onerror=onerror;xhr.send(null)}
}setWindowTitle=function(title){document.title=title}}else{var
out=Module["print"]||console.log.bind(console);var err=Module["printErr"]||console.warn.bind(console);for(key
in
moduleOverrides){if(moduleOverrides.hasOwnProperty(key)){Module[key]=moduleOverrides[key]}}moduleOverr
ides=null;if(Module["arguments"])arguments_=Module["arguments"];if(Module["thisProgram"])thisProgram=
Module["thisProgram"];if(Module["quit"])quit_=Module["quit"];var
wasmBinary;if(Module["wasmBinary"])wasmBinary=Module["wasmBinary"];var
noExitRuntime=Module["noExitRuntime"]||true;if(typeof WebAssembly!="object"){abort("no native wasm
support detected")}var wasmMemory;var
ABORT=false;var EXITSTATUS;function assert(condition,text){if(!condition){abort("Assertion failed:
"+text)}}function getCFunc(ident){var func=Module["_"+ident];assert(func,"Cannot call unknown function
"+ident+", make sure it is exported");return func}function ccall(ident,returnType,argTypes,args,opts){var
toC={"string":function(str){var ret=0;if(str!=null&&str!=undefined&&str!=0){var
len=(str.length<<2)+1;ret=stackAlloc(len);stringToUTF8(str,ret,len)}return ret},"array":function(arr){var
ret=stackAlloc(arr.length);writeArrayToMemory(arr,ret);return ret}};function
convertReturnValue(ret){if(returnType=="string")return UTF8ToString(ret);if(returnType=="boolean")return
Boolean(ret);return ret}var func=getCFunc(ident);var cArgs=[];var stack=0;if(args){for(var
i=0;i<args.length;i++){var
converter=toC[argTypes[i]];if(converter){if(stack==0)stack=stackSave();cArgs[i]=converter(args[i])}else{cArgs[i
]=args[i]}}var ret=func.apply(null,cArgs);ret=convertReturnValue(ret);if(stack!=0)stackRestore(stack);return
ret}function cwrap(ident,returnType,argTypes,opts){argTypes=argTypes||[];var
numericArgs=argTypes.every(function(type){return type=="number"});var
numericRet=returnType!="string";if(numericRet&&numericArgs&&!opts){return getCFunc(ident)}return
function(){return ccall(ident,returnType,argTypes,arguments,opts)}}var UTF8Decoder=typeof
TextDecoder!="undefined"?new TextDecoder("utf8"):undefined;function
UTF8ArrayToString(heap,idx,maxBytesToRead){var endIdx=idx+maxBytesToRead;var
endPtr=idx;while(heap[endPtr]&&!(endPtr>=endIdx))++endPtr;if(endPtr-
idx>16&&heap.subarray&&UTF8Decoder){return UTF8Decoder.decode(heap.subarray(idx,endPtr))}else{var
str="";while(idx<endPtr){var u0=heap[idx++];if(!(u0&128)){str+=String.fromCharCode(u0);continue}var
u1=heap[idx++]&63;if((u0&224)==192){str+=String.fromCharCode((u0&31)<<6|u1);continue}var
u2=heap[idx++]&63;if((u0&240)==224){u0=(u0&15)<<12|u1<<6|u2}else{u0=(u0&7)<<18|u1<<12|u2<<6|heap[id
x++]&63;if(u0<65536){str+=String.fromCharCode(u0)}else{var
ch=u0-65536;str+=String.fromCharCode(55296|ch>>10,56320|ch&1023)}}}return str}function
UTF8ToString(ptr,maxBytesToRead){return
ptr?UTF8ArrayToString(HEAPU8,ptr,maxBytesToRead):""}function
stringToUTF8Array(str,heap,outIdx,maxBytesToWrite){if(!(maxBytesToWrite>0))return 0;var startIdx=outIdx;var
endIdx=outIdx+maxBytesToWrite-1;for(var i=0;i<str.length;++i){var
u=str.charCodeAt(i);if(u>=55296&&u<=57343){var
u1=str.charCodeAt(++i);u=65536+((u&1023)<<10|u1&1023)}if(u<=127){if(outIdx>=endIdx)break;heap[outIdx++]
=u}else if(u<=2047){if(outIdx+1>=endIdx)break;heap[outIdx++]=192|u>>6;heap[outIdx++]=128|u&63}else
if(u<=65535){if(outIdx+2>=endIdx)break;heap[outIdx++]=224|u>>12;heap[outIdx++]=128|u>>6&63;heap[outIdx

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++]=128|u&63}else{if(outIdx+3>=endIdx)break;heap[outIdx++]=240|u>>18;heap[outIdx++]=128|u>>12&63;heap[
outIdx++]=128|u>>6&63;heap[outIdx++]=128|u&63}}heap[outIdx]=0;return outIdx-startIdx}function
stringToUTF8(str,outPtr,maxBytesToWrite){return
stringToUTF8Array(str,HEAPU8,outPtr,maxBytesToWrite)}function
writeArrayToMemory(array,buffer){HEAP8.set(array,buffer)}function
alignUp(x,multiple){if(x%multiple>0){x+=multiple-x%multiple}return x}var
buffer,HEAP8,HEAPU8,HEAP16,HEAPU16,HEAP32,HEAPU32,HEAPF32,HEAPF64;function
updateGlobalBufferAndViews(buf){buffer=buf;Module["HEAP8"]=HEAP8=new
Int8Array(buf);Module["HEAP16"]=HEAP16=new Int16Array(buf);Module["HEAP32"]=HEAP32=new
Int32Array(buf);Module["HEAPU8"]=HEAPU8=new Uint8Array(buf);Module["HEAPU16"]=HEAPU16=new
Uint16Array(buf);Module["HEAPU32"]=HEAPU32=new
Uint32Array(buf);Module["HEAPF32"]=HEAPF32=new
Float32Array(buf);Module["HEAPF64"]=HEAPF64=new Float64Array(buf)}var
INITIAL_MEMORY=Module["INITIAL_MEMORY"]||16777216;var wasmTable;var __ATPRERUN__=[];var
__ATINIT__=[];var __ATMAIN__=[];var __ATPOSTRUN__=[];var
runtimeInitialized=false;__ATINIT__.push({func:function(){__wasm_call_ctors()}});function
preRun(){if(Module["preRun"]){if(typeof
Module["preRun"]=="function")Module["preRun"]=[Module["preRun"]];while(Module["preRun"].length){a
ddOnPreRun(Module["preRun"].shift())}callRuntimeCallbacks(__ATPRERUN__)}function
initRuntime(){runtimeInitialized=true;callRuntimeCallbacks(__ATINIT__)}function
preMain(){callRuntimeCallbacks(__ATMAIN__)}function postRun(){if(Module["postRun"]){if(typeof
Module["postRun"]=="function")Module["postRun"]=[Module["postRun"]];while(Module["postRun"].lengt
h){addOnPostRun(Module["postRun"].shift())}callRuntimeCallbacks(__ATPOSTRUN__)}function
addOnPreRun(cb){__ATPRERUN__.unshift(cb)}function addOnPostRun(cb){__ATPOSTRUN__.unshift(cb)}var
runDependencies=0;var runDependencyWatcher=null;var dependenciesFulfilled=null;function
addRunDependency(id){runDependencies++;if(Module["monitorRunDependencies"]){Module["monitorRunDep
endencies"]((runDependencies))}function removeRunDependency(id){runDependencies--
;if(Module["monitorRunDependencies"]){Module["monitorRunDependencies"]((runDependencies))if(runDepen
dencies==0){if(runDependencyWatcher!=null){clearInterval(runDependencyWatcher);runDependencyWatcher=nul
l}if(dependenciesFulfilled){var
callback=dependenciesFulfilled;dependenciesFulfilled=null;callback()}}Module["preloadedImages"]={};Module
["preloadedAudios"]={};function
abort(what){if(Module["onAbort"]){Module["onAbort"](what)}what+="\n";err(what);ABORT=true;EXITSTAT
US=1;what="abort("+what+"\n). Build with -s ASSERTIONS=1 for more info.";var e=new
WebAssembly.RuntimeError(what);readyPromiseReject(e);throw e}function hasPrefix(str,prefix){return
String.prototype.startsWith?str.startsWith(prefix):str.indexOf(prefix)===0}var
dataURIPrefix="data:application/octet-stream;base64,";function isDataURI(filename){return
hasPrefix(filename,dataURIPrefix)}var fileURIPrefix="file://";function isFileURI(filename){return
hasPrefix(filename,fileURIPrefix)}var wasmBinaryFile="tfjs-backend-
wasm.wasm";if(!isDataURI(wasmBinaryFile)){wasmBinaryFile=locateFile(wasmBinaryFile)}function
getBinary(file){try{if(file===wasmBinaryFile&&wasmBinary){return new
Uint8Array(wasmBinary)}if(readBinary){return readBinary(file)}else{throw"both async and sync fetching of the
wasm failed"}}catch(err){abort(err)}}function
getBinaryPromise(){if(!wasmBinary&&(ENVIRONMENT_IS_WEB||ENVIRONMENT_IS_WORKER)){if(typeof
fetch==="function"&&!isFileURI(wasmBinaryFile)){return fetch(wasmBinaryFile,{credentials:"same-
origin"}).then(function(response){if(!response["ok"]){throw"failed to load wasm binary file at
"+"wasmBinaryFile+"})}return response["arrayBuffer"]()}).catch(function(){return
getBinary(wasmBinaryFile)})}else{if(readAsync){return new

```

```

Promise(function(resolve,reject){readAsync(wasmBinaryFile,function(response){resolve(new
Uint8Array(response))},reject)}})}return Promise.resolve().then(function(){return
getBinary(wasmBinaryFile))})function createWasm(){var info={"a":asmLibraryArg};function
receiveInstance(instance,module){var
exports=instance.exports;Module["asm"]=exports;wasmMemory=Module["asm"]()["j"];updateGlobalBufferAnd
Views(wasmMemory.buffer);wasmTable=Module["asm"]()["r"];removeRunDependency("wasm-
instantiate")}addRunDependency("wasm-instantiate");function
receiveInstantiatedSource(output){receiveInstance(output["instance"]);}function
instantiateArrayBuffer(receiver){return getBinaryPromise().then(function(binary){return
WebAssembly.instantiate(binary,info))).then(receiver,function(reason){err("failed to asynchronously prepare
wasm: "+reason);abort(reason)})}function instantiateAsync(){if(!wasmBinary&&typeof
WebAssembly.instantiateStreaming===function"&&!isDataURI(wasmBinaryFile)&&!isFileURI(wasmBinaryFil
e)&&typeof fetch===function"){return fetch(wasmBinaryFile,{credentials:"same-
origin"}).then(function(response){var result=WebAssembly.instantiateStreaming(response,info);return
result.then(receiveInstantiatedSource,function(reason){err("wasm streaming compile failed: "+reason);err("falling
back to ArrayBuffer
instantiation");return instantiateArrayBuffer(receiveInstantiatedSource)}))}else{return
instantiateArrayBuffer(receiveInstantiatedSource)}if(Module["instantiateWasm"]){try{var
exports=Module["instantiateWasm"](info,receiveInstance);return exports}catch(e){err("Module.instantiateWasm
callback failed with error: "+e);return false}}instantiateAsync().catch(readyPromiseReject);return{}}function
callRuntimeCallbacks(callbacks){while(callbacks.length>0){var callback=callbacks.shift();if(typeof
callback===function"){callback(Module);continue}var func=callback.func;if(typeof
func===function){if(callback.arg===undefined){wasmTable.get(func)}else{wasmTable.get(func)(callback.arg)
}}else{func(callback.arg===undefined?null:callback.arg)}}function _abort(){abort()}function
_emsripten_memcpy_big(dest,src,num){HEAPU8.copyWithin(dest,src,src+num)}function
_emsripten_get_heap_size(){return HEAPU8.length}function
emsripten_realloc_buffer(size){try{wasmMemory.grow(size-
buffer.byteLength+65535>>>16);updateGlobalBufferAndViews(wasmMemory.buffer);return
1}catch(e){}}function _emsripten_resize_heap(requestedSize){var oldSize=_emsripten_get_heap_size();var
maxHeapSize=2147483648;if(requestedSize>maxHeapSize){return false}for(var
cutDown=1;cutDown<=4;cutDown*=2){var
overGrownHeapSize=oldSize*(1+.2/cutDown);overGrownHeapSize=Math.min(overGrownHeapSize,requestedSize
+100663296);var
newSize=Math.min(maxHeapSize,alignUp(Math.max(requestedSize,overGrownHeapSize),65536));var
replacement=emsripten_realloc_buffer(newSize);if(replacement){return true}}return false}var
SYSCALLS={mappings:{},buffers:[null,[],[]],printChar:function(stream,curr){var
buffer=SYSCALLS.buffers[stream];if(curr===0||curr===10){(stream===1?out:err)(UTF8ArrayToString(buffer,0));
buffer.length=0}else{buffer.push(curr)}},varargs:undefined,get:function(){SYSCALLS.varargs+=4;var
ret=HEAP32[SYSCALLS.varargs-4>>2];return ret},getStr:function(ptr){var ret=UTF8ToString(ptr);return
ret},get64:function(low,high){return
low}};function _fd_close(fd){return 0}function _fd_seek(fd,offset_low,offset_high,whence,newOffset){}function
_fd_write(fd,iow,iowcnt,pnum){var num=0;for(var i=0;i<iowcnt;i++){var ptr=HEAP32[iow+i*8>>2];var
len=HEAP32[iow+(i*8+4)>>2];for(var
j=0;j<len;j++){SYSCALLS.printChar(fd,HEAPU8[ptr+j])}num+=len}HEAP32[pnum>>2]=num;return 0}function
_pthread_create(){return 6}function _pthread_join(){return 28}function
setErrNo(value){HEAP32[___errno_location()>>2]=value;return value}function
_sysconf(name){switch(name){case 30:return 16384;case 85:var maxHeapSize=2147483648;return
maxHeapSize/16384;case 132:case 133:case 12:case 137:case 138:case 15:case 235:case 16:case 17:case 18:case

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19:case 20:case 149:case 13:case 10:case 236:case 153:case 9:case 21:case 22:case 159:case 154:case 14:case
77:case 78:case 139:case 82:case 68:case 67:case 164:case 11:case 29:case 47:case 48:case 95:case 52:case 51:case
46:return 200809;case 27:case 246:case 127:case 128:case 23:case 24:case 160:case
161:case 181:case 182:case 242:case 183:case 184:case 243:case 244:case 245:case 165:case 178:case 179:case
49:case 50:case 168:case 169:case 175:case 170:case 171:case 172:case 97:case 76:case 32:case 173:case 35:case
80:case 81:case 79:return-1;case 176:case 177:case 7:case 155:case 8:case 157:case 125:case 126:case 92:case
93:case 129:case 130:case 131:case 94:case 91:return 1;case 74:case 60:case 69:case 70:case 4:return 1024;case
31:case 42:case 72:return 32;case 87:case 26:case 33:return 2147483647;case 34:case 1:return 47839;case 38:case
36:return 99;case 43:case 37:return 2048;case 0:return 2097152;case 3:return 65536;case 28:return 32768;case
44:return 32767;case 75:return 16384;case 39:return 1e3;case 89:return 700;case 71:return 256;case 40:return
255;case 2:return 100;case 180:return 64;case 25:return 20;case 5:return 16;case 6:return 6;case 73:return 4;case
84:{if(typeof navigator===\"object\")return navigator[\"hardwareConcurrency\"]||1;return 1}}setErrNo(28);return-
1}var
asmLibraryArg={\"a\":_abort,\"d\":_emscripten_memcpy_big,\"e\":_emscripten_resize_heap,\"f\":_fd_close,\"c\":_f
d_seek,\"b\":_fd_write,\"h\":_pthread_create,\"g\":_pthread_join,\"i\":_sysconf};var asm=createWasm();var
__wasm_call_ctors=Module[\"__wasm_call_ctors\"]=function(){return(__wasm_call_ctors=Module[\"__wasm
_call_ctors\"]=Module[\"asm\"][\"k\"]).apply(null,arguments)};var
_init=Module[\"_init\"]=function(){return(_init=Module[\"_init\"]=Module[\"asm\"][\"l\"]).apply(null,arguments)};
var
_init_with_threads_count=Module[\"_init_with_threads_count\"]=function(){return(_init_with_threads_count=Mod
ule[\"_init_with_threads_count\"]=Module[\"asm\"][\"m\"]).apply(null,arguments)};var
_get_threads_count=Module[\"_get_threads_count\"]=function(){return(_get_threads_count=Module[\"_get_threads
_count\"]=Module[\"asm\"][\"n\"]).apply(null,arguments)};var
_register_tensor=Module[\"_register_tensor\"]=function(){return(_register_tensor=Module[\"_register_tensor\"]=M
odule[\"asm\"][\"o\"]).apply(null,arguments)};var
_dispose_data=Module[\"_dispose_data\"]=function(){return(_dispose_data=Module[\"_dispose_data\"]=Module[\"
asm\"][\"p\"]).apply(null,arguments)};var
_dispose=Module[\"_dispose\"]=function(){return(_dispose=Module[\"_dispose\"]=Module[\"asm\"][\"q\"]).apply(n
ull,arguments)};var
_Abs=Module[\"_Abs\"]=function(){return(_Abs=Module[\"_Abs\"]=Module[\"asm\"][\"s\"]).apply(null,arguments
)};var
_Add=Module[\"_Add\"]=function(){return(_Add=Module[\"_Add\"]=Module[\"asm\"][\"t\"]).apply(null,argument
s)};var
_AddN=Module[\"_AddN\"]=function(){return(_AddN=Module[\"_AddN\"]=Module[\"asm\"][\"u\"]).apply(null,ar
guments)};var
_All=Module[\"_All\"]=function(){return(_All=Module[\"_All\"]=Module[\"asm\"][\"v\"]).apply(null,arguments)};
var
_Any=Module[\"_Any\"]=function(){return(_Any=Module[\"_Any\"]=Module[\"asm\"][\"w\"]).apply(null,argumen
ts)};var
_ArgMax=Module[\"_ArgMax\"]=function(){return(_ArgMax=Module[\"_ArgMax\"]=Module[\"asm\"][\"x\"]).app
ly(null,arguments)};var
_AvgPool=Module[\"_AvgPool\"]=function(){return(_AvgPool=Module[\"_AvgPool\"]=Module[\"asm\"][\"y\"]).a
pply(null,arguments)};var
_BatchMatMul=Module[\"_BatchMatMul\"]=function(){return(_BatchMatMul=Module[\"_BatchMatMul\"]=Modu
le[\"asm\"][\"z\"]).apply(null,arguments)};var
_Ceil=Module[\"_Ceil\"]=function(){return(_Ceil=Module[\"_Ceil\"]=Module[\"asm\"][\"A\"]).apply(null,argument
s)};var
_ClipByValue=Module[\"_ClipByValue\"]=function(){return(_ClipByValue=Module[\"_ClipByValue\"]=Module[\"

```



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"asm\")[\["B\").apply(null,arguments));var
_Conv2D=Module[\["_Conv2D\"]=function(){return(_Conv2D=Module[\["_Conv2D\"]=Module[\["asm\")[\["C\").ap
ply(null,arguments));var
_Conv2DBackpropInput=Module[\["_Conv2DBackpropInput\"]=function(){return(_Conv2DBackpropInput=Modul
e[\["_Conv2DBackpropInput\"]=Module[\["asm\")[\["D\").apply(null,arguments));var
_Cos=Module[\["_Cos\"]=function(){return(_Cos=Module[\["_Cos\"]=Module[\["asm\")[\["E\").apply(null,arguments
));var
_Cosh=Module[\["_Cosh\"]=function(){return(_Cosh=Module[\["_Cosh\"]=Module[\["asm\")[\["F\").apply(null,argu
ments));var
_CropAndResize=Module[\["_CropAndResize\"]=function(){return(_CropAndResize=Module[\["_CropAndResize\"]=
Module[\["asm\")[\["G\").apply(null,arguments));var
_Cumsum=Module[\["_Cumsum\"]=function(){return(_Cumsum=Module[\["_Cumsum\"]=Module[\["asm\")[\["H\").a
pply(null,arguments));var
_DepthToSpace=Module[\["_DepthToSpace\"]=function(){return(_DepthToSpace=Module[\["_DepthToSpace\"]=M
odule[\["asm\")[\["I\").apply(null,arguments));var
_DepthwiseConv2dNative=Module[\["_DepthwiseConv2dNative\"]=function(){return(_DepthwiseConv2dNative=M
odule[\["_DepthwiseConv2dNative\"]=Module[\["asm\")[\["J\").apply(null,arguments));var
_Elu=Module[\["_Elu\"]=function(){return(_Elu=Module[\["_Elu\"]=Module[\["asm\")[\["K\").apply(null,arguments)
};var
_Equal=Module[\["_Equal\"]=function(){return(_Equal=Module[\["_Equal\"]=Module[\["asm\")[\["L\").apply(null,arg
uments));var
_Exp=Module[\["_Exp\"]=function(){return(_Exp=Module[\["_Exp\"]=Module[\["asm\")[\["M\").apply(null,argument
s));var
_FlipLeftRight=Module[\["_FlipLeftRight\"]=function(){return(_FlipLeftRight=Module[\["_FlipLeftRight\"]=Modul
e[\["asm\")[\["N\").apply(null,arguments));var
_Floor=Module[\["_Floor\"]=function(){return(_Floor=Module[\["_Floor\"]=Module[\["asm\")[\["O\").apply(null,argu
ments));var
_FloorDiv=Module[\["_FloorDiv\"]=function(){return(_FloorDiv=Module[\["_FloorDiv\"]=Module[\["asm\")[\["P\").
apply(null,arguments));var
_FusedBatchNorm=Module[\["_FusedBatchNorm\"]=function(){return(_FusedBatchNorm=Module[\["_FusedBatchN
orm\"]=Module[\["asm\")[\["Q\").apply(null,arguments));var
_FusedConv2D=Module[\["_FusedConv2D\"]=function(){return(_FusedConv2D=Module[\["_FusedConv2D\"]=Mod
ule[\["asm\")[\["R\").apply(null,arguments));var
_FusedDepthwiseConv2D=Module[\["_FusedDepthwiseConv2D\"]=function(){return(_FusedDepthwiseConv2D=M
odule[\["_FusedDepthwiseConv2D\"]=Module[\["asm\")[\["S\").apply(null,arguments));var
_Gather=Module[\["_Gather\"]=function(){return(_Gather=Module[\["_Gather\"]=Module[\["asm\")[\["T\").apply(null
,arguments));var
_GatherNd=Module[\["_GatherNd\"]=function(){return(_GatherNd=Module[\["_GatherNd\"]=Module[\["asm\")[\["U\
]).apply(null,arguments));var
_Greater=Module[\["_Greater\"]=function(){return(_Greater=Module[\["_Greater\"]=Module[\["asm\")[\["V\").apply(
null,arguments));var
_GreaterEqual=Module[\["_GreaterEqual\"]=function(){return(_GreaterEqual=Module[\["_GreaterEqual\"]=Module[\
["asm\")[\["W\").apply(null,arguments));var
_LeakyRelu=Module[\["_LeakyRelu\"]=function(){return(_LeakyRelu=Module[\["_LeakyRelu\"]=Module[\["asm\")[\
["X\").apply(null,arguments));var
_Less=Module[\["_Less\"]=function(){return(_Less=Module[\["_Less\"]=Module[\["asm\")[\["Y\").apply(null,argume
nts));var
_LessEqual=Module[\["_LessEqual\"]=function(){return(_LessEqual=Module[\["_LessEqual\"]=Module[\["asm\")[\["

```

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Z\").apply(null,arguments));var
_Log=Module[\"_Log\"]=function(){return(_Log=Module[\"_Log\"]=Module[\"asm\"][\"_\"]).apply(null,arguments
));var
_LogicalAnd=Module[\"_LogicalAnd\"]=function(){return(_LogicalAnd=Module[\"_LogicalAnd\"]=Module[\"asm
\"][\"$\"]).apply(null,arguments));var
_Max=Module[\"_Max\"]=function(){return(_Max=Module[\"_Max\"]=Module[\"asm\"][\"aa\"]).apply(null,argume
nts));var
_MaxPool=Module[\"_MaxPool\"]=function(){return(_MaxPool=Module[\"_MaxPool\"]=Module[\"asm\"][\"ba\"]).
apply(null,arguments));var
_Maximum=Module[\"_Maximum\"]=function(){return(_Maximum=Module[\"_Maximum\"]=Module[\"asm\"][\"c
a\"]).apply(null,arguments));var
_Mean=Module[\"_Mean\"]=function(){return(_Mean=Module[\"_Mean\"]=Module[\"asm\"][\"da\"]).apply(null,ar
guments));var
_Min=Module[\"_Min\"]=function(){return(_Min=Module[\"_Min\"]=Module[\"asm\"][\"ea\"]).apply(null,argumen
ts));var
_Minimum=Module[\"_Minimum\"]=function(){return(_Minimum=Module[\"_Minimum\"]=Module[\"asm\"][\"fa\
\"]).apply(null,arguments));var
_MirrorPad=Module[\"_MirrorPad\"]=function(){return(_MirrorPad=Module[\"_MirrorPad\"]=Module[\"asm\"][\"g
a\"]).apply(null,arguments));var
_Multiply=Module[\"_Multiply\"]=function(){return(_Multiply=Module[\"_Multiply\"]=Module[\"asm\"][\"ha\"]).a
pply(null,arguments));var
_Neg=Module[\"_Neg\"]=function(){return(_Neg=Module[\"_Neg\"]=Module[\"asm\"][\"ia\"]).apply(null,argument
s));var
_NonMaxSuppressionV3=Module[\"_NonMaxSuppressionV3\"]=function(){return(_NonMaxSuppressionV3=Mod
ule[\"_NonMaxSuppressionV3\"]=Module[\"asm\"][\"ja\"]).apply(null,arguments));var
_NonMaxSuppressionV4=Module[\"_NonMaxSuppressionV4\"]=function(){return(_NonMaxSuppressionV4=Mod
ule[\"_NonMaxSuppressionV4\"]=Module[\"asm\"][\"ka\"]).apply(null,arguments));var
_NonMaxSuppressionV5=Module[\"_NonMaxSuppressionV5\"]=function(){return(_NonMaxSuppressionV5=Mod
ule[\"_NonMaxSuppressionV5\"]=Module[\"asm\"][\"la\"]).apply(null,arguments));var
_NotEqual=Module[\"_NotEqual\"]=function(){return(_NotEqual=Module[\"_NotEqual\"]=Module[\"asm\"][\"ma\
\"]).apply(null,arguments));var
_OneHot=Module[\"_OneHot\"]=function(){return(_OneHot=Module[\"_OneHot\"]=Module[\"asm\"][\"na\"]).appl
y(null,arguments));var
_PadV2=Module[\"_PadV2\"]=function(){return(_PadV2=Module[\"_PadV2\"]=Module[\"asm\"][\"oa\"]).apply(nul
l,arguments));var
_Pow=Module[\"_Pow\"]=function(){return(_Pow=Module[\"_Pow\"]=Module[\"asm\"][\"pa\"]).apply(null,argume
nts));var
_Prelu=Module[\"_Prelu\"]=function(){return(_Prelu=Module[\"_Prelu\"]=Module[\"asm\"][\"qa\"]).apply(null,argu
ments));var
_Prod=Module[\"_Prod\"]=function(){return(_Prod=Module[\"_Prod\"]=Module[\"asm\"][\"ra\"]).apply(null,argum
ents));var
_RealDiv=Module[\"_RealDiv\"]=function(){return(_RealDiv=Module[\"_RealDiv\"]=Module[\"asm\"][\"sa\"]).app
ly(null,arguments));var
_Relu=Module[\"_Relu\"]=function(){return(_Relu=Module[\"_Relu\"]=Module[\"asm\"][\"ta\"]).apply(null,argume
nts));var
_Relu6=Module[\"_Relu6\"]=function(){return(_Relu6=Module[\"_Relu6\"]=Module[\"asm\"][\"ua\"]).apply(null,ar
guments));var
_ResizeBilinear=Module[\"_ResizeBilinear\"]=function(){return(_ResizeBilinear=Module[\"_ResizeBilinear\"]=Mo

```

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dule["asm\"][\"va\").apply(null,arguments));var
 Reverse=Module[\"_Reverse\"]=function(){return(_Reverse=Module[\"_Reverse\"]=Module[\"asm\"][\"wa\"]).app
ly(null,arguments));var
 RotateWithOffset=Module[\"_RotateWithOffset\"]=function(){return(_RotateWithOffset=Module[\"_RotateWith
Offset\"]=Module[\"asm\"][\"xa\"]).apply(null,arguments));var
 Round=Module[\"_Round\"]=function(){return(_Round=Module[\"_Round\"]=Module[\"asm\"][\"ya\"]).apply(nul
l,arguments));var
 Rsqrt=Module[\"_Rsqrt\"]=function(){return(_Rsqrt=Module[\"_Rsqrt\"]=Module[\"asm\"][\"za\"]).apply(null,arg
uments));var
 ScatterNd=Module[\"_ScatterNd\"]=function(){return(_ScatterNd=Module[\"_ScatterNd\"]=Module[\"asm\"][\"Aa
\"]).apply(null,arguments));var
 SelectV2=Module[\"_SelectV2\"]=function(){return(_SelectV2=Module[\"_SelectV2\"]=Module[\"asm\"][\"Ba\"])
.apply(null,arguments));var
 Sigmoid=Module[\"_Sigmoid\"]=function(){return(_Sigmoid=Module[\"_Sigmoid\"]=Module[\"asm\"][\"Ca\"]).ap
ply(null,arguments));var
 Sin=Module[\"_Sin\"]=function(){return(_Sin=Module[\"_Sin\"]=Module[\"asm\"][\"Da\"]).apply(null,arguments)
};var
 Softmax=Module[\"_Softmax\"]=function(){return(_Softmax=Module[\"_Softmax\"]=Module[\"asm\"][\"Ea\"]).ap
ply(null,arguments));var
 Sqrt=Module[\"_Sqrt\"]=function(){return(_Sqrt=Module[\"_Sqrt\"]=Module[\"asm\"][\"Fa\"]).apply(null,argumen
ts));var
 Square=Module[\"_Square\"]=function(){return(_Square=Module[\"_Square\"]=Module[\"asm\"][\"Ga\"]).apply(n
ull,arguments));var
 SquaredDifference=Module[\"_SquaredDifference\"]=function(){return(_SquaredDifference=Module[\"_Squared
Difference\"]=Module[\"asm\"][\"Ha\"]).apply(null,arguments));var
 Step=Module[\"_Step\"]=function(){return(_Step=Module[\"_Step\"]=Module[\"asm\"][\"Ia\"]).apply(null,argume
nts));var
 StridedSlice=Module[\"_StridedSlice\"]=function(){return(_StridedSlice=Module[\"_StridedSlice\"]=Module[\"as
m\"][\"Ja\"]).apply(null,arguments));var
 Sub=Module[\"_Sub\"]=function(){return(_Sub=Module[\"_Sub\"]=Module[\"asm\"][\"Ka\"]).apply(null,argument
s));var
 Sum=Module[\"_Sum\"]=function(){return(_Sum=Module[\"_Sum\"]=Module[\"asm\"][\"La\"]).apply(null,argum
ents));var
 Tan=Module[\"_Tan\"]=function(){return(_Tan=Module[\"_Tan\"]=Module[\"asm\"][\"Ma\"]).apply(null,argumen
ts));var
 Tanh=Module[\"_Tanh\"]=function(){return(_Tanh=Module[\"_Tanh\"]=Module[\"asm\"][\"Na\"]).apply(null,argu
ments));var
 Tile=Module[\"_Tile\"]=function(){return(_Tile=Module[\"_Tile\"]=Module[\"asm\"][\"Oa\"]).apply(null,argumen
ts));var
 TopK=Module[\"_TopK\"]=function(){return(_TopK=Module[\"_TopK\"]=Module[\"asm\"][\"Pa\"]).apply(null,ar
guments));var
 Transform=Module[\"_Transform\"]=function(){return(_Transform=Module[\"_Transform\"]=Module[\"asm\"][\"Qa
\"]).apply(null,arguments));var
 Transpose=Module[\"_Transpose\"]=function(){return(_Transpose=Module[\"_Transpose\"]=Module[\"asm\"][\"Ra
\"]).apply(null,arguments));var
 FusedMatMul=Module[\"__FusedMatMul\"]=function(){return(__FusedMatMul=Module[\"__FusedMatMul\"]=
Module[\"asm\"][\"Sa\"]).apply(null,arguments));var

```

```

_malloc=Module["_malloc"]=function(){return(_malloc=Module["_malloc"]=Module["asm"]()["Ta"]).apply(null,arguments)};var
_free=Module["_free"]=function(){return(_free=Module["_free"]=Module["asm"]()["Ua"]).apply(null,arguments)};var
___errno_location=Module["___errno_location"]=function(){return(___errno_location=Module["___errno_location"]=Module["asm"]()["Va"]).apply(null,arguments)};var
stackSave=Module["stackSave"]=function(){return(stackSave=Module["stackSave"]=Module["asm"]()["Wa"]).apply(null,arguments)};var
stackRestore=Module["stackRestore"]=function(){return(stackRestore=Module["stackRestore"]=Module["asm"]()["Xa"]).apply(null,arguments)};var
stackAlloc=Module["stackAlloc"]=function(){return(stackAlloc=Module["stackAlloc"]=Module["asm"]()["Ya"]).apply(null,arguments)};Module["cwrap"]=cwrap;var calledRun;function
ExitStatus(status){this.name="ExitStatus";this.message="Program terminated with
exit("+status+")";this.status=status}dependenciesFulfilled=function
runCaller(){if(!calledRun)run();if(!calledRun)dependenciesFulfilled=runCaller};function
run(args){args=args||arguments_;if(runDependencies>0){return}preRun();if(runDependencies>0){return}function
doRun(){if(calledRun)return;calledRun=true;Module["calledRun"]=true;if(ABORT)return;initRuntime();preMain(
);readyPromiseResolve(Module);if(Module["onRuntimeInitialized"]())Module["onRuntimeInitialized"]();postRun(
)}if(Module["setStatus"]){Module["setStatus"]("Running...");setTimeout(function(){setTimeout(function(){Module["setStatus"]("")},1);doRun()},1)}else{doRun()}}Module["run"]=run;if(Module["preInit"]){if(typeof
Module["preInit"]=="function")Module["preInit"]=[Module["preInit"]];while(Module["preInit"].length>0){
Module["preInit"].pop()})();return WasmBackendModule.ready})();nif (typeof exports ===
'object' && typeof module === 'object')\n module.exports = WasmBackendModule;\nelse if (typeof define ===
'function' && define['amd'])\n define([], function() { return WasmBackendModule; });\nelse if (typeof exports ===
'object')\n exports["WasmBackendModule"] = WasmBackendModule;\n"/**\n * @license\n * Copyright 2019
Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you
may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*/\nimport './flags_wasm';\nimport {backend_util, BackendTimingInfo, DataStorage, DataType, deprecationWarn,
engine, env, KernelBackend, TensorInfo, util} from '@tensorflow/tfjs-core';\nimport {BackendWasmModule,
WasmFactoryConfig} from './wasm-out/tfjs-backend-wasm';\nimport {BackendWasmThreadedSimdModule} from
'./wasm-out/tfjs-backend-wasm-threaded-simd';\nimport wasmFactoryThreadedSimd from './wasm-out/tfjs-
backend-wasm-threaded-simd.worker.js';\n// @ts-ignore\nimport {wasmWorkerContents} from './wasm-out/tfjs-backend-
wasm-threaded-simd.worker.js';\nimport wasmFactory from './wasm-out/tfjs-backend-wasm.js';\n\ninterface
TensorData {\n id: number;\n memoryOffset: number;\n shape: number[];\n dtype: DataType;\n refCount:
number;\n /** Only used for string tensors, storing encoded bytes. */\n stringBytes?: Uint8Array[];\n}\n\nexport
type DataId = object; // object instead of {} to force non-primitive.\n\nexport class BackendWasm extends
KernelBackend {\n // 0 is reserved for null data ids.\n private dataIdNextNumber = 1;\n dataIdMap:
DataStorage<TensorData>;\n\n constructor(public
wasm: BackendWasmModule|BackendWasmThreadedSimdModule) {\n super();\n
this.wasm.tfjs.initWithThreadsCount(threadsCount);\n actualThreadsCount = this.wasm.tfjs.getThreadsCount();\n
this.dataIdMap = new DataStorage(this, engine());\n }\n\n write(values: backend_util.BackendValues, shape:
number[], dtype: DataType):\n DataId {\n const dataId = {id: this.dataIdNextNumber++};\n
this.move(dataId, values, shape, dtype, 1);\n return dataId;\n }\n\n numDataIds(): number {\n return

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this.dataIdMap.numDataIds();\n }\n\n async time(f: () => void): Promise<BackendTimingInfo> {\n  const start =
util.now();\n  f();\n  const kernelMs = util.now() - start;\n  return {kernelMs};\n }\n\n move(\n  dataId:
DataId, values: backend_util.BackendValues, shape: number[],\n  dtype: DataType, refCount: number): void {\n
const id = this.dataIdNextNumber++;\n  if (dtype === 'string') {\n    const stringBytes = values as Uint8Array[];\n
    this.dataIdMap.set(\n
      dataId,\n      {id, stringBytes, shape, dtype, memoryOffset: null, refCount});\n    return;\n  }\n\n  const
size = util.sizeFromShape(shape);\n  const numBytes = size * util.bytesPerElement(dtype);\n  const
memoryOffset = this.wasm._malloc(numBytes);\n  this.dataIdMap.set(dataId, {id, memoryOffset, shape, dtype,
refCount});\n\n  this.wasm.tfjs.registerTensor(id, size, memoryOffset);\n\n  if (values != null) {\n
this.wasm.HEAPU8.set(\n    new Uint8Array(\n      (values as backend_util.TypedArray).buffer,\n
(values as backend_util.TypedArray).byteOffset, numBytes),\n    memoryOffset);\n  }\n\n  }\n\n  async
read(dataId: DataId): Promise<backend_util.BackendValues> {\n    return this.readSync(dataId);\n  }\n\n  readSync(dataId: DataId): backend_util.BackendValues {\n    const {memoryOffset, dtype, shape, stringBytes} =\n
this.dataIdMap.get(dataId);\n    if (dtype === 'string') {\n      return
stringBytes;\n    }\n    const bytes = this.wasm.HEAPU8.slice(\n      memoryOffset,\n      memoryOffset +
util.sizeFromShape(shape) * util.bytesPerElement(dtype));\n    return typedArrayFromBuffer(bytes.buffer, dtype);\n
}\n\n  /**\n   * Dispose the memory if the dataId has 0 refCount. Return true if the memory\n   * is released, false
otherwise.\n   * @param dataId\n   * @oaram force Optional, remove the data regardless of refCount\n   */\n
disposeData(dataId: DataId, force = false): boolean {\n  if (this.dataIdMap.has(dataId)) {\n    const data =
this.dataIdMap.get(dataId);\n    data.refCount--;\n    if (!force && data.refCount > 0) {\n      return false;\n
    }\n    this.wasm._free(data.memoryOffset);\n    this.wasm.tfjs.disposeData(data.id);\n
    this.dataIdMap.delete(dataId);\n  }\n  return true;\n }\n\n  /** Return refCount of a `TensorData`. */\n
refCount(dataId: DataId): number {\n  if (this.dataIdMap.has(dataId)) {\n    const tensorData =
this.dataIdMap.get(dataId);\n
    return tensorData.refCount;\n  }\n  return 0;\n }\n\n  incRef(dataId: DataId) {\n    const data =
this.dataIdMap.get(dataId);\n    if (data != null) {\n      data.refCount++;\n    }\n  }\n\n  floatPrecision(): 32 {\n
return 32;\n }\n\n  // Returns the memory offset of a tensor. Useful for debugging and unit\n  // testing.\n
getMemoryOffset(dataId: DataId): number {\n    return this.dataIdMap.get(dataId).memoryOffset;\n  }\n\n  dispose() {\n
this.wasm.tfjs.dispose();\n  if ('PThread' in this.wasm) {\n
this.wasm.PThread.terminateAllThreads();\n  }\n  this.wasm = null;\n }\n\n  memory() {\n    return {unreliable:
false};\n  }\n\n  /**\n   * Make a tensor info for the output of an op. If `memoryOffset` is not\n   * present, this
method allocates memory on the WASM heap. If `memoryOffset`\n   * is present, the memory was allocated
elsewhere (in c++) and we just record\n   * the pointer where that memory lives.\n   */\n  makeOutput(shape:
number[], dtype: DataType, memoryOffset?: number):\n    TensorInfo {\n    let dataId: {};\n    if (memoryOffset
== null) {\n      dataId = this.write(null /* values */, shape, dtype);\n    } else {\n      const id =
this.dataIdNextNumber++;\n      dataId = {id};\n      this.dataIdMap.set(dataId, {id, memoryOffset, shape, dtype,
refCount: 1});\n      const size = util.sizeFromShape(shape);\n      this.wasm.tfjs.registerTensor(id, size,
memoryOffset);\n    }\n    return {dataId, shape, dtype};\n  }\n\n  typedArrayFromHeap({shape, dtype, dataId}:
TensorInfo):\n    backend_util.TypedArray {\n    const buffer = this.wasm.HEAPU8.buffer;\n    const
{memoryOffset} = this.dataIdMap.get(dataId);\n    const size = util.sizeFromShape(shape);\n    switch (dtype) {\n
case 'float32':\n      return new Float32Array(buffer, memoryOffset, size);\n    case 'int32':\n      return new
Int32Array(buffer, memoryOffset, size);\n    case 'bool':\n      return new Uint8Array(buffer, memoryOffset,
size);\n    default:\n      throw new Error(`Unknown dtype ${dtype}`);\n    }\n  }\n\n  }\n\n  function
createInstantiateWasmFunc(path: string) {\n    // this will be replace by rollup plugin patchWechatWebAssembly in\n
// minprogram's output.\n    // tslint:disable-next-line:no-any\n    return (imports: any, callback: any) => {\n
util.fetch(path, {credentials: 'same-origin'}).then((response) => {\n      if (!response['ok']) {\n
imports.env.a^failed to load wasm binary file at '${path}');\n      }\n      response.arrayBuffer().then(binary => {\n
WebAssembly.instantiate(binary, imports).then(output => {\n        callback(output.instance, output.module);\n

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});\n    });\n    });\n    return {};\n    };\n    }\n\n    /**\n     * Returns the path of the WASM binary.\n     *\n     * @param simdSupported whether SIMD is supported\n     * @param threadsSupported whether multithreading is supported\n     * @param wasmModuleFolder the directory containing the WASM binaries.\n     */\n\n    function getPathToWasmBinary(\n        simdSupported: boolean, threadsSupported: boolean,\n        wasmModuleFolder: string) {\n        if (wasmPath != null)\n            // If wasmPath is defined, the user has supplied a full path to\n            // the vanilla .wasm binary.\n            return\n                wasmPath;\n        }\n        let path: WasmBinaryName = 'tfjs-backend-wasm.wasm';\n        if (simdSupported && threadsSupported) {\n            path = 'tfjs-backend-wasm-threaded-simd.wasm';\n        } else if (simdSupported) {\n            path = 'tfjs-backend-wasm-simd.wasm';\n        }\n        if (wasmFileMap != null) {\n            if (wasmFileMap[path] != null) {\n                return wasmFileMap[path];\n            }\n        }\n        return wasmModuleFolder + path;\n    }\n\n    /**\n     * Initializes the wasm module and creates the js <--> wasm bridge.\n     *\n     * NOTE: We wrap the wasm module in a object with property 'wasm' instead of\n     * returning Promise<BackendWasmModule> to avoid freezing Chrome (last tested\n     * in Chrome 76).\n     *\n     * export async function init(): Promise<{wasm: BackendWasmModule}> {\n     *   const [simdSupported,\n     *         threadsSupported] = await Promise.all([\n     *     env().getAsync('WASM_HAS_SIMD_SUPPORT'),\n     *     env().getAsync('WASM_HAS_MULTITHREAD_SUPPORT')\n     *   ]);\n     *   return new Promise((resolve, reject) => {\n     *     const factoryConfig: WasmFactoryConfig = {};\n     *     /**\n     *      * This function overrides the Emscripten module locateFile utility.\n     *      * @param path The relative path to the file that needs to be loaded.\n     *      * @param prefix The path to the main JavaScript file's directory.\n     *      */\n     *     factoryConfig.locateFile = (path, prefix) => {\n     *       if (path.endsWith('.worker.js')) {\n     *         const response = wasmWorkerContents;\n     *         const blob = new Blob([response], {type: 'application/javascript'});\n     *         return URL.createObjectURL(blob);\n     *       }\n     *       if (path.endsWith('.wasm')) {\n     *         return getPathToWasmBinary(\n     *             simdSupported as boolean,\n     *             threadsSupported as boolean,\n     *             wasmPathPrefix != null ? wasmPathPrefix : prefix);\n     *       }\n     *       return prefix + path;\n     *     };\n     *     \n     *     // Use the instantiateWasm override when system fetch is not available.\n     *     // Reference:\n     *     // https://github.com/emscripten-core/emscripten/blob/2bca083cbbd5a4133db61fbd74d04f7feecfa907/tests/manual_wasm_instantiate.html#L170\n     *     if (customFetch) {\n     *       factoryConfig.instantiateWasm = (\n     *         createInstantiateWasmFunc(getPathToWasmBinary(\n     *             simdSupported as boolean, threadsSupported as boolean,\n     *             wasmPathPrefix != null ? wasmPathPrefix : ''));\n     *     );\n     *     let initialized = false;\n     *     factoryConfig.onAbort = () => {\n     *       if (initialized) {\n     *         // Emscripten already called console.warn so no need to double log.\n     *         return;\n     *       }\n     *       if (initAborted) {\n     *         // Emscripten calls `onAbort` twice, resulting in double error\n     *         // messages.\n     *         return;\n     *       }\n     *       initAborted = true;\n     *       const rejectMsg =\n     *         'Make sure the server can serve the `.wasm` file relative to the '+\n     *         '\nbundled\n     *         js file. For more details see https://github.com/tensorflow/tfjs/blob/master/tfjs-backend-wasm/README.md#using-bundlers';\n     *       reject({message: rejectMsg});\n     *     };\n     *     let wasm: Promise<BackendWasmModule>;\n     *     // If `wasmPath` has been defined we must initialize the vanilla module.\n     *     if (threadsSupported && simdSupported && wasmPath == null) {\n     *       factoryConfig.mainScriptUrlOrBlob = new Blob([\n     *         var WasmBackendModuleThreadedSimd = `\n     *           +\n     *           wasmFactoryThreadedSimd.toString(),\n     *           {type: 'text/javascript'};\n     *       ];\n     *       wasm = wasmFactoryThreadedSimd(factoryConfig);\n     *     } else {\n     *       // The wasmFactory works for both vanilla and SIMD binaries.\n     *       wasm = wasmFactory(factoryConfig);\n     *     }\n     *     // The WASM module has been successfully created by the factory.\n     *     // Any error will be caught by the onAbort callback defined above.\n     *     wasm.then((module) => {\n     *       initialized = true;\n     *       initAborted = false;\n     *       const voidReturnType: string = null;\n     *       // Using the tfjs namespace to avoid conflict with emscripten's API.\n     *       module.tfjs = {\n     *         init: module.cwrap('init', null, []),\n     *         initWithThreadsCount: module.cwrap('init_with_threads_count', null, [number]),\n     *         getThreadsCount: module.cwrap('get_threads_count', number, []),\n     *         registerTensor: module.cwrap(\n     *             'register_tensor', null,\n     *             [\n     *                 number, // id\n     *                 number, // size\n     *                 number, // memoryOffset\n     *             ]),\n     *         disposeData: module.cwrap('dispose_data', voidReturnType,\n
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['number']),\n    dispose: module.cwrap('dispose', voidReturnType, []),\n    resolve({ wasm: module});\n  });\n});\n\nfunction typedArrayFromBuffer(\n  buffer: ArrayBuffer, dtype: DataType):
backend_util.TypedArray {\n  switch (dtype) {\n    case 'float32':\n      return new Float32Array(buffer);\n    case
'int32':\n      return new Int32Array(buffer);\n
    case 'bool':\n      return new Uint8Array(buffer);\n    default:\n      throw new Error(`Unknown dtype ${dtype}`);\n  }\n}\n\nconst wasmBinaryNames = [\n  'tfjs-backend-wasm.wasm', 'tfjs-backend-wasm-simd.wasm',\n  'tfjs-backend-wasm-threaded-simd.wasm'\n] as const;\n\nexport type WasmBinaryName = typeof
wasmBinaryNames[number];\n\nlet wasmPath: string = null;\nlet wasmPathPrefix: string = null;\nlet wasmFileMap:
{[key in WasmBinaryName]?: string} = {};\nlet initAborted = false;\nlet customFetch = false;\n\n/**\n *
@deprecated Use `setWasmPaths` instead.\n * Sets the path to the `.wasm` file which will be fetched when the
wasm\n * backend is initialized. See\n * https://github.com/tensorflow/tfjs/blob/master/tfjs-backend-wasm/README.md#using-bundlers\n * for more details.\n * @param path wasm file path or url\n * @param
usePlatformFetch optional boolean to use platform fetch to download\n * the wasm file, default to false.\n *\n * @doc {heading: 'Environment', namespace: 'wasm'}\n */\n\nexport
function setWasmPath(path: string, usePlatformFetch = false): void {\n  deprecationWarn(\n    'setWasmPath has
been deprecated in favor of setWasmPaths and ' +\n    ' will be removed in a future release.);\n  if (initAborted) {\n    throw new Error(\n      'The WASM backend was already initialized. Make sure you call ' +\n      ' `setWasmPath`\n    before you call `tf.setBackend()` or `tf.ready()`);\n  }\n  wasmPath = path;\n  customFetch =
usePlatformFetch;\n}\n\n/**\n * Configures the locations of the WASM binaries.\n *\n * `js` setWasmPaths({\n *   'tfjs-backend-wasm.wasm': 'renamed.wasm',\n *   'tfjs-backend-wasm-simd.wasm': 'renamed-simd.wasm',\n *   'tfjs-backend-wasm-threaded-simd.wasm': 'renamed-threaded-simd.wasm'\n * });\n * tf.setBackend('wasm');\n *\n * @param prefixOrFileMap This can be either a string or object:\n * - (string) The path to the directory
where the WASM binaries are located.\n * Note that this prefix will be used to load each binary
(vanilla,\n * SIMD-enabled, threading-enabled, etc.).\n * - (object) Mapping from names of WASM binaries to
custom\n * full paths specifying the locations of those binaries. This is useful if\n * your WASM binaries are
not all located in the same directory, or if your\n * WASM binaries have been renamed.\n * @param
usePlatformFetch optional boolean to use platform fetch to download\n * the wasm file, default to false.\n *\n * @doc {heading: 'Environment', namespace: 'wasm'}\n */\n\nexport function setWasmPaths(\n  prefixOrFileMap:
string|{[key in WasmBinaryName]?: string},\n  usePlatformFetch = false): void {\n  if (initAborted) {\n    throw
new Error(\n      'The WASM backend was already initialized. Make sure you call ' +\n      ' `setWasmPaths`\n    before you call `tf.setBackend()` or ' +\n      ' `tf.ready()`);\n  }\n  if (typeof prefixOrFileMap === 'string') {\n    wasmPathPrefix = prefixOrFileMap;\n  } else {\n    wasmFileMap = prefixOrFileMap;\n  }\n\n  const missingPaths =\n    wasmBinaryNames.filter(name => wasmFileMap[name] == null);\n  if
(missingPaths.length > 0) {\n    throw new Error(\n      `There were no entries found for the following binaries: `
+ \n      `${missingPaths.join(',')}. Please either call setWasmPaths with a ` + \n      `map providing a path for
each binary, or with a string indicating ` + \n      `the directory where all the binaries can be found.`);\n  }\n}\n\nlet customFetch = usePlatformFetch;\n\n/**\n * Used in unit tests.\n */\n\nexport function resetWasmPath(): void {\n  wasmPath = null;\n  wasmPathPrefix = null;\n  wasmFileMap = {};\n  customFetch = false;\n  initAborted =
false;\n}\n\nlet threadsCount = -1;\nlet actualThreadsCount = -1;\n\n/**\n * Sets the number of threads that will be
used by XNNPACK to create\n * threadpool (default to the number of logical CPU cores).\n *\n * This must be
called before calling `tf.setBackend('wasm')`.\n */\n\nexport function setThreadsCount(numThreads:
number) {\n  threadsCount = numThreads;\n}\n\n/**\n * Gets the actual threads count that is used by
XNNPACK.\n *\n * It is set after the backend is initialized.\n */\n\nexport function getThreadsCount(): number {\n  if
(actualThreadsCount === -1) {\n    throw new Error(`WASM backend not initialized.`);\n  }\n  return
actualThreadsCount;\n}\n\n"/** @license See the LICENSE file. */\n\n// This code is auto-generated, do not modify
this file!\n\nconst version = '3.11.0';\nexport { version};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All
Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n */

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OR CONDITIONS OF ANY KIND, either
express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n *

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=====\\n
*\\n\\nimport './flags_wasm';\\n\\nimport {registerBackend} from '@tensorflow/tfjs-core';\\n\\nimport {BackendWasm,
init} from './backend_wasm';\\n\\nexport {BackendWasm, getThreadsCount, setThreadsCount, setWasmPath,
setWasmPaths} from './backend_wasm';\\n\\nexport {version as version_wasm} from './version';\\n\\nconst
WASM_PRIORITY = 2;\\nregisterBackend('wasm', async () => {\\n  const {wasm} = await init();\\n  return new
BackendWasm(wasm);\\n},
WASM_PRIORITY);\\n}], "names":["_FusedMatMul", "util", "Abs", "backend_util", "Add", "AddN", "Identity", "setup",
"Transpose", "All", "Any", "wasmFunc", "ArgMax", "AvgPool", "Reshape", "BatchMatMul", "slice_util", "buffer", "sliceI
mplCPU", "Slice", "BatchToSpaceND", "Cast", "Ceil", "ClipByValue", "concatImplCPU", "Concat", "Conv2D", "Conv2
DBackpropInput", "Cos", "Cosh", "CropAndResize", "Cumsum", "DepthToSpace", "DepthwiseConv2dNative", "Elu", "s
upportsFullBroadcast", "Equal", "Exp", "ExpandDims", "Fill", "FlipLeftRight", "Floor", "FloorDiv", "FusedBatchNorm",
"FusedConv2D", "FusedDepthwiseConv2D", "GatherNd", "GatherV2", "Greater", "GreaterEqual", "setupFunc", "Leaky
Relu", "Less", "LessEqual", "Log", "LogicalAnd", "Max", "Maximum", "MaxPool", "Mean", "Min", "Minimum", "Mirror
Pad", "Multiply", "Neg", "NonMaxSuppressionV3", "NonMaxSuppressionV4", "NonMaxSuppressionV5", "kernelFunc
", "NotEqual", "OneHot", "OnesLike", "Pack", "PadV2", "Pow", "Prelu", "Prod", "rangeImplCPU", "Range", "RealDiv", "R
elu", "Relu6", "ResizeBilinear", "Reverse", "RotateWithOffset", "Round", "Rsqr", "ScatterNd", "Select", "Sigmoid", "Sin
", "Softmax", "SpaceToBatchND", "SplitV", "Sqr", "Square", "SquaredDifference", "Step", "StridedSlice", "Sub", "Sum",
"Tan", "Tanh", "Tile", "TopK", "Transform", "Unpack", "ZerosLike", "registerKernel", "env", "require$$0", "require$$1",
"require$$2", "global", "require$$3", "require$$4", "tslib_1.__extends", "DataStorage", "engine", "KernelBackend", "wa
smFactoryThreadedSimd", "wasmFactory", "deprecationWarn", "registerBackend"], "mappings":";;;;;;;;;;;
AAAA;;;;;;;;;;;AAiBA;AACA,IAAY,QAMX;AAND,WAAY,QAAQ;IACIB,6CAAW,CAAA;IACX,yCAAS,C
AAA;IACt,uCAAQ,CAAA;IACR,2CAAU,CAAA;IACV,iDAaA,CAAA;AACf,CAAC,EAaW,QAAQ,KAAR,QA
AQ,QAMnB;AAED;AACA,IAAY,iBAQX;AARD,WAAY,iBAaIB;IAC3B,6DAAU,CAAA;IACV,yDAaQ,CAA
A;IACR,2DAAS,CAAA;IACt,2DAAS,CAAA;IACt,mEAaA,CAAA;IACb,+DAaW,CAAA;IACX,uDAaO,CAA
A;AACT,CAAC,EAaW,iBAaIB,KAAjB,iBAaIB;AC3B7B;;;;;;;;;;;AAuBA,IAAI,eAKQ,CAAC;AAEb,SAAS,
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SAAS,CAAC,GAAG,CAAC,sBAaB,CAAC,MAAM,CAAC,CAAC,EAAE,CAAC;IAC5D,IAAM,eAAe,GACjB,i
BAaiB,CAAC,UAAkD,CAAC,CAAC;IAC1E,IAAI,eAAe,IAAI,IAAI,EAAE;QAC3B,MAAM,IAAI,KAAK,CAC
R,UAAU,mDAaGD;YAC7D,sBAaB,CAAC,CAAC;KAC7B;IAED,IAAM,OAAO,GAAG,UAAU,GAAG,CAAC,
CAAC,KAAK,CAAC,CAAC,CAAC,GAAG,CAAC,CAAC,KAAK,CAAC,CAAC,CAAC,CAAC;IACrD,IAAM,Q
```


AAQ,GAAG,UAAU,GAAG,CAAC,CAAC,KAAC,CAAC,CAAC,CAAC,GAAG,CAAC,CAAC,KAAC,CAAC,C
AAC,CAAC,CAAC;IACtD,IAAM,QAAQ,GAAG,CAAC,CAAC,KAAC,CAAC,CAAC,CAAC,CAAC;IAE5B,IA
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C,IAAI,UAAU,CAAC,CAAC,CAAC,KAAC,CAAC,CAAC,MAAM,CAAC,CAAC;IAEnE,eAAe,CACX,GAAG,E
AAE,WAAW,EAAE,CAAC,CAAC,KAAC,CAAC,MAAM,EAAE,GAAG,EAAE,WAAW,EAAE,CAAC,CAAC,K
AAK,CAAC,MAAM,EACIE,UAAU,EAAE,UAAU,EAAE,eAAe,EAAE,MAAM,EAAE,wBAAwB,EACzE,cAAc,I
AAI,CAAC,EAAE,KAAC,CAAC,CAAC;IAEhC,OAAO,GAAG,CAAC;AACb,CAAC;AAEM,IAAM,iBAaIB,GA
AiB;IAC7C,UAAU,EAAEA,qBAAY;IACxB,WAAW,EAAE,MAAM;IACnB,SAAS,EAAE,KAAC;IACbB,UAAU
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Found

in path(s):

* /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/tf-backend-wasm.node.js.map

No license file was found, but licenses were detected in source scan.

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ourcesContent": [ "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the
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ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n *
limitations under the License.\n *
=====
*\n\n// This enum must align with the enum defined in cc/backend.h.\nexport enum CppDType {\n  float32 = 0,\n  int32 = 1,\n  bool = 2,\n  string = 3,\n  complex64 = 4\n}\n\n// Must match enum in cc/fusable_activations.h.\nexport
enum FusableActivation {\n  linear = 0,\n  relu = 1,\n  relu6 = 2,\n  prelu = 3,\n  leakyrelu = 4,\n  sigmoid = 5,\n  elu
= 6\n}\n"} ] }
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Found in path(s):

* /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/types.js.map

No license file was found, but licenses were detected in source scan.

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```
=====\n\n/*\n\nimport { KernelConfig, KernelFunc, Reverse, ReverseAttrs, ReverseInputs, TensorInfo, util } from\n '@tensorflow/tfjs-core';\n\nimport { BackendWasm } from './backend_wasm';\n\nimport { identity } from\n './Identity';\n\nimport { reshape } from './Reshape';\n\nlet wasmReverse: (\n  xId: number, axes: Uint8Array,\n  axesLength: number, outShape: Uint8Array,\n  outShapeLength: number, outId: number) => void;\n\nfunction\n  setup(backend:\n    BackendWasm) {\n  wasmReverse = backend.wasm.cwrap(Reverse, null, [\n    'number', // x_id\n    'array', // axes\n    'number', // axes_length\n    'array', // out_shape\n    'number', // out_shape_length\n    'number' // out_id\n  ]);\n\n  export function reverse(\n    args: { inputs: ReverseInputs, backend: BackendWasm, attrs:\n      ReverseAttrs }):\n    TensorInfo {\n    const { inputs, backend, attrs } = args;\n    const { x } = inputs;\n    const { dims } =\n      attrs;\n\n    const axes = util.parseAxisParam(dims, x.shape);\n\n    if (x.shape.length === 0) {\n      return\n        identity({ inputs: { x }, backend });\n    }\n\n    const out = backend.makeOutput(x.shape, x.dtype);\n    const xId =\n      backend.dataIdMap.get(x.dataId).id;\n    const outId = backend.dataIdMap.get(out.dataId).id;\n\n    const axesBytes =\n      new Uint8Array(new Int32Array(axes).buffer);\n    const outShapeBytes = new Uint8Array(new\n      Int32Array(x.shape).buffer);\n\n    wasmReverse(\n      xId, axesBytes, axes.length, outShapeBytes, x.shape.length,\n      outId);\n\n    const reshaped =\n      reshape({ inputs: { x: out }, attrs: { shape: x.shape }, backend });\n\n    backend.disposeData(out.dataId);\n    return reshaped;\n  }\n\n  export const reverseConfig: KernelConfig = {\n    kernelName: Reverse,\n    backendName: 'wasm',\n    kernelFunc: reverse as { } as KernelFunc,\n    setupFunc:\n      setup\n  };"}\n\n
```

Found in path(s):

* /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Reverse.js.map

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 * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.
 * See the License for the specific language governing permissions and
 * limitations under the License.
 *
 * =====
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```

Found in path(s):

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- /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Select.js
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- * /tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/ZerosLike.ts
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- * /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/OnesLike.d.ts
- * /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Conv2DBackpropInput.js
- * /tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/Floor.ts
- * /tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/Step.ts
- * /tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernel_utils/shared.ts
- * /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/register_all_kernels.js
- * /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Fill.js
- *
- /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Softmax.d.ts
- * /tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/Mean.ts
- * /tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/Reverse.ts
- * /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/NotEqual.d.ts
- * /tfjs-backend-wasm-zip/tfjs-backend-wasm/wasm-out/tfjs-backend-wasm-threaded-simd.d.ts
- * /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/NonMaxSuppressionV4.d.ts
- * /tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/Equal.ts

```

* /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Pack.d.ts
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* /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Range.d.ts
* /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernel_utils/shared.d.ts
* /tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/Fill.ts
*

```

```

/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Cumsum.d.ts
* /tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/Identity.ts
* /tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/OneHot.ts

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No license file was found, but licenses were detected in source scan.

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","sourcesContent":["/*\n * @license\n * Copyright 2021 Google LLC. All Rights Reserved.\n * Licensed under
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License.\n
* =====\n
*\nimport {KernelConfig, Ceil} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from
'./unary_kernel';\n\nexport const ceilConfig: KernelConfig = createUnaryKernelConfig(Ceil);\n"]}

```

Found in path(s):

```

* /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Ceil.js.map

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No license file was found, but licenses were detected in source scan.

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```
=====\n*\n\nimport { KernelConfig, KernelFunc, Tile, TileAttrs, TileInputs } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nimport { CppDType } from './types';\nlet wasmTile: (n   xId: number, xShape: Uint8Array, xShapeSize: number, newShape: Uint8Array, newShapeSize: number, dtype: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n  wasmTile = backend.wasm.cwrap(Tile, null /* void */, [\n    'number', // x_id\n    'array', // x_shape\n    'number', // new_shape\n    'array', // new_shape\n    'number', // new_shape_size\n    'number', // dtype\n    'number', // out_id\n  ]);\n\n  function tile(\n    args: { inputs: TileInputs, backend: BackendWasm, attrs: TileAttrs }) {\n    const { inputs, backend, attrs } = args;\n    const { x } = inputs;\n    const xId = backend.dataIdMap.get(x.dataId).id;\n    const { reps } = attrs;\n    const newShape: number[] = new Array(x.shape.length);\n    for (let i = 0; i < newShape.length; i++) {\n      newShape[i] = x.shape[i] * reps[i];\n    }\n    const xShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);\n    const newShapeBytes = new Uint8Array(new Int32Array(newShape).buffer);\n    const out = backend.makeOutput(newShape, x.dtype);\n    const outId = backend.dataIdMap.get(out.dataId).id;\n    wasmTile(\n      xId, xShapeBytes, x.shape.length, newShapeBytes, newShape.length,\n      CppDType[out.dtype], outId);\n    return out;\n  }\n\n  export const tileConfig: KernelConfig = {\n    kernelName: Tile,\n    backendName: 'wasm',\n    setupFunc: setup,\n    kernelFunc: tile as { } as KernelFunc\n  };
}
```

Found in path(s):

* /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Tile.js.map

No license file was found, but licenses were detected in source scan.

```
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```

```
=====\n*\n\nimport { Cosh, KernelConfig } from '@tensorflow/tfjs-core';\nimport { createUnaryKernelConfig } from\n '../unary_kernel';\nexport const coshConfig: KernelConfig = createUnaryKernelConfig(Cosh);\n"] }
```

Found in path(s):

* /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Cosh.js.map

No license file was found, but licenses were detected in source scan.

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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express
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License.\n *
=====
*\n\nimport {DepthToSpace, DepthToSpaceAttrs, DepthToSpaceInputs, KernelConfig, KernelFunc, TensorInfo,
util} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nlet wasmDepthToSpace:
(\n  xId: number, blockSize: number, channelsLast: number, xStrides: Uint8Array,\n  xStridesLength: number,
outputShape: Uint8Array, outputStrides: Uint8Array,\n  outSize: number, outId: number) => void;\n\nfunction
setup(backend: BackendWasm): void {\n  wasmDepthToSpace = backend.wasm.cwrap(DepthToSpace, null
/*void*/, [\n    'number', // xId\n    'number', // blockSize\n    'number', // channelsLast\n    'array', // xStrides\n
'number', // xStridesLength\n    'array', // outputShape\n    'array', // outputStrides\n    'number', // outSize\n
```



```
'number',
// outId\n ]);\n}\n\nexport function depthToSpace(args: {\n backend: BackendWasm,\n inputs:
DepthToSpaceInputs,\n attrs: DepthToSpaceAttrs\n}): TensorInfo {\n const {backend, inputs, attrs} = args;\n
const {x} = inputs;\n const {blockSize, dataFormat} = attrs;\n\n const batchSize = x.shape[0];\n const inputHeight
= (dataFormat === 'NHWC') ? x.shape[1] : x.shape[2];\n const inputWidth = (dataFormat === 'NHWC') ?
x.shape[2] : x.shape[3];\n const inputDepth = (dataFormat === 'NHWC') ? x.shape[3] : x.shape[1];\n\n const
outputHeight = inputHeight * blockSize;\n const outputWidth = inputWidth * blockSize;\n const outputDepth =
inputDepth / (blockSize * blockSize);\n\n const outputShape = (dataFormat === 'NHWC') ?\n [batchSize,
outputHeight, outputWidth, outputDepth] :\n [batchSize, outputDepth, outputHeight, outputWidth];\n\n const
out = backend.makeOutput(outputShape, 'float32');\n\n const xData = backend.dataIdMap.get(x.dataId);\n const
xId = xData.id;\n const
xStridesBytes =\n new Uint8Array(new Int32Array(util.computeStrides(x.shape)).buffer);\n\n const
outputShapeBytes = new Uint8Array(new Int32Array(outputShape).buffer);\n const outStridesBytes =\n new
Uint8Array(new Int32Array(util.computeStrides(outputShape)).buffer);\n\n const outId =
backend.dataIdMap.get(out.dataId).id;\n const channelsLast = dataFormat === 'NHWC' ? 1 : 0;\n
wasmDepthToSpace(\n xId, blockSize, channelsLast, xStridesBytes, x.shape.length - 1,\n outputShapeBytes,
outStridesBytes, outputShape.length, outId);\n\n return out;\n}\n\nexport const depthToSpaceConfig: KernelConfig
= {\n kernelName: DepthToSpace,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: depthToSpace as
{} as KernelFunc\n};\n"]}
```

Found in path(s):

* /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/DepthToSpace.js.map

No license file was found, but licenses were detected in source scan.

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```

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```

```
=====\\n\n *\\n\\n// This enum must align with the enum defined in cc/backend.h.\n * export enum CppDType {\n *   float32 = 0,\n *   int32 = 1,\n *   bool = 2,\n *   string = 3,\n *   complex64 = 4\n * }\n * \\n\\n// Must match enum in cc/fusable_activations.h.\n * export enum FusableActivation {\n *   linear = 0,\n *   relu = 1,\n *   relu6 = 2,\n *   prelu = 3,\n *   leakyrelu = 4,\n *   sigmoid = 5,\n *   elu = 6\n * }\n * \\n\\n/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n
```

```
\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *\n
```

```
=====\\n\n *\\n\\nimport { _FusedMatMul, _FusedMatMulAttrs, _FusedMatMulInputs, KernelConfig, KernelFunc } from\n * '@tensorflow/tfjs-core';\n * \\n\\nimport { BackendWasm } from '../backend_wasm';\n * \\n\\nimport { FusableActivation } from './types';\n * \\n\\nlet wasmFusedMatMul: (\n *   aId: number, aShape: Uint8Array, aShapeSize: number, bId: number,\n *   bShape: Uint8Array, bShapeSize: number, transposeA: boolean,\n *   transposeB: boolean, activation: number, biasId: number,\n *   preluActivationWeightsId: number, leakyreluAlpha: number, outId: number) =>\n *   void;\n * \\n\\nfunction setup(backend: BackendWasm) {\n *   wasmFusedMatMul = backend.wasm.cwrap(_FusedMatMul,\n *   null /* void */, [\n
```

```
   'number', // a_id\n *   'array', // a_shape\n *   'number', // a_shape.length\n *   'number', // b_id\n *   'array', // b_shape\n *   'number', // b_shape.length\n *   'number', // transpose_a\n *   'number', // transpose_b\n *   'number', // activation\n *   'number', // biasId\n *   'number', // preluActivationWeightsId\n *   'number', // leakyreluAlpha\n *   'number' // out_id\n *   ]);\n * \\n\\nfunction fusedBatchMatMul(args: {\n *   inputs: _FusedMatMulInputs,\n *   backend: BackendWasm,\n *   attrs: _FusedMatMulAttrs\n * }) {\n *   const { inputs, backend, attrs } = args;\n *   const { a, b, bias, preluActivationWeights } = inputs;\n *   \\n\\n if (a.dtype !== 'float32' || b.dtype !== 'float32') {\n *     throw new Error(`\n *       _FusedMatMul for non non-float32 tensors not yet supported.`);\n *   }\n *   \\n\\n const { transposeA, transposeB, activation, leakyreluAlpha } = attrs;\n *   const aId = backend.dataIdMap.get(a.dataId).id;\n *   const bId = backend.dataIdMap.get(b.dataId).id;\n *   \\n\\n let biasId = 0;\n *   if (bias != null)\n *     {\n *       const biasData = backend.dataIdMap.get(bias.dataId);\n *       if (biasData.shape.length !== 1) {\n *         throw new Error(`\n *           _FusedMatMul only supports rank-1 bias but got ` +\n *             `rank ${biasData.shape.length}`);\n *       }\n *       biasId = biasData.id;\n *     }\n *   \\n\\n const preluActivationWeightsId = preluActivationWeights == null ?\n *     0 : backend.dataIdMap.get(preluActivationWeights.dataId).id;\n *   \\n\\n const fusedActivation =\n
```

```
FusableActivation[activation as { } as keyof typeof FusableActivation];\n if (fusedActivation == null) {\n  throw\n  new Error(\n    `${activation} activation not yet supported for FusedConv2D` +\n    `in the wasm backend.`);\n }\n\n const leftDim = transposeA ? a.shape[2] : a.shape[1];\n const rightDim = transposeB ? b.shape[1] :\n b.shape[2];\n const batchDim = a.shape[0];\n\n const out = backend.makeOutput([batchDim, leftDim, rightDim],\n a.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n const aShapeBytes = new\n Uint8Array(new Int32Array(a.shape).buffer);\n const bShapeBytes = new Uint8Array(new\n Int32Array(b.shape).buffer);\n\n wasmFusedMatMul(\n  aId, aShapeBytes, a.shape.length, bId, bShapeBytes,\n b.shape.length,\n  transposeA, transposeB, fusedActivation, biasId, preluActivationWeightsId,\n leakyreluAlpha || 0, outId);\n\n return out;\n}\n\nexport const fusedMatMulConfig: KernelConfig = {\n  kernelName: '_FusedMatMul',\n  backendName: 'wasm',\n  setupFunc: setup,\n  kernelFunc: fusedBatchMatMul as\n { } as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed\n under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the\n License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed\n on an "AS IS" BASIS,\n * WITHOUT
```

WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *

```
=====\n\n*/\n\nimport {DataType, KernelConfig, TensorInfo, UnaryInputs, util} from '@tensorflow/tfjs-core';\n\nimport\n {BackendWasm} from '../backend_wasm';\n\nimport {CppType} from './types';\n\nexport function\n createUnaryKernelConfig(\n  kernelName: string, outType?: DataType): KernelConfig {\n  let wasmFunc: (xId:\n number, dtype: number, outId: number) => void;\n\n  function setupFunc(backend: BackendWasm): void {\n    wasmFunc = backend.wasm.cwrap(kernelName, null /* void */, [\n      'number', // x_id\n      'number', // dtype\n      'number', // out_id\n    ]);\n  }\n\n  function kernelFunc(args: {backend: BackendWasm, inputs: UnaryInputs}): \n TensorInfo {\n    const {backend, inputs: {x}} = args;\n    const xId = backend.dataIdMap.get(x.dataId).id;\n    const out = backend.makeOutput(x.shape, outType || x.dtype);\n    const outId =\n backend.dataIdMap.get(out.dataId).id;\n\n    // Short-circuit zero-sized tensors.\n    if (util.sizeFromShape(out.shape)\n === 0) {\n      return out;\n    }\n\n    wasmFunc(xId, CppDType[x.dtype], outId);\n    return out;\n  }\n\n  return\n {kernelName, backendName: 'wasm', setupFunc, kernelFunc};\n}\n\n"/**\n * @license\n * Copyright 2019 Google\n LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not\n use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,\n software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES\n OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n governing permissions\n and\n * limitations under the License.\n *\n
```

```
=====\n\n*/\n\nimport {Abs, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from\n '../unary_kernel';\n\nexport const absConfig: KernelConfig = createUnaryKernelConfig(Abs);\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\n License at\n *\n http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or\n agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *\n WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n the specific language governing permissions and\n * limitations under the License.\n *\n
```

```
=====\n\n*/\n\nimport {backend_util, BinaryInputs, DataType, KernelConfig, TensorInfo, util} from '@tensorflow/tfjs-\n core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport {CppType} from './types';\n\nexport
```



```

inputs.map(x => backend.dataIdMap.get(x.dataId).id);\n const inputIdsBytes = new Uint8Array(new
Int32Array(inputIds).buffer);\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmFunc(inputIdsBytes,
inputIds.length, CppDType[out.dtype], outId);\n\n return out;\n}\n\nexport const addNConfig: KernelConfig = {\n
kernelName: AddN,\n backendName: 'wasm',\n setupFunc,\n kernelFunc: addn as {} as KernelFunc,\n};\n\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version
2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable
law
or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {Identity, IdentityInputs, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';\nimport
{TensorInfo} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nexport function
identity(args: {inputs: IdentityInputs, backend: BackendWasm});\n  TensorInfo {\n    const {inputs: {x}, backend} =
args;\n    const out = backend.makeOutput(x.shape, x.dtype);\n    const inVals = backend.typedArrayFromHeap(x);\n
const outVals = backend.typedArrayFromHeap(out);\n    outVals.set(inVals);\n    return out;\n  }\n\nexport const
identityConfig: KernelConfig = {\n  kernelName: Identity,\n  backendName: 'wasm',\n
  kernelFunc: identity as {} as KernelFunc,\n};\n\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {KernelConfig, KernelFunc, TensorInfo, Transpose, TransposeAttrs, TransposeInputs} from
'@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport {identity} from
'./Identity';\n\nimport
{CppType} from './types';\n\nlet wasmTranspose: (\n  xId: number, xShape: Uint8Array, xShapeLength:
number, dtype: CppDType,\n  outId: number, perm: Uint8Array, permLength: number) => void;\n\nfunction
setup(backend: BackendWasm) {\n  wasmTranspose = backend.wasm.cwrap(Transpose, null /* void */, [\n
'number', // xId\n 'array', // x.shape\n 'number', // x.shape.length\n 'number', // dtype\n 'number', // outId\n
'array', // perm\n 'number', // perm.length\n ]);\n\nexport function transpose(\n  args: {\n    inputs:
TransposeInputs, backend: BackendWasm, attrs: TransposeAttrs);\n  TensorInfo {\n    const {inputs, backend,
attrs} = args;\n    // Reduce any dimensions with size one. Lower-rank transpose kernel performs\n    // better due to
simpler memory access pattern.\n    const [reducedShape, perm] = removeOneSizeDims(inputs.x.shape,
attrs.perm);\n\n    let permIsNoOp = true;\n    for (let i = 0; i < perm.length; i++) {\n      if (perm[i] !== i) {\n
permIsNoOp = false;\n      }\n    }\n    const outShape = computeOutShape(inputs.x.shape, attrs.perm);\n    const x = {\n
dataId: inputs.x.dataId,\n    shape: reducedShape,\n    dtype: inputs.x.dtype\n };\n\n    if (permIsNoOp) {\n      const
cloned = identity({inputs, backend});\n      cloned.shape = outShape;\n      return cloned;\n    }\n\n    const out =
backend.makeOutput(outShape, x.dtype);\n    const xId = backend.dataIdMap.get(x.dataId).id;\n    const outId =
backend.dataIdMap.get(out.dataId).id;\n    const permBytes = new Uint8Array(new Int32Array(perm).buffer);\n\n    const xShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);\n\n    wasmTranspose(\n      xId,
xShapeBytes, x.shape.length, CppDType[x.dtype], outId, permBytes,\n      perm.length);\n    return
out;\n  }\n\nfunction computeOutShape(inShape: number[], perm: number[]): number[] {\n    const outShape = new
Array(inShape.length);\n    for (let i = 0; i < outShape.length; i++) {\n      outShape[i] = inShape[perm[i]];\n    }\n
return outShape;\n  }\n\nfunction

```

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removeOneSizeDims(\n  shape: number[], perm: number[]): [number[], number[]] {\n  const newShape: number[]
= [];\n  const newPerm: number[] = [];\n  for (let i = 0; i < shape.length; ++i) {\n    if (shape[i] !== 1) {\n
newShape.push(shape[i]);\n    }\n    if (shape[perm[i]] !== 1) {\n      newPerm.push(perm[i]);\n    }\n  }\n  for (let i =
0; i < newPerm.length; ++i) {\n    let minValIdx = -1;\n    for (let j = 0; j < newPerm.length; ++j) {\n      if
(newPerm[j] >= i && (minValIdx === -1 || newPerm[minValIdx] > newPerm[j])) {\n        minValIdx = j;\n
    }\n  }\n  newPerm[minValIdx] = i;\n  }\n  return [newShape, newPerm];\n}\n\nexport const transposeConfig:
KernelConfig = {\n  kernelName: Transpose,\n  backendName: 'wasm',\n  kernelFunc: transpose as {} as
KernelFunc,\n  setupFunc: setup,\n};\n\n", "/*\n * @license\n * Copyright 2020 Google Inc. All Rights Reserved.\n *
Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use
this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *

=====
*\n\nimport { backend_util, TensorInfo, util } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from
'./backend_wasm';\nimport { transpose } from './Transpose';\n\n/*\n * Compute permutation axes and do a transpose
if necessary.\n *\n * Used by reduction ops.\n *\n * @param x input TensorInfo\n * @param axis reduction axes\n *
@param backend wasm backend instance\n */\nexport function permuteAxesAndTranspose(\n  x: TensorInfo,
axis:
number|number[], backend: BackendWasm): {\n  transposed: TensorInfo|null,\n  axes: number[],\n  originalAxes:
number[],\n  inputWasTransposed: boolean\n} {\n  const xShape = x.shape;\n  const xRank = x.shape.length;\n  const
originalAxes = util.parseAxisParam(axis, xShape);\n  let axes = originalAxes;\n  const permutedAxes =
backend_util.getAxesPermutation(axes, xRank);\n  let xTransposed = null;\n  let inputWasTransposed = false;\n  if
(permutedAxes !== null) {\n    const newShape: number[] = new Array(xRank);\n    for (let i = 0; i <
newShape.length; i++) {\n      newShape[i] = xShape[permutedAxes[i]];\n    }\n    axes =
backend_util.getInnerMostAxes(axes.length, xRank);\n    xTransposed =\n      transpose({ inputs: { x }, attrs: { perm:
permutedAxes }, backend });\n    const xId = backend.dataIdMap.get(x.dataId).id;\n    const transposedId =
backend.dataIdMap.get(xTransposed.dataId).id;\n    if (transposedId !== xId) {\n      inputWasTransposed = true;\n
    }\n  }\n  return { transposed:
xTransposed, originalAxes, axes, inputWasTransposed };\n}\n\n", "/*\n * @license\n * Copyright 2021 Google LLC.
All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *

=====
*\n\nimport { All, AllAttrs, AllInputs, backend_util, KernelConfig, KernelFunc, TensorInfo, util } from
'@tensorflow/tfjs-core';\nimport { BackendWasm } from './backend_wasm';\nimport
{ permuteAxesAndTranspose }
from './kernel_utils';\n\nlet wasmAll: (xId: number, reduceSize: number, outId: number) => void;\n\nfunction
setup(backend: BackendWasm): void {\n  wasmAll = backend.wasm.cwrap(All, null /*void*/, ['number, number,
number']);\n}\n\nfunction all(args: { backend: BackendWasm, inputs: AllInputs, attrs: AllAttrs }):\n  TensorInfo {\n
const { backend, inputs, attrs } = args;\n  const { axis, keepDims } = attrs;\n  const { x } = inputs;\n  const xId =
backend.dataIdMap.get(x.dataId).id;\n  let inputId = xId;\n  let input = x;\n  const { transposed, axes, originalAxes,
inputWasTransposed } =\n    permuteAxesAndTranspose(x, axis, backend);\n  if (inputWasTransposed) {\n
const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n    input = transposed;\n    inputId =

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```

transposedId;\n }\n\n const inputRank = input.shape.length;\n backend_util.assertAxesAreInnerMostDims('all',
axes, inputRank);\n const [outShape, reduceShape] =\n
backend_util.computeOutAndReduceShapes(input.shape,
axes);\n const reduceSize = util.sizeFromShape(reduceShape);\n\n const out = backend.makeOutput(outShape,
x.dtype);\n if (util.sizeFromShape(input.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n
wasmAll(inputId, reduceSize, outId);\n }\n\n if (inputWasTransposed) {\n // dispose of the transposed tensor.\n
backend.disposeData(transposed.dataId);\n }\n\n if (keepDims) {\n // reshape\n const newShape =
backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n out.shape = newShape;\n }\n\n return
out;\n}\n\nexport const allConfig: KernelConfig = {\n kernelName: All,\n backendName: 'wasm',\n setupFunc:
setup,\n kernelFunc: all as { } as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2021 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n
*\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is
distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n *
=====
*\n\nimport { Any, AnyAttrs, AnyInputs, backend_util, KernelConfig, KernelFunc, TensorInfo, util } from
'@tensorflow/tfjs-core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nimport
{ permuteAxesAndTranspose } from './kernel_utils';\n\nlet wasmAny: (xId: number, reduceSize: number, outId:
number) => void;\n\nfunction setup(backend: BackendWasm): void {\n wasmAny = backend.wasm.cwrap(Any,
null /*void*/, ['number, number, number']);\n}\n\nfunction any(args: { backend: BackendWasm, inputs: AnyInputs,
attrs: AnyAttrs }):\n TensorInfo {\n const { backend,
inputs, attrs } = args;\n const { axis, keepDims } = attrs;\n const { x } = inputs;\n const xId =
backend.dataIdMap.get(x.dataId).id;\n let inputId = xId;\n let input = x;\n\n const { transposed, axes, originalAxes,
inputWasTransposed } =\n permuteAxesAndTranspose(x, axis, backend);\n\n if (inputWasTransposed) {\n
const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n input = transposed;\n inputId =
transposedId;\n }\n\n const inputRank = input.shape.length;\n backend_util.assertAxesAreInnerMostDims('any',
axes, inputRank);\n const [outShape, reduceShape] =\n
backend_util.computeOutAndReduceShapes(input.shape, axes);\n const reduceSize =
util.sizeFromShape(reduceShape);\n\n const out = backend.makeOutput(outShape, x.dtype);\n if
(util.sizeFromShape(input.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n
wasmAny(inputId, reduceSize, outId);\n }\n\n if (inputWasTransposed) {\n // dispose of the transposed tensor.\n
backend.disposeData(transposed.dataId);\n }\n\n if (keepDims) {\n // reshape\n const newShape =
backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n out.shape = newShape;\n }\n\n return
out;\n}\n\nexport const anyConfig: KernelConfig = {\n kernelName: Any,\n backendName: 'wasm',\n setupFunc:
setup,\n kernelFunc: any as { } as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n
*\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the
License.\n *
=====
*\n\nimport { ArgMax, ArgMaxAttrs, ArgMaxInputs, KernelConfig, KernelFunc, util } from '@tensorflow/tfjs-
core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nimport { permuteAxesAndTranspose } from

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/kernel_utils';\nimport { CppDType } from './types';\n\nlet wasmFunc: (\n  xId: number, dtype: number, outerSize: number, innerSize: number,\n  outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n  wasmFunc = backend.wasm.cwrap(ArgMax, null /* void */, [\n    'number', // x_id\n    'number', // dtype\n    'number', // outer_size\n    'number', // inner_size\n    'number' // out_id\n  ]);\n\n  function argmax(\n    args: {\n      inputs: ArgMaxInputs, backend: BackendWasm, attrs: ArgMaxAttrs\n    }) {\n    const { backend, inputs, attrs } = args;\n    const { axis } = attrs as {} as ArgMaxAttrs;\n    const { x } = inputs as {} as ArgMaxInputs;\n    const xId = backend.dataIdMap.get(x.dataId).id;\n\n    let inputId = xId;\n    let input = x;\n\n    const { transposed, axes, inputWasTransposed } =\n      permuteAxesAndTranspose(x, axis, backend);\n\n    if (inputWasTransposed) {\n      const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n      if (transposedId !== xId) {\n        // transpose was not a no-op. We will need to dispose of this\n        // once we are done.\n        input = transposed;\n        inputId = transposedId;\n      }\n\n      const outShape = input.shape.slice(0, -1);\n      const out = backend.makeOutput(outShape, 'int32');\n      const outId = backend.dataIdMap.get(out.dataId).id;\n      const outerSize = util.sizeFromShape(out.shape);\n      const innerSize = input.shape[axes[0]];\n      wasmFunc(inputId, CppDType[input.dtype], outerSize, innerSize, outId);\n\n      if (inputWasTransposed) {\n        // dispose of the transposed tensor.\n        backend.disposeData(transposed.dataId);\n      }\n\n      return out;\n    }\n\n    export const argMaxConfig: KernelConfig = {\n      kernelName: ArgMax,\n      backendName: 'wasm',\n      kernelFunc: argmax as {} as KernelFunc,\n      setupFunc: setup\n    };\n\n    /**\n     * @license\n     * Copyright 2019 Google LLC. All Rights Reserved.\n     * Licensed under the Apache License, Version 2.0 (the "License");\n     * you may not use this file except in compliance with the License.\n     * You may obtain a copy of the License at\n     * http://www.apache.org/licenses/LICENSE-2.0\n     * Unless required by applicable law or agreed to in writing,\n     * software distributed under the License is distributed on an "AS IS" BASIS,\n     * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n     * See the License for the specific language governing permissions and\n     * limitations under the License.\n     */\n\n    =====\n    *\n    \nimport { AvgPool, AvgPoolAttrs, AvgPoolInputs, backend_util, KernelConfig, KernelFunc, Tensor4D } from\n    '@tensorflow/tfjs-core';\n    \nimport { BackendWasm } from '../backend_wasm';\n    \nlet wasmAvgPool: (\n      xId: number, batchSize: number, inputHeight: number, inputWidth: number,\n      filterHeight: number, filterWidth: number, padTop: number, padRight: number,\n      padBottom: number, padLeft: number, strideHeight: number, strideWidth: number,\n      channels: number, outId: number) => void;\n\n    function setup(backend: BackendWasm) {\n      wasmAvgPool = backend.wasm.cwrap(AvgPool, null /* void */, [\n        'number', // xId\n        'number', // batchSize\n        'number', // inputHeight\n        'number', // inputWidth\n        'number', // filterHeight\n        'number', // filterWidth\n        'number', // padTop\n        'number', // padRight\n        'number', // padBottom\n        'number', // padLeft\n        'number', // strideHeight\n        'number', // strideWidth\n        'number', // channels\n        'number', // outId\n      ]);\n\n      function\n      avgPool(\n        args: {\n          inputs: AvgPoolInputs, backend: BackendWasm, attrs: AvgPoolAttrs\n        }) {\n          const { inputs, attrs, backend } = args;\n          const x = inputs.x as Tensor4D;\n          const xId = backend.dataIdMap.get(x.dataId).id;\n\n          const { filterSize, strides, pad, dimRoundingMode } = attrs;\n          const convInfo = backend_util.computePool2DInfo(\n            x.shape, filterSize, strides, 1 /* dilations */, pad,\n            dimRoundingMode);\n          const filterHeight = convInfo.filterHeight;\n          const filterWidth = convInfo.filterWidth;\n          const padTop = convInfo.padInfo.top;\n          const padRight = convInfo.padInfo.right;\n          const padBottom = convInfo.padInfo.bottom;\n          const padLeft = convInfo.padInfo.left;\n          const strideHeight = convInfo.strideHeight;\n          const strideWidth = convInfo.strideWidth;\n          const channels = convInfo.inChannels;\n\n          if (convInfo.dataFormat !== 'channelsLast') {\n            throw new Error(\n              `wasm backend does not support dataFormat: "${convInfo.dataFormat}". Please use 'channelsLast'.`);\n          }\n\n          if (convInfo.dilationWidth !== 1 || convInfo.dilationHeight !== 1) {\n            throw new Error(\n              `was backend only supports average pooling with dilation = [1, 1],`);\n          }\n\n          const out = backend.makeOutput(convInfo.outShape, 'float32');\n          const outId = backend.dataIdMap.get(out.dataId).id;\n

```



```
wasmAvgPool(\n    xId, x.shape[0], x.shape[1], x.shape[2], filterHeight, filterWidth,\n    padTop, padRight,\n    padBottom, padLeft, strideHeight, strideWidth, channels,\n    outId);\n    return out;\n}\n\nexport const\navgPoolConfig: KernelConfig = {\n    kernelName: AvgPool,\n    backendName: 'wasm',\n    setupFunc: setup,\n    kernelFunc: avgPool as {} as KernelFunc\n};\n\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is\n * distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either\n * express or implied.\n * See the License for the specific language governing permissions and\n * limitations under\n * the License.\n */\n\n=====\n\n*/\n\nimport {KernelConfig, KernelFunc, Reshape, ReshapeAttrs, ReshapeInputs, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nexport function reshape(\n    args: {inputs: ReshapeInputs, attrs: ReshapeAttrs, backend: BackendWasm}) {\n    const {inputs, attrs} = args;\n    const {x} = inputs;\n    const {shape} = attrs;\n\n    const xSize = util.sizeFromShape(x.shape);\n    const $shape = util.inferFromImplicitShape(shape, xSize);\n    util.assert(\n        xSize === util.sizeFromShape($shape),\n        () =>`\n        new shape: ${$shape}, old shape: ${x.shape}. New shape and old\n        `shape must have the same number of\n        elements.`);\n\n    // Backend needs to track\n    refCount for the dataId for reshape op\n    args.backend.incRef(x.dataId);\n    return {dataId: x.dataId, shape: $shape, dtype: x.dtype};\n}\n\nexport const reshapeConfig: KernelConfig = {\n    kernelName: Reshape,\n    backendName: 'wasm',\n    kernelFunc: reshape as {} as KernelFunc\n};\n\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n\n=====\n\n*/\n\nimport {BatchMatMul, BatchMatMulAttrs, BatchMatMulInputs, KernelConfig, KernelFunc, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nimport {reshape} from './Reshape';\n\nlet wasmBatchMatMul: (\n    aId: number, aShape: Uint8Array, aShapeSize: number, bId: number,\n    bShape: Uint8Array, bShapeSize: number, transposeA: boolean,\n    transposeB: boolean, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n    wasmBatchMatMul = backend.wasm.cwrap(BatchMatMul, null /* void */, [\n        'number', // a_id\n        'array', // a_shape\n        'number', // a_shape.length\n        'number', // b_id\n        'array', // b_shape\n        'number', // b_shape.length\n        'number', // transpose_a\n        'number', // transpose_b\n        'number' // out_id\n    ]);\n\n    function batchMatMul(args: {\n        inputs: BatchMatMulInputs,\n        backend: BackendWasm,\n        attrs: BatchMatMulAttrs\n    }) {\n        const {inputs, backend, attrs} = args;\n        const {a, b} = inputs;\n        const {transposeA, transposeB} = attrs;\n\n        if (a.dtype !== 'float32' || b.dtype !== 'float32') {\n            throw new Error(\n                `BatchMatMul for non non-float32 tensors not yet supported.`);\n        }\n\n        const aRank = a.shape.length;\n        const bRank = b.shape.length;\n\n        const innerShapeA = transposeA ? a.shape[aRank - 2] : a.shape[aRank - 1];\n        const innerShapeB = transposeB ? b.shape[bRank - 1] : b.shape[bRank - 2];\n\n        const outerShapeA = transposeA ? a.shape[aRank - 1] : a.shape[aRank - 2];\n        const outerShapeB = transposeB ? b.shape[bRank - 2] : b.shape[bRank - 1];\n\n        const outerDimsA = a.shape.slice(0, -2);\n        const outerDimsB = b.shape.slice(0, -2);\n\n        const batchDimA = util.sizeFromShape(outerDimsA);\n        const batchDimB = util.sizeFromShape(outerDimsB);\n\n        const batchDimsCompatible =\n            batchDimA === batchDimB ||\n            batchDimA === 1 || batchDimB === 1;\n\n        util.assert(\n            aRank >= 2 && bRank >= 2 && batchDimsCompatible,\n            () => `Error in matMul: the input batch`
```

```

dimensions must either be the same or at least one input batch dimension must be 1. Got input
batch dimensions of ({outerDimsA}) and ({outerDimsB}).`);
const outShapeOuterDims = batchDimA > batchDimB ? a.shape.slice(0, -2) : b.shape.slice(0, -2);
const outShape = outShapeOuterDims.concat([outerShapeA, outerShapeB]);
util.assert(innerShapeA === innerShapeB,
() => `Error in matMul: inner shapes ({innerShapeA}) and ({innerShapeB}) of Tensors with shapes
${a.shape} and ${b.shape} and transposeA=${transposeA} and transposeB=${transposeB}
must match.`);
const a3dShape = transposeA ? [batchDimA, innerShapeA, outerShapeA] :
[batchDimA, outerShapeA, innerShapeA];
const b3dShape = transposeB ? [batchDimB, outerShapeB,
innerShapeB] :
[batchDimB, innerShapeB, outerShapeB];
// The rest of the
implementation
is designed to operate on rank-3 tensors
const a3d = reshape({inputs: {x: a}, backend, attrs: {shape:
a3dShape}});
const b3d = reshape({inputs: {x: b}, backend, attrs: {shape: b3dShape}});
const a3dId = backend.dataIdMap.get(a3d.dataId).id;
const b3dId = backend.dataIdMap.get(b3d.dataId).id;
const leftDim = transposeA ? a3d.shape[2] : a3d.shape[1];
const rightDim = transposeB ? b3d.shape[1] : b3d.shape[2];
const batchDim = Math.max(batchDimA, batchDimB);
const out = backend.makeOutput([batchDim, leftDim,
rightDim], a3d.dtype);
const outId = backend.dataIdMap.get(out.dataId).id;
const aShapeBytes = new Uint8Array(new Int32Array(a3d.shape).buffer);
const bShapeBytes = new Uint8Array(new Int32Array(b3d.shape).buffer);
wasmBatchMatMul(a3dId, aShapeBytes, a3d.shape.length, b3dId,
bShapeBytes, b3d.shape.length, transposeA, transposeB, outId);
backend.disposeData(a3d.dataId);
backend.disposeData(b3d.dataId);
out.shape
= outShape;
return out;
}
export const batchMatMulConfig: KernelConfig = {
kernelName:
BatchMatMul,
backendName: 'wasm',
setupFunc: setup,
kernelFunc: batchMatMul as } as
KernelFunc;
/*
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 * distributed under the License is distributed
on an "AS IS" BASIS,
 * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.
 * See the License for the specific language governing permissions and
 * limitations under the
License.
 */
=====
import { backend_util, buffer, Slice, slice_util, util } from '@tensorflow/tfjs-core';
import {
assertNotComplex } from './cpu_util';
export function sliceImpl(vals, begin, size, shape, dtype) {
const
isContinuous = slice_util.isSliceContinuous(shape, begin, size);
const length = util.sizeFromShape(size);
const
xStrides = util.computeStrides(shape);
if (isContinuous) {
const flatOffset =
slice_util.computeFlatOffset(begin, xStrides);
if (dtype === 'string') {
return vals.slice(flatOffset,
flatOffset + length);
}
return vals.subarray(flatOffset, flatOffset + length);
}
const decodedData
= dtype === 'string' ?
backend_util.fromUint8ToStringArray(vals) : vals;
const inBuf =
buffer(shape, dtype, decodedData);
const outBuf = buffer(size, dtype);
for (let i = 0; i < outBuf.size; ++i) {
const outLoc = outBuf.indexToLoc(i);
const inLoc = outLoc.map((idx, j) => idx + begin[j]);
outBuf.set(inBuf.get(...inLoc), ...outLoc);
}
if (dtype === 'string') {
return backend_util.fromStringArrayToUint8(outBuf.values);
}
return
outBuf.values;
}
export function slice(args) {
const { inputs, backend, attrs } = args;
const { x } =
inputs;
const { begin, size } = attrs;
assertNotComplex(x, 'slice');
const [$begin, $size] =
slice_util.parseSliceParams(x, begin, size);
slice_util.assertParamsValid(x, $begin, $size);
const vals =
backend.data.get(x.dataId).values;
const outVals = sliceImpl(vals, $begin, $size, x.shape, x.dtype);
return
backend.makeTensorInfo($size, x.dtype, outVals);
}
export const sliceConfig = {
kernelName: Slice,
backendName: 'cpu',
kernelFunc: slice;
}
sourceMappingURL=data:application/json;base64,eyJ2ZXJzaW9uIjozLCJmaWxlIjoiaU2xpY2UuanMiLCJzb3VyY2

```

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```
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License for the specific language governing permissions and\n * limitations under the License.\n *
```

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```

'./kernel_utils/shared';\n\nexport function slice(\n  args: {inputs: SliceInputs, attrs: SliceAttrs, backend:
BackendWasm}) {\n  const {inputs: {x}, attrs: {begin, size}, backend} = args;\n\n  const [begin_, size_] =
slice_util.parseSliceParams(x, begin, size);\n\n  const isContinuous
= slice_util.isSliceContinuous(x.shape, begin_, size_);\n  const xVals = backend.readSync(x.dataId);\n  const out =
backend.makeOutput(size_, x.dtype);\n  const xStrides = util.computeStrides(x.shape);\n  const outData =
backend.dataIdMap.get(out.dataId);\n\n  if (isContinuous) {\n    const flatOffset =
slice_util.computeFlatOffset(begin_, xStrides);\n\n    if (x.dtype === 'string') {\n      outData.stringBytes =\n(xVals as Uint8Array[])\n      .slice(flatOffset, flatOffset + util.sizeFromShape(size_));\n    } else {\n      const
outVals = backend.toArrayFromHeap(out);\n      outVals.set(\n        (xVals as TypedArray)\n        .subarray(flatOffset, flatOffset + util.sizeFromShape(size_));\n      );\n\n      return out;\n    }\n\n    if (x.dtype ===
'string') {\n      const res = sliceImplCPU(xVals, begin_, size_, x.shape, x.dtype);\n      outData.stringBytes = res as
Uint8Array[];\n      return out;\n    }\n\n    const outVals = backend.toArrayFromHeap(out);\n    const
rank = x.shape.length;\n    if (rank === 2) {\n      slice2d(\n        xVals as TypedArray, xStrides[0], outVals, begin_ as
[number, number],\n        size_ as [number, number]);\n    } else if (rank === 3) {\n      slice3d(\n        xVals as
TypedArray, xStrides[0], xStrides[1], outVals,\n        begin_ as [number, number, number], size_ as [number,
number, number]);\n    } else if (rank === 4) {\n      slice4d(\n        xVals as TypedArray, xStrides[0], xStrides[1],
xStrides[2], outVals,\n        begin_ as [number, number, number, number],\n        size_ as [number, number, number,
number]);\n    } else {\n      const res =\n      sliceImplCPU(xVals, begin_, size_, x.shape, x.dtype) as TypedArray;\n      outVals.set(res);\n    }\n\n    return out;\n  }\n\n  function slice2d(\n    xVals: backend_util.TypedArray, xStride:
number,\n    outVals: backend_util.TypedArray, begin: [number, number],\n    size: [number, number]): void {\n    let
outOffset = 0;\n    const beginI = begin[0];\n    const beginJ = begin[1];\n\n    const endI = beginI + size[0];\n    for (let i = beginI; i < endI; i++) {\n      const xOffset = i * xStride + beginJ;\n      outVals.set(xVals.subarray(xOffset, xOffset + size[1]), outOffset);\n      outOffset += size[1];\n    }\n\n    function
slice3d(\n      xVals: backend_util.TypedArray, xStride1: number, xStride2: number,\n      outVals:
backend_util.TypedArray, begin: [number, number, number],\n      size: [number, number, number]): void {\n      let
outOffset = 0;\n      const beginI = begin[0];\n      const beginJ = begin[1];\n      const beginK = begin[2];\n      const endI =
beginI + size[0];\n      const endJ = beginJ + size[1];\n      for (let i = beginI; i < endI; i++) {\n        for (let j = beginJ; j <
endJ; j++) {\n          const xOffset = i * xStride1 + j * xStride2 + beginK;\n          outVals.set(xVals.subarray(xOffset,
xOffset + size[2]), outOffset);\n          outOffset += size[2];\n        }\n      }\n\n      function slice4d(\n        xVals:
backend_util.TypedArray, xStride1: number, xStride2: number,\n        xStride3: number, outVals:
backend_util.TypedArray,\n        begin: [number, number, number, number],\n        size: [number, number, number,
number]): void {\n        let outOffset = 0;\n        const beginI = begin[0];\n        const beginJ = begin[1];\n        const beginK =
begin[2];\n        const endI = beginI + size[0];\n        const endJ = beginJ + size[1];\n        const endK = beginK + size[2];\n        const
beginL = begin[3];\n\n        for (let i = beginI; i < endI; i++) {\n          for (let j = beginJ; j < endJ; j++) {\n            for (let k
= beginK; k < endK; k++) {\n              const xOffset = i * xStride1 + j * xStride2 + k * xStride3 + beginL;\n              outVals.set(xVals.subarray(xOffset, xOffset + size[3]), outOffset);\n              outOffset += size[3];\n            }\n          }\n        }\n\n        export const sliceConfig: KernelConfig = {\n          kernelName: Slice,\n          backendName: 'wasm',\n          kernelFunc:
slice as {} as KernelFunc,\n        };\n\n        /**\n         * @license\n         * Copyright 2021 Google LLC. All Rights Reserved.\n         *
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this file except in compliance with the License.\n         * You may obtain a copy of the License at\n         *
http://www.apache.org/licenses/LICENSE-2.0\n         * Unless required by applicable law or agreed to in writing,
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OR CONDITIONS OF ANY KIND, either express or implied.\n         * See the License for the specific language
governing permissions and\n         * limitations under the License.\n         *\n         *
=====*\n\n        *\n\n        import {backend_util, BatchToSpaceND, BatchToSpaceNDAttrs, BatchToSpaceNDInputs, KernelConfig,
KernelFunc} from '@tensorflow/tfjs-core';\n\n        import {BackendWasm} from './backend_wasm';\n\n        import
{reshape} from './Reshape';\n\n        import {slice} from './Slice';\n\n        import {transpose} from './Transpose';\n\n        function

```

```

batchToSpaceND(args: {\n inputs: BatchToSpaceNDInputs,\n backend: BackendWasm,\n attrs:
BatchToSpaceNDAttrs\n}) {\n const
  {inputs, backend, attrs} = args;\n const {x} = inputs;\n const {blockShape, crops} = attrs;\n\n const prod =
blockShape.reduce((a, b) => a * b);\n\n const reshaped = backend_util.getReshaped(x.shape, blockShape, prod);\n
const permuted = backend_util.getPermuted(reshaped.length, blockShape.length);\n const reshapedPermuted =\n
backend_util.getReshapedPermuted(x.shape, blockShape, prod);\n const sliceBeginCoords =\n
backend_util.getSliceBeginCoords(crops, blockShape.length);\n const sliceSize =\n
backend_util.getSliceSize(reshapedPermuted, crops, blockShape.length);\n\n const xReshaped = reshape({inputs:
{x}, backend, attrs: {shape: reshaped}});\n const xTransposed =\n  transpose({inputs: {x: xReshaped}, backend,
attrs: {perm: permuted}});\n const xTransposedReshaped = reshape(\n  {inputs: {x: xTransposed}, backend,
attrs: {shape: reshapedPermuted}});\n const result = slice({\n  inputs: {x: xTransposedReshaped},\n  backend,\n  attrs: {begin: sliceBeginCoords,
size: sliceSize}\n });\n\n backend.disposeData(xReshaped.dataId);\n backend.disposeData(xTransposed.dataId);\n
backend.disposeData(xReshaped.dataId);\n\n return result;\n}\n\n\nexport const batchToSpaceNDConfig:
KernelConfig = {\n  kernelName: BatchToSpaceND,\n  backendName: 'wasm',\n  kernelFunc: batchToSpaceND as
{} as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed
under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
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Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n */
=====
*/\n\nimport {Cast, CastAttrs, CastInputs, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';\nimport
{TensorInfo} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nexport function
cast(\n  args: {inputs: CastInputs, attrs: CastAttrs, backend: BackendWasm});\n  TensorInfo {\n    const {inputs:
{x}, attrs: {dtype}, backend} = args;\n    const out = backend.makeOutput(x.shape, dtype);\n    const inVals =
backend.typedArrayFromHeap(x);\n    const outVals = backend.typedArrayFromHeap(out);\n    outVals.set(inVals);\n
return out;\n}\n\n\nexport const castConfig: KernelConfig = {\n  kernelName: Cast,\n  backendName: 'wasm',\n
kernelFunc: cast as {} as KernelFunc,\n};\n\n"/**\n * @license\n * Copyright 2021 Google LLC. All Rights
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by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS"
BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the
License for the specific language governing permissions and\n * limitations under the License.\n */
=====
*/\n\nimport {KernelConfig, Ceil} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from
'/unary_kernel';\n\nexport const ceilConfig: KernelConfig = createUnaryKernelConfig(Ceil);\n\n"/**\n *
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distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n */
=====
*/\n\nimport {ClipByValue, ClipByValueAttrs, ClipByValueInputs, KernelConfig, KernelFunc} from

```

```
@tensorflow/tfjs-core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nlet wasmClip: (xId: number, min: number, max: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n  wasmClip = backend.wasm.cwrap(ClipByValue, null /* void */, [\n    'number', // x_id\n    'number', // min\n    'number', // max\n    'number' // out_id\n  ]);\n\n  function clip(args: {\n    inputs: ClipByValueInputs,\n    backend: BackendWasm,\n    attrs: ClipByValueAttrs\n  }) {\n    const { inputs, backend, attrs } = args;\n    const { x } = inputs;\n    const { clipValueMin, clipValueMax } = attrs;\n    const xId = backend.dataIdMap.get(x.dataId).id;\n    const out = backend.makeOutput(x.shape, x.dtype);\n    const outId = backend.dataIdMap.get(out.dataId).id;\n    wasmClip(xId, clipValueMin, clipValueMax, outId);\n    return out;\n  }\n\n  export const clipByValueConfig: KernelConfig = {\n    kernelName: ClipByValue,\n    backendName: 'wasm',\n    setupFunc: setup,\n    kernelFunc: clip as {} as KernelFunc\n  };\n\n  /**\n   * @license\n   * Copyright 2019 Google LLC. All Rights Reserved.\n   * Licensed under the Apache License, Version 2.0 (the "License");\n   * you may not use this file except in compliance with the License.\n   * You may obtain a copy of the License at\n   * http://www.apache.org/licenses/LICENSE-2.0\n   * Unless required by applicable law or agreed to in writing,\n   * software distributed under the License is distributed on an "AS IS" BASIS,\n   * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n   * See the License for the specific language governing permissions and\n   * limitations under the License.\n   */\n\n  =====\n\n  *\n\n  import { backend_util, Concat, ConcatAttrs, ConcatInputs, KernelConfig, KernelFunc, util } from '@tensorflow/tfjs-core';\n  import { BackendWasm } from '../backend_wasm';\n  import { concatImplCPU } from '../kernel_utils/shared';\n  import { identity } from './Identity';\n  import { reshape } from './Reshape';\n\n  export function concat(\n    args: {\n      inputs: ConcatInputs,\n      backend: BackendWasm,\n      attrs: ConcatAttrs\n    }) {\n    const { inputs, backend } = args;\n    const axis = util.parseAxisParam(args.attrs.axis, inputs[0].shape)[0];\n    let outShape = backend_util.computeOutShape(inputs.map(t => t.shape), axis);\n\n    // Keep only non-empty tensors (ignore tensors with 0 in their shape).\n    const $inputs = inputs.filter(t => util.sizeFromShape(t.shape) > 0);\n    if ($inputs.length === 1) {\n      return identity({ inputs: { x: $inputs[0] }, backend });\n    }\n\n    const out = backend.makeOutput(outShape, inputs[0].dtype);\n\n    if (util.sizeFromShape(outShape) === 0) {\n      return out;\n    }\n\n    const shapes = $inputs.map(t => t.shape);\n    backend_util.assertParamsConsistent(shapes, axis);\n\n    if ($inputs[0].dtype === 'string') {\n      // Any concat of n-dimensional tensors across any axis can be reduced to a concatenation of two-dimensional tensors across the axis 1 by first partitioning the axes of the original tensors into those less than the axis to be concatenated and the rest. Then reshape the tensors into a two-dimensional tensor by collapsing these two sets of axes and concatenate the resulting matrices across the axis 1, finally reshaping the result to have the proper shape.\n      const inputs2D = $inputs.map(t => {\n        const innerSize = util.sizeFromShape(t.shape.slice(axis));\n        const shape = [-1, innerSize];\n        return reshape({ inputs: { x: t }, backend, attrs: { shape } });\n      });\n      const inputsValShapes = inputs2D.map(t => {\n        return {\n          vals: backend.readSync(t.dataId),\n          shape: t.shape\n        };\n      });\n      // Concat 2d tensors along axis=1.\n      outShape = backend_util.computeOutShape(inputs2D.map(t => t.shape), 1 /* axis */);\n      const simplyConcat = inputs2D[0].shape[0] === 1;\n      const outVals = simplyConcat ? concatImplCPU(inputsValShapes, outShape, inputs[0].dtype, simplyConcat) as string[] : backend_util.computeOutShape($inputs.map(t => t.shape), axis);\n      out.shape = finalOutShape = backend_util.computeOutShape($inputs.map(t => t.shape), axis);\n      outData = backend.dataIdMap.get(out.dataId);\n      outData.stringBytes = backend_util.fromStringArrayToUint8(outVals);\n      inputs2D.forEach(t => backend.disposeData(t.dataId));\n      return out;\n    }\n\n    const batchDim = util.sizeFromShape($inputs[0].shape.slice(0, axis));\n    let sumInnerDims = 0;\n    const innerDims = $inputs.map(input => {\n      const innerDim = util.sizeFromShape(input.shape.slice(axis));\n      sumInnerDims += innerDim;\n      return innerDim;\n    });\n    const inVals = $inputs.map(input => backend.TypedArrayFromHeap(input));\n    const outVals = backend.TypedArrayFromHeap(out);\n    for (let b = 0; b < batchDim; b++) {\n      let outOffset = b * sumInnerDims;\n      for (let i = 0; i < inVals.length; i++) {\n        const innerDim = innerDims[i];\n        const inOffset = b * innerDim;\n
```

```
const vals = inVals[i].subarray(inOffset, inOffset + innerDim);
    outVals.set(vals, outOffset);
    outOffset += innerDim;
}
return out;
}
export const concatConfig: KernelConfig = {
    kernelName: 'Concat',
    backendName: 'wasm',
    kernelFunc: concat as { } as KernelFunc,
};
"/**
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 * you may not use this file except in compliance
 * with the License.
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 * distributed on an "AS IS" BASIS,
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 * limitations under
 * the License.
 */
```


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```
//
padLeft\n 'number', // isSamePad\n 'number', // dilationHeight\n 'number', // dilationWidth\n 'number', //
strideHeight\n 'number', // strideWidth\n 'number', // inputChannels\n 'number', // outputChannels\n
'number', // outId\n );\n}\n\nfunction conv2d(\n  args: {inputs: Conv2DInputs, backend: BackendWasm, attrs:
Conv2DAttrs}) {\n  const {inputs, attrs, backend} = args;\n\n  const {x, filter} = inputs;\n  const xId =
backend.dataIdMap.get(x.dataId).id;\n  const filterId = backend.dataIdMap.get(filter.dataId).id;\n\n  const {strides,
dilations, pad, dimRoundingMode, dataFormat} = attrs;\n  const $dataFormat =
backend_util.convertConv2DDataFormat(dataFormat);\n  const convInfo = backend_util.computeConv2DInfo(\n
(x as Tensor4D).shape, (filter as Tensor4D).shape, strides, dilations,\n    pad, dimRoundingMode, false,
$dataFormat);\n\n  const filterHeight = convInfo.filterHeight;\n  const filterWidth = convInfo.filterWidth;\n  const
padTop = convInfo.padInfo.top;\n
  const padRight = convInfo.padInfo.right;\n  const padBottom = convInfo.padInfo.bottom;\n  const padLeft =
convInfo.padInfo.left;\n  const dilationHeight = convInfo.dilationHeight;\n  const dilationWidth =
convInfo.dilationWidth;\n  const strideHeight = convInfo.strideHeight;\n  const strideWidth =
convInfo.strideWidth;\n  const inputChannels = convInfo.inChannels;\n  const outputChannels =
convInfo.outChannels;\n  const isSamePad = convInfo.padInfo.type === 'SAME' ? 1 : 0;\n\n  if
(convInfo.dataFormat !== 'channelsLast') {\n    throw new Error(\n      `wasm backend Conv2D does not support
dataFormat:` +\n      `${convInfo.dataFormat}`. Please use 'channelsLast'.`);\n  }\n\n  const out =
backend.makeOutput(convInfo.outShape, 'float32');\n  const outId = backend.dataIdMap.get(out.dataId).id;\n
wasmConv2d(\n    xId, x.shape[0], x.shape[1], x.shape[2], filterId, filterHeight,\n    filterWidth, padTop,
padRight, padBottom, padLeft, isSamePad,\n    dilationHeight,
dilationWidth, strideHeight, strideWidth, inputChannels,\n    outputChannels, outId);\n  return out;\n}\n\nexport
const conv2DConfig: KernelConfig = {\n  kernelName: Conv2D,\n  backendName: 'wasm',\n  setupFunc: setup,\n
kernelFunc: conv2d as { } as KernelFunc\n};\n", "/**\n * @license\n * Copyright 2020 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*/\n\nimport
{backend_util, Conv2DBackpropInput, Conv2DBackpropInputAttrs, Conv2DBackpropInputInputs, KernelConfig,
KernelFunc, TensorInfo, util} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from
'./backend_wasm';\n\nlet wasmConv2DBackpropInput: (\n  dyId: number, filterId: number, batchSize: number,
filterHeight: number,\n  filterWidth: number, inHeight: number, inWidth: number, inChannels: number,\n
outHeight: number, outWidth: number, outChannels: number,\n  strideHeight: number, strideWidth: number,
topPad: number, leftPad: number,\n  fltS0: number, fltS1: number, fltS2: number, xBatchStride: number,\n
xRowStride: number, xColStride: number, xChannelStride: number,\n  yBatchStride: number, yRowStride:
number, yColStride: number,\n  yChannelStride: number, outId: number) => void;\n\nfunction setup(backend:
BackendWasm): void {\n  wasmConv2DBackpropInput = backend.wasm.cwrap(Conv2DBackpropInput, null, [\n
'number', // dyId\n 'number', // filterId\n
'number', // batchSize\n 'number', // filterHeight\n 'number', // filterWidth\n 'number', // inHeight\n
'number', // inWidth\n 'number', // inChannels\n 'number', // outHeight\n 'number', // outWidth\n 'number',
// outChannels\n 'number', // strideHeight\n 'number', // strideWidth\n 'number', // topPad\n 'number', //
leftPad\n 'number', // fltS0\n 'number', // fltS1\n 'number', // fltS2\n 'number', // xBatchStride\n 'number',
// xRowStride\n 'number', // xColStride\n 'number', // xChannelStride\n 'number', // yBatchStride\n
'number', // yRowStride\n 'number', // yColStride\n 'number', // yChannelStride\n 'number', // outId\n
```

```

]);\n\nfunction conv2DBackpropInput(args: {\n  backend: BackendWasm,\n  inputs: Conv2DBackpropInputInputs,\n  attrs: Conv2DBackpropInputAttrs\n}): TensorInfo {\n  const {backend, inputs, attrs} = args;\n  const {dy, filter} = inputs;\n  const {strides, pad, dataFormat, dimRoundingMode, inputShape} = attrs;\n\n  const dilations = 1;\n  const $dataFormat = backend_util.convertConv2DDataFormat(dataFormat);\n  const convInfo = backend_util.computeConv2DInfo(\n    inputShape, filter.shape as [number, number, number, number], strides,\n    dilations, pad, dimRoundingMode, false /* depthwise */, $dataFormat);\n  const {\n    batchSize,\n    filterHeight,\n    filterWidth,\n    inChannels,\n    inHeight,\n    inWidth,\n    outChannels,\n    outHeight,\n    outWidth,\n    strideHeight,\n    strideWidth\n  } = convInfo;\n\n  const topPad = filterHeight - 1 - convInfo.padInfo.top;\n  const leftPad = filterWidth - 1 - convInfo.padInfo.left;\n\n  const isChannelsLast = convInfo.dataFormat === 'channelsLast';\n  const dxStrides = util.computeStrides(convInfo.inShape);\n  const dyStrides = util.computeStrides(dy.shape);\n  const [fltS0, fltS1, fltS2] = util.computeStrides(filter.shape);\n  const xBatchStride = dxStrides[0];\n  const xRowStride = isChannelsLast\n    ? dxStrides[1] : dxStrides[2];\n  const xColStride = isChannelsLast ? dxStrides[2] : 1;\n  const xChannelStride = isChannelsLast ? 1 : dxStrides[1];\n  const yBatchStride = dyStrides[0];\n  const yRowStride = isChannelsLast ? dyStrides[1] : dyStrides[2];\n  const yColStride = isChannelsLast ? dyStrides[2] : 1;\n  const yChannelStride = isChannelsLast ? 1 : dyStrides[1];\n\n  const out = backend.makeOutput(convInfo.inShape, 'float32');\n  const outId = backend.dataIdMap.get(out.dataId).id;\n  const dyId = backend.dataIdMap.get(dy.dataId).id;\n  const filterId = backend.dataIdMap.get(filter.dataId).id;\n\n  wasmConv2DBackpropInput(\n    dyId, filterId, batchSize, filterHeight, filterWidth, inHeight, inWidth,\n    inChannels, outHeight, outWidth, outChannels, strideHeight, strideWidth,\n    topPad, leftPad, fltS0, fltS1, fltS2, xBatchStride, xRowStride,\n    xColStride, xChannelStride, yBatchStride, yRowStride, yColStride,\n    yChannelStride, outId);\n  return out;\n}\n\nexport\nconst conv2DBackpropInputConfig: KernelConfig = {\n  kernelName: Conv2DBackpropInput,\n  backendName: 'wasm',\n  setupFunc: setup,\n  kernelFunc: conv2DBackpropInput as {} as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or\n * agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n\n=====\n\n*/\n\nimport {Cos, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig}\n  from './unary_kernel';\nexport const cosConfig: KernelConfig = createUnaryKernelConfig(Cos);\n\n"/**\n * @license\n * Copyright 2021 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or\n * agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n\n=====\n\n*/\n\nimport {Cosh, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig}\n  from './unary_kernel';\nexport const coshConfig: KernelConfig =\n  createUnaryKernelConfig(Cosh);\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not use this file except in\n * compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or\n * agreed to in writing,\n * software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language

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```
=====\\n
*/\\n\\nimport {CropAndResize, CropAndResizeAttrs, CropAndResizeInputs, KernelConfig, KernelFunc,
TensorInfo} from '@tensorflow/tfjs-core';\\n\\nimport {BackendWasm} from '../backend_wasm';\\n\\nimport {cast}
from './Cast';\\n\\n// Must match enum in CropAndResize.cc\\nenum
InterpolationMethod {\\n  bilinear = 0,\\n  nearest = 1\\n}\\n\\nlet wasmCropAndResize: (\\n  imagesId: number,
boxesId: number, boxIndId: number, numBoxes: number,\\n  imagesShape: Uint8Array, cropHeight: number,
cropWidth: number,\\n  method: number, extrapolationValue: number, outId: number) => void;\\n\\nfunction
setup(backend: BackendWasm): void {\\n  wasmCropAndResize = backend.wasm.cwrap(CropAndResize, null
/*void*/, [\\n    'number', // imagesId\\n    'number', // boxesId\\n    'number', // boxIndId\\n    'number', // numBoxes\\n
'array', // images shape\\n    'number', // cropHeight\\n    'number', // cropWidth\\n    'number', // method\\n
'number', // extrapolation value\\n    'number' // out id\\n  ]);\\n}\\n\\nfunction cropAndResize(args: {\\n  backend:
BackendWasm,\\n  inputs: CropAndResizeInputs,\\n  attrs: CropAndResizeAttrs\\n}): TensorInfo {\\n  const {backend,
inputs, attrs} = args;\\n  const {method, extrapolationValue, cropSize} = attrs;\\n  const {image,
boxes, boxInd} = inputs;\\n  const numBoxes = boxes.shape[0];\\n  const [cropHeight, cropWidth] = cropSize as
[number, number];\\n  const outShape = [numBoxes, cropHeight, cropWidth, image.shape[3]];\\n  let imagesData =
backend.dataIdMap.get(image.dataId);\\n  let castedData;\\n  if (image.dtype !== 'float32') {\\n    castedData =
cast({backend, inputs: {x: image}, attrs: {dtype: 'float32'}});\\n    imagesData =
backend.dataIdMap.get(castedData.dataId);\\n  }\\n  const imagesId = imagesData.id;\\n  const boxesId =
backend.dataIdMap.get(boxes.dataId).id;\\n  const boxIndId = backend.dataIdMap.get(boxInd.dataId).id;\\n  const
out = backend.makeOutput(outShape, 'float32');\\n  const outId = backend.dataIdMap.get(out.dataId).id;\\n  const
imagesShapeBytes = new Uint8Array(new Int32Array(image.shape).buffer);\\n  wasmCropAndResize(\\n
imagesId, boxesId, boxIndId, numBoxes, imagesShapeBytes, cropHeight,\\n  cropWidth,\\n
InterpolationMethod[method as {}] as keyof typeof InterpolationMethod),\\n
  extrapolationValue, outId);\\n  if (castedData !== null) {\\n    backend.disposeData(castedData.dataId);\\n  }\\n  return out;\\n}\\n\\nexport const cropAndResizeConfig: KernelConfig = {\\n  kernelName: CropAndResize,\\n
backendName: 'wasm',\\n  setupFunc: setup,\\n  kernelFunc: cropAndResize as {} as KernelFunc\\n};\\n", "/*\\n *
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\\n * See the License for
the specific language governing permissions and\\n * limitations under the License.\\n *
```

```
=====\\n
*/\\n\\nimport {backend_util, KernelConfig, KernelFunc, Cumsum, CumsumAttrs, CumsumInputs, TensorInfo, util}
from '@tensorflow/tfjs-core';\\n\\nimport {BackendWasm} from '../backend_wasm';\\n\\nimport {CppType} from
'./types';\\n\\nimport {transpose} from './Transpose';\\n\\nlet wasmCumsum: (xId: number, exclusive: number, reverse:
number,\\n  finalDim: number, outId: number, dtype: CCppType) => void;\\n\\nfunction setup(backend:
BackendWasm) {\\n  wasmCumsum = backend.wasm.cwrap(Cumsum, null /* void */, [\\n    'number', // x_id\\n
'number', // exclusive\\n    'number', // reverse\\n    'number', // final_dim\\n    'number', // out_id\\n
'number' // dtype\\n  ]);\\n}\\n\\nexport function cumsum(\\n  args: {inputs: CumsumInputs, backend: BackendWasm, attrs:
CumsumAttrs}): TensorInfo {\\n  const {inputs, backend, attrs} = args;\\n  const {x} = inputs;\\n  const {axis,
exclusive, reverse} = attrs;\\n  const xRank = x.shape.length;\\n  util.assert(x.dtype
=== 'float32' || x.dtype === 'int32',\\n    () => `cumsum does not support ${x.dtype} tensors in the WASM
backend`);\\n  // permute required axis to inner most axis\\n  const permutation =
backend_util.getAxesPermutation([axis], xRank);\\n  let permutedX = x;\\n  if (permutation !== null) {\\n
permutedX = transpose({inputs: {x}, attrs: {perm: permutation}, backend});\\n  }\\n  const permutedAxis =
backend_util.getInnerMostAxes(1, xRank)[0];\\n  backend_util.assertAxesAreInnerMostDims('cumsum',
```


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```
=====
*\n\nimport {backend_util, DepthwiseConv2dNative, DepthwiseConv2dNativeAttrs,
DepthwiseConv2dNativeInputs, KernelConfig, KernelFunc, Tensor4D} from '@tensorflow/tfjs-core';\n\nimport
{BackendWasm} from '../backend_wasm';\n\nlet wasmDepthwiseConv2d: (\n  xId: number, batchSize: number,
inputHeight: number, inputWidth: number,\n  filterId: number, filterHeight: number, filterWidth: number, padTop:
number,\n  padRight: number, padBottom: number, padLeft: number, isSamePad: number,\n  dilationHeight:
number, dilationWidth:
number, strideHeight: number,\n  strideWidth: number, inputChannels: number, outputChannels: number,\n
outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n  wasmDepthwiseConv2d =\n  backend.wasm.cwrap(DepthwiseConv2dNative, null /* void */, [\n    'number', // xId\n    'number', //
batchSize\n    'number', // inputHeight\n    'number', // inputWidth\n    'number', // filterId\n    'number', //
filterHeight\n    'number', // filterWidth\n    'number', // padTop\n    'number', // padRight\n    'number', //
padBottom\n    'number', // padLeft\n    'number', // isSamePad\n    'number', // dilationHeight\n    'number', // dilationWidth\n    'number', // strideHeight\n    'number', // strideWidth\n    'number', //
inputChannels\n    'number', // outputChannels\n    'number', // outId\n  ]);\n\n  function
depthwiseConv2d(args: {\n    inputs: DepthwiseConv2dNativeInputs,\n    backend: BackendWasm,\n    attrs: DepthwiseConv2dNativeAttrs\n  }) {\n    const {inputs, attrs, backend} = args;\n    const {x, filter} = inputs;\n    const xId = backend.dataIdMap.get(x.dataId).id;\n    const filterId =
backend.dataIdMap.get(filter.dataId).id;\n    const {strides, dilations, pad, dimRoundingMode} = attrs;\n    const
$dilations = dilations == null ? [1, 1] : dilations;\n    const convInfo = backend_util.computeConv2DInfo(\n      (x as
Tensor4D).shape, (filter as Tensor4D).shape, strides,\n      ($dilations as number | [number, number]), pad,
dimRoundingMode,\n      true /* depthwise */);\n    const filterHeight = convInfo.filterHeight;\n    const filterWidth =
convInfo.filterWidth;\n    const padTop = convInfo.padInfo.top;\n    const padRight = convInfo.padInfo.right;\n    const
padBottom = convInfo.padInfo.bottom;\n    const padLeft = convInfo.padInfo.left;\n    const dilationHeight =
convInfo.dilationHeight;\n    const dilationWidth = convInfo.dilationWidth;\n    const strideHeight =
convInfo.strideHeight;\n    const strideWidth = convInfo.strideWidth;\n    const inputChannels = convInfo.inChannels;\n    const outputChannels
= convInfo.outChannels;\n    const isSamePad = convInfo.padInfo.type === 'SAME' ? 1 : 0;\n    if
(convInfo.dataFormat !== 'channelsLast') {\n      throw new Error(\n        `wasm backend DepthwiseConv2dNative
does not support dataFormat: ` +\n        `${convInfo.dataFormat}`. Please use 'channelsLast'.`);\n    }\n    const out =
backend.makeOutput(convInfo.outShape, 'float32');\n    const outId = backend.dataIdMap.get(out.dataId).id;\n    wasmDepthwiseConv2d(\n      xId, x.shape[0], x.shape[1], x.shape[2], filterId, filterHeight,\n      filterWidth,
padTop, padRight, padBottom, padLeft, isSamePad,\n      dilationHeight, dilationWidth, strideHeight, strideWidth,
inputChannels,\n      outputChannels, outId);\n    return out;\n  }\n\n  export const depthwiseConv2dNativeConfig:
KernelConfig = {\n    kernelName: DepthwiseConv2dNative,\n    backendName: 'wasm',\n    setupFunc: setup,\n    kernelFunc: depthwiseConv2d as { } as KernelFunc\n  }; \n  }, "/*\n * @license\n * Copyright 2021 Google LLC. All
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file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
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=====
*\n\nimport {Elu, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from
'../unary_kernel';\n\nexport const eluConfig: KernelConfig = createUnaryKernelConfig(Elu);\n  }, "/*\n * @license\n *
```

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the specific language governing permissions and\n * limitations under the License.\n *

```
=====\n\n*\\nimport {Equal, KernelConfig} from '@tensorflow/tfjs-core';\\n\\nimport {createBinaryKernelConfig} from  
 './binary_kernel';\\n\\nconst supportsFullBroadcast = false;\\n\\nexport const equalConfig: KernelConfig =\\n  
createBinaryKernelConfig(Equal, supportsFullBroadcast, 'bool');\\n\\n"/**\\n * @license\\n * Copyright  
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OR CONDITIONS OF ANY KIND, either express or implied.\\n * See the License for the specific language  
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```

```
=====\n\n*\\nimport {Exp, KernelConfig} from '@tensorflow/tfjs-core';\\n\\nimport {createUnaryKernelConfig} from  
 './unary_kernel';\\n\\nexport const expConfig: KernelConfig = createUnaryKernelConfig(Exp, 'float32');\\n\\n"/**\\n *  
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BASIS,\\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\\n * See the  
License for the specific language governing permissions and\\n * limitations under the License.\\n *
```

```
=====\n\n*\\n\\nimport {ExpandDims, ExpandDimsAttrs, ExpandDimsInputs, KernelConfig, KernelFunc, util} from  
 '@tensorflow/tfjs-core';\\n\\nimport {BackendWasm} from '../backend_wasm';\\n\\nimport {reshape} from  
 './Reshape';\\n\\nexport function expandDims(args: {\\n  inputs: ExpandDimsInputs,\\n  attrs: ExpandDimsAttrs,\\n  backend: BackendWasm\\n}) {\\n  const {inputs, attrs, backend} = args;\\n  const  
    {input} = inputs;\\n  const {dim} = attrs;\\n\\n  const inputRank = input.shape.length;\\n  const newShape =  
    input.shape.slice();\\n  let $dim = dim;\\n  if (dim < 0) {\\n    // Negative value is counted from the tail of rank.\\n  
    util.assert(\\n      -(inputRank + 1) <= dim,\\n      () => `Axis must be in the interval [${- (inputRank + 1)}, ${\\n  
        inputRank}]`);\\n      $dim = inputRank + dim + 1;\\n    }\\n    newShape.splice($dim, 0, 1);\\n\\n    return reshape({inputs:  
      {x: input}, backend, attrs: {shape: newShape}});\\n  }\\n\\n  export const expandDimsConfig: KernelConfig = {\\n  
    kernelName: ExpandDims,\\n    backendName: 'wasm',\\n    kernelFunc: expandDims as {} as KernelFunc,\\n  };\\n  "/**\\n  
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```

```
=====\n\n*\\n\\nimport {KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';\\n\\nimport {Fill, FillAttrs} from  
 '@tensorflow/tfjs-core';\\n\\nimport {BackendWasm} from '../backend_wasm';\\n\\nexport function fill(args: {attrs:  
  FillAttrs, backend: BackendWasm}) {\\n  const {attrs: {shape, value, dtype}, backend} = args;\\n  const out =  
    backend.makeOutput(shape, dtype);\\n  const outVals = backendtypedArrayFromHeap(out);\\n  outVals.fill(value as  
    number);\\n  return out;\\n}\\n\\nexport const fillConfig: KernelConfig = {\\n  kernelName: Fill,\\n  backendName:
```

```
'wasm',\n kernelFunc: fill as { } as KernelFunc,\n};\n", "/**\n
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the specific language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {FlipLeftRight, FlipLeftRightInputs, KernelConfig, KernelFunc, TensorInfo} from '@tensorflow/tfjs-
core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nlet wasmFlipLeftRight: (\n  xId: number, batch:
number, imageHeight: number, imageWidth: number,\n  numChannels:
number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n  wasmFlipLeftRight =
backend.wasm.cwrap(FlipLeftRight, null /* void */, [\n    'number', // xId\n    'number', // batch\n    'number', //
imageHeight\n    'number', // imageWidth\n    'number', // numChannels\n    'number', // outId\n  ]);\n}\n\nexport
function flipLeftRight(\n  args: {inputs: FlipLeftRightInputs, backend: BackendWasm}): TensorInfo {\n  const
{inputs, backend} = args;\n  const {image} = inputs;\n  const out = backend.makeOutput(image.shape,
image.dtype);\n  const imageId = backend.dataIdMap.get(image.dataId).id;\n  const outId =
backend.dataIdMap.get(out.dataId).id;\n  const [batch, imageHeight, imageWidth, numChannels] =
image.shape;\n  const wasmFlipLeftRight(\n    imageId, batch, imageHeight, imageWidth, numChannels, outId);\n
return out;\n}\n\nexport const flipLeftRightConfig: KernelConfig = {\n  kernelName: FlipLeftRight,\n
backendName: 'wasm',\n  kernelFunc: flipLeftRight
as { } as KernelFunc,\n  setupFunc: setup\n};\n", "/**\n
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=====
*\n\nimport {Floor, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from
'/unary_kernel';\n\nexport const floorConfig: KernelConfig = createUnaryKernelConfig(Floor);\n", "/**\n
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=====
*\n\nimport {FloorDiv, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createBinaryKernelConfig} from
'/binary_kernel';\n\nconst supportsFullBroadcast = false;\n\nexport const floorDivConfig: KernelConfig =\n  createBinaryKernelConfig(FloorDiv, supportsFullBroadcast);\n", "/**\n
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```



```

=====\\n
*\\n\\nimport {FusedBatchNorm, FusedBatchNormAttrs, FusedBatchNormInputs, KernelConfig, KernelFunc,
TensorInfo, util} from '@tensorflow/tfjs-core';\\n\\nimport {BackendWasm} from '../backend_wasm';\\n\\nlet
wasmBatchNorm: (\\n  xId: number, meanId: number, varianceId: number, offsetId: number,\\n  scaleId: number,
varianceEpsilon: number, outId: number) => void;\\n\\nfunction setup(backend: BackendWasm): void {\\n
wasmBatchNorm = backend.wasm.cwrap(\\n  FusedBatchNorm, null /* void */,\\n  ['number', 'number',
'number', 'number', 'number', 'number', 'number']);\\n}\\n\\nfunction fusedBatchNorm(args: {\\n  backend:
BackendWasm,\\n  inputs: FusedBatchNormInputs,\\n  attrs: FusedBatchNormAttrs\\n}): TensorInfo {\\n  const
{backend, inputs, attrs} = args;\\n  const {varianceEpsilon} = attrs;\\n  const {x, mean, variance, offset, scale} =
inputs;\\n  const xId = backend.dataIdMap.get(x.dataId).id;\\n  const meanId =
backend.dataIdMap.get(mean.dataId).id;\\n  const varianceId = backend.dataIdMap.get(variance.dataId).id;\\n  const
offsetId = offset != null ? backend.dataIdMap.get(offset.dataId).id : 0;\\n  const scaleId = scale != null ?
backend.dataIdMap.get(scale.dataId).id : 0;\\n\\n  const out = backend.makeOutput(x.shape, x.dtype);\\n  // Short-
circuit zero-sized tensors.\\n  if (util.sizeFromShape(x.shape) ===
0) {\\n    return out;\\n  }\\n\\n  const outId = backend.dataIdMap.get(out.dataId).id;\\n\\n  wasmBatchNorm(\\n    xId,
meanId, varianceId, offsetId, scaleId, varianceEpsilon, outId);\\n  return out;\\n}\\n\\nexport const
fusedBatchNormConfig: KernelConfig = {\\n  kernelName: FusedBatchNorm,\\n  backendName: 'wasm',\\n
setupFunc: setup,\\n  kernelFunc: fusedBatchNorm as {} as KernelFunc\\n};\\n", "/*\\n * @license\\n * Copyright 2019
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OR CONDITIONS OF ANY KIND, either express or implied.\\n * See the License for the specific language
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=====\\n
*\\n\\nimport {backend_util, FusedConv2D, FusedConv2DAttrs, FusedConv2DInputs, KernelConfig, KernelFunc,
Tensor4D} from '@tensorflow/tfjs-core';\\n\\nimport {BackendWasm} from '../backend_wasm';\\n\\nimport
{FusableActivation} from './types';\\n\\nlet wasmFusedConv2d: (\\n  xId: number, batchSize: number, inputHeight:
number, inputWidth: number,\\n  filterId: number, filterHeight: number, filterWidth: number,\\n  biasId: number,
padTop: number, padRight: number, padBottom: number,\\n  padLeft: number, isSamePad: number,
dilationHeight: number,\\n  dilationWidth: number, strideHeight: number, strideWidth: number,\\n
inputChannels: number, outputChannels: number, activation: number,\\n  preluActivationWeightsId: number,
leakyreluAlpha: number, outId: number) =>\\n  void;\\n\\nfunction setup(backend: BackendWasm) {\\n
wasmFusedConv2d = backend.wasm.cwrap(FusedConv2D, null /*
void */, [\\n  'number', // xId\\n  'number', // batchSize\\n  'number', // inputHeight\\n  'number', // inputWidth\\n
'number', // filterId\\n  'number', // filterHeight\\n  'number', // filterWidth\\n  'number', // biasId\\n  'number', //
padTop\\n  'number', // padRight\\n  'number', // padBottom\\n  'number', // padLeft\\n  'number', // isSamePad\\n
'number', // dilationHeight\\n  'number', // dilationWidth\\n  'number', // strideHeight\\n  'number', //
strideWidth\\n  'number', // inputChannels\\n  'number', // outputChannels\\n  'number', // activation\\n  'number',
// preluActivationWeightsId\\n  'number', // leakyreluAlpha\\n  'number', // outId\\n  ]);\\n}\\n\\nfunction
fusedConv2d(args: {\\n  inputs: FusedConv2DInputs,\\n  backend: BackendWasm,\\n  attrs: FusedConv2DAttrs\\n})
{\\n  const {inputs, attrs, backend} = args;\\n  const {x, filter, bias, preluActivationWeights} = inputs;\\n  const {\\n
strides,\\n  pad,\\n  dilations,\\n
dataFormat,\\n  dimRoundingMode,\\n  activation,\\n  leakyreluAlpha\\n  } = attrs;\\n\\n  const convInfo =
backend_util.computeConv2DInfo(\\n    (x as Tensor4D).shape, (filter as Tensor4D).shape, strides, dilations,\\n
pad, dimRoundingMode);\\n\\n  const fusedActivation =\\n    FusableActivation[activation as {} as keyof typeof
FusableActivation];\\n  if (fusedActivation == null) {\\n    throw new Error(\\n      `{$activation} activation not yet

```

```

supported for FusedConv2D `+` in the wasm backend.`);
}

const xId =
backend.dataIdMap.get(x.dataId).id;
const filterId = backend.dataIdMap.get(filter.dataId).id;
const
outputChannels = convInfo.outChannels;
let biasId = 0;
if (bias != null) {
const biasData =
backend.dataIdMap.get(bias.dataId);
if (biasData.shape.length !== 1) {
throw new Error(
`FusedConv2D only supports rank-1 bias but got ` +
`rank ${biasData.shape.length}.`);
}
if
(biasData.shape[0] !== outputChannels)
{
throw new Error(
`FusedConv2D bias shape (${biasData.shape}) does not ` +
`match the
number of output channels (${outputChannels})`);
}
biasId = biasData.id;
}

const filterHeight =
convInfo.filterHeight;
const filterWidth = convInfo.filterWidth;
const padTop = convInfo.padInfo.top;
const
padRight = convInfo.padInfo.right;
const padBottom = convInfo.padInfo.bottom;
const padLeft =
convInfo.padInfo.left;
const dilationHeight = convInfo.dilationHeight;
const dilationWidth =
convInfo.dilationWidth;
const strideHeight = convInfo.strideHeight;
const strideWidth =
convInfo.strideWidth;
const inputChannels = convInfo.inChannels;
const isSamePad = convInfo.padInfo.type
=== 'SAME' ? 1 : 0;
const batchSize = convInfo.batchSize;
const inHeight = convInfo.inHeight;
const
inWidth = convInfo.inWidth;
if (dataFormat !== 'NHWC') {
throw new Error(
`wasm backend
FusedConv2D does not
support dataFormat: ` +
`${dataFormat}'. Please use 'NHWC'.`);
}

const out =
backend.makeOutput(convInfo.outShape, 'float32');
const outId = backend.dataIdMap.get(out.dataId).id;
const
preluActivationWeightsId = preluActivationWeights == null ? 0 :
backend.dataIdMap.get(preluActivationWeights.dataId).id;

wasmFusedConv2d(
xId, batchSize, inHeight,
inWidth, filterId, filterHeight, filterWidth,
biasId, padTop, padRight, padBottom, padLeft, isSamePad,
dilationHeight,
dilationWidth, strideHeight, strideWidth, inputChannels, outputChannels,
fusedActivation,
preluActivationWeightsId, leakyreluAlpha || 0, outId);

return out;
}

export const fusedConv2DConfig:
KernelConfig = {
kernelName: FusedConv2D,
backendName: 'wasm',
setupFunc: setup,
kernelFunc:
fusedConv2d as {} as KernelFunc
};

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 */
=====
*/
import {backend_util, FusedDepthwiseConv2D, FusedDepthwiseConv2DAttrs,
FusedDepthwiseConv2DInputs, KernelConfig, KernelFunc, Tensor4D} from '@tensorflow/tfjs-core';
import
{BackendWasm} from './backend_wasm';
import {FusableActivation} from './types';
let
wasmFusedDepthwiseConv2d(
xId: number, batchSize: number, inputHeight: number, inputWidth: number,
filterId: number,
filterHeight: number, filterWidth: number,
biasId: number, padTop: number, padRight: number, padBottom:
number,
padLeft: number, isSamePad: number, dilationHeight: number,
dilationWidth: number,
strideHeight: number, strideWidth: number,
inputChannels: number, outputChannels: number, activation:
number,
preluActivationWeightsId: number, leakyreluAlpha: number, outId: number) =>
void;

function setup(backend: BackendWasm) {
wasmFusedDepthwiseConv2d =
backend.wasm.cwrap(FusedDepthwiseConv2D, null /* void */, [
number, // xId
number, //
batchSize
number, // inputHeight
number, // inputWidth
number, // filterId
number, //
filterHeight
number, // filterWidth
number, // biasId
number, // padTop
number, //
padRight
number, // padBottom
number, // padLeft
number, // isSamePad
number, // dilationHeight
number, // dilationWidth
number, // strideHeight
number, //
strideWidth
number, // inputChannels
number, // outputChannels
number, // activation

```



```

{params, indices} = inputs;\n\n const [resultShape, numSlices, sliceSize, strides] =\n
gather_util.prepareAndValidate(params, indices);\n\n const out = backend.makeOutput(resultShape,\n
params.dtype);\n\n if (numSlices === 0) {\n\n return out;\n\n }\n\n const indicesShape = indices.shape;\n\n const\n
sliceRank = indicesShape[indicesShape.length - 1];\n\n const xData = backend.dataIdMap.get(params.dataId);\n\n
const xId = xData.id;\n\n const indicesData = backend.dataIdMap.get(indices.dataId);\n\n const indicesId =\n
indicesData.id;\n\n const stridesBytes = new Uint8Array(new Int32Array(strides).buffer);\n\n const outId =\n
backend.dataIdMap.get(out.dataId).id;\n\n wasmGatherNd(\n\n xId, CppDType[params.dtype], indicesId,\n
numSlices, sliceRank, sliceSize,\n\n
stridesBytes, outId);\n\n return out;\n\n }\n\n\nexport const gatherNdConfig: KernelConfig = {\n\n kernelName:\n
GatherNd,\n\n backendName: 'wasm',\n\n setupFunc: setup,\n\n kernelFunc: gatherNd\n};\n\n", "/*\n\n * @license\n\n *\n
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the specific language governing permissions and\n\n * limitations under the License.\n\n *\n
=====
*\n\nimport { backend_util, GatherV2, GatherV2Attrs, GatherV2Inputs, KernelConfig,\n
KernelFunc, Tensor, TensorInfo, TypedArray, util } from '@tensorflow/tfjs-core';\n\nimport { BackendWasm } from\n
'./backend_wasm';\n\nimport { reshape } from './Reshape';\n\nimport { CppDType } from './types';\n\nlet wasmGather:\n
(\n\n xId: number, dtype: CppDType, xStrides: Uint8Array, stridesSize: number,\n\n indicesId: number, batchSize:\n
number, outStrides: Uint8Array,\n\n outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n\n
wasmGather = backend.wasm.cwrap('Gather', null /*void*/, [\n\n 'number', // xId\n\n 'number', // dtype\n\n 'array',\n
// xStrides\n\n 'number', // stridesSize\n\n 'number', // indicesId\n\n 'number', // batchSize\n\n 'array', //\n
outStrides\n\n 'number' // outId\n\n ]);\n\n\nfunction gatherV2(\n\n args: { backend: BackendWasm, inputs:\n
GatherV2Inputs, attrs: GatherV2Attrs }):\n\n TensorInfo {\n\n const { backend, inputs, attrs } = args;\n\n const { x,\n
indices } = inputs;\n\n const { axis, batchDims } = attrs;\n\n\n // Throw error when any\n
index is out of bound.\n\n const parsedAxis = util.parseAxisParam(axis, x.shape)[0];\n\n const indicesVals =\n
backend.readSync(indices.dataId) as TypedArray;\n\n const axisDim = x.shape[parsedAxis];\n\n for (let i = 0; i <\n
indicesVals.length; ++i) {\n\n const index = indicesVals[i];\n\n util.assert(\n\n index <= axisDim - 1 && index >=\n
0,\n\n () =>\n\n `GatherV2: the index value ${index} is not in [0, ${axisDim - 1}]`);\n\n }\n\n\n const\n
shapeInfo = backend_util.segment_util.collectGatherOpShapeInfo(\n\n x as Tensor, indices as Tensor, parsedAxis,\n
batchDims);\n\n\n const flattenX = reshape({\n\n inputs: { x },\n\n attrs: {\n\n shape: [\n\n shapeInfo.batchSize,\n
shapeInfo.outerSize, shapeInfo.dimSize,\n\n shapeInfo.sliceSize\n\n ]\n\n },\n\n backend\n\n });\n\n const\n
indicesSize = util.sizeFromShape(indices.shape);\n\n const flattenIndex = reshape({\n\n inputs: { x: indices },\n\n attrs:\n
{ shape: [shapeInfo.batchSize, indicesSize / shapeInfo.batchSize] },\n\n
backend\n\n });\n\n const flattenOutputShape = [\n\n shapeInfo.batchSize, shapeInfo.outerSize, indicesSize /\n
shapeInfo.batchSize,\n\n shapeInfo.sliceSize\n\n ];\n\n\n const out = backend.makeOutput(flattenOutputShape,\n
x.dtype);\n\n if (util.sizeFromShape(x.shape) === 0) {\n\n return out;\n\n }\n\n const stridesSize = flattenX.shape.length\n
- 1;\n\n const xData = backend.dataIdMap.get(flattenX.dataId);\n\n const xId = xData.id;\n\n\n const indicesData =\n
backend.dataIdMap.get(flattenIndex.dataId);\n\n const indicesId = indicesData.id;\n\n const outId =\n
backend.dataIdMap.get(out.dataId).id;\n\n\n const xStridesBytes = new Uint8Array(\n\n new\n
Int32Array(util.computeStrides(flattenX.shape)).buffer);\n\n const outStridesBytes = new Uint8Array(\n\n new\n
Int32Array(util.computeStrides(flattenOutputShape)).buffer);\n\n\n wasmGather(\n\n xId, CppDType[x.dtype],\n
xStridesBytes, stridesSize, indicesId,\n\n shapeInfo.batchSize, outStridesBytes, outId);\n\n\n
backend.disposeData(flattenX.dataId);\n\n\n
backend.disposeData(flattenIndex.dataId);\n\n\n // reshape\n\n out.shape = shapeInfo.outputShape;\n\n return\n
out;\n\n }\n\n\nexport const gatherV2Config: KernelConfig = {\n\n kernelName: GatherV2,\n\n backendName: 'wasm',\n

```

setupFunc: setup,\n kernelFunc: gatherV2 as { } as KernelFunc\n);\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *

=====\n\n * \nimport { Greater, KernelConfig } from '@tensorflow/tfjs-core';\n\nimport { createBinaryKernelConfig } from './binary_kernel';\n\nconst supportsFullBroadcast = false;\nexport const greaterConfig: KernelConfig =\ncreateBinaryKernelConfig(Greater, supportsFullBroadcast, 'bool');\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *

=====\n\n * \nimport { GreaterEqual, KernelConfig } from '@tensorflow/tfjs-core';\n\nimport { createBinaryKernelConfig } from './binary_kernel';\n\nconst supportsFullBroadcast = false;\nexport const greaterEqualConfig: KernelConfig =\ncreateBinaryKernelConfig(GreaterEqual, supportsFullBroadcast, 'bool');\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *

=====\n\n * \n\nimport { KernelConfig, KernelFunc, LeakyRelu, LeakyReluAttrs, LeakyReluInputs, TensorInfo, util } from '@tensorflow/tfjs-core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nimport { CppDType } from './types';\n\nlet wasmFunc: (\n xId: number, dtype: number, leakyreluAlpha: number, outId: number) => void;\n\nfunction setupFunc(backend: BackendWasm): void {\n wasmFunc = backend.wasm.cwrap(LeakyRelu, null /* void */, [\n 'number', // x_id\n 'number', // dtype\n 'number', // leakyrelu_alpha\n 'number', // out_id\n]);\n\nexport function leakyRelu(\n args: {\n inputs: LeakyReluInputs, attrs: LeakyReluAttrs, backend: BackendWasm }):\n TensorInfo {\n const { inputs: { x }, attrs: { alpha }, backend } = args;\n\n const xId = backend.dataIdMap.get(x.dataId).id;\n // According to TF API, LeakyRelu returns float32 when input is either float32\n // or int32.\n const out = backend.makeOutput(x.shape, 'float32');\n\n if (util.sizeFromShape(x.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmFunc(xId, CppDType[x.dtype], alpha, outId);\n }\n\n return out;\n }\n\nexport const leakyReluConfig: KernelConfig = {\n kernelName: LeakyRelu,\n backendName: 'wasm',\n setupFunc,\n kernelFunc: leakyRelu as { } as KernelFunc,\n);\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *

=====\n\n

```

*\nimport { KernelConfig, Less } from '@tensorflow/tfjs-core';\n\nimport { createBinaryKernelConfig } from
'./binary_kernel';\nconst supportsFullBroadcast = false;\nexport const lessConfig: KernelConfig =\ncreateBinaryKernelConfig(Less, supportsFullBroadcast, 'bool');\n"/**\n * @license\n * Copyright 2019 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not
use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport { KernelConfig, LessEqual } from '@tensorflow/tfjs-core';\n\nimport { createBinaryKernelConfig } from
'./binary_kernel';\nconst supportsFullBroadcast = false;\nexport const lessEqualConfig: KernelConfig =\ncreateBinaryKernelConfig(LessEqual, supportsFullBroadcast, 'bool');\n"/**\n * @license\n * Copyright 2019
Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you
may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*\nimport { KernelConfig, Log } from '@tensorflow/tfjs-core';\n\nimport { createUnaryKernelConfig } from
'./unary_kernel';\nexport const logConfig: KernelConfig = createUnaryKernelConfig(Log);\n"/**\n * @license\n *
Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
"License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====
*\nimport { KernelConfig, LogicalAnd }
from '@tensorflow/tfjs-core';\n\nimport { createBinaryKernelConfig } from './binary_kernel';\nconst
supportsFullBroadcast = false;\nexport const logicalAndConfig: KernelConfig =\ncreateBinaryKernelConfig(LogicalAnd, supportsFullBroadcast, 'bool');\n"/**\n * @license\n * Copyright 2019
Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you
may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport { backend_util,
KernelConfig, KernelFunc, Max, MaxAttrs, MaxInputs, TensorInfo, util } from '@tensorflow/tfjs-core';\n\nimport
{ BackendWasm } from './backend_wasm';\n\nimport { permuteAxesAndTranspose } from './kernel_utils';\nimport
{ CppDType } from './types';\n\nlet wasmMax: (xId: number, dtype: number, reduceSize: number, outId: number)
=>\n  void;\n\nfunction setup(backend: BackendWasm): void {\n  wasmMax = backend.wasm.cwrap(Max, null
/*void*/, [\n    'number', // x_id\n    'number', // dtype\n    'number', // reduce_size\n    'number', // out_id\n
]);\n\n  function max(args: { backend: BackendWasm, inputs: MaxInputs, attrs: MaxAttrs }):\n    TensorInfo {\n    const { backend, inputs, attrs } = args;\n    const { reductionIndices: axis, keepDims } = attrs;\n    const { x } = inputs;\n

```

```
const xId = backend.dataIdMap.get(x.dataId).id;\n let inputId = xId;\n let input = x;\n\n const {transposed, axes,\n originalAxes, inputWasTransposed} =\n   permuteAxesAndTranspose(x, axis, backend);\n\n if\n    (inputWasTransposed)\n {\n   const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n   input = transposed;\n   inputId =\n     transposedId;\n }\n\n const inputRank = input.shape.length;\n backend_util.assertAxesAreInnerMostDims('max',\n axes, inputRank);\n\n const [outShape, reduceSize] =\n   backend_util.computeOutAndReduceShapes(input.shape, axes);\n\n const reduceSize =\n   util.sizeFromShape(reduceSize);\n\n const out = backend.makeOutput(outShape, x.dtype);\n\n if\n   (util.sizeFromShape(input.shape) !== 0) {\n     const outId = backend.dataIdMap.get(out.dataId).id;\n\n     wasmMax(inputId, CppDType[x.dtype], reduceSize, outId);\n   }\n\n if (inputWasTransposed) {\n     // dispose of the\n     transposed tensor.\n     backend.disposeData(transposed.dataId);\n   }\n\n if (keepDims) {\n     // reshape\n     const\n     newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n     out.shape = newShape;\n   }\n\n return out;\n}\n\nexport const maxConfig: KernelConfig = {\n kernelName: Max,\n\n  backendName: 'wasm',\n  setupFunc: setup,\n  kernelFunc: max as {} as KernelFunc\n};\n\n"/**\n * @license\n *\n Copyright 2019 Google LLC. All Rights Reserved.\n *\n Licensed under the Apache License, Version 2.0 (the\n "\nLicense"\n);\n *\n you may not use this file except in compliance with the License.\n *\n You may obtain a copy of the\n License at\n *\n http://www.apache.org/licenses/LICENSE-2.0\n *\n Unless required by applicable law or\n agreed to in writing, software\n *\n distributed under the License is distributed on an "AS IS" BASIS,\n *\n WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n *\n See the License for\n the specific language governing permissions and\n limitations under the License.\n */\n\n=====\n*/\nimport {KernelConfig, Maximum} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from\n './binary_kernel';\nconst supportsFullBroadcast = false;\nexport const maximumConfig:\n\n KernelConfig =\n   createBinaryKernelConfig(Maximum, supportsFullBroadcast);\n\n"/**\n * @license\n *\n Copyright 2019 Google LLC. All Rights Reserved.\n *\n Licensed under the Apache License, Version 2.0 (the\n "\nLicense"\n);\n *\n you may not use this file except in compliance with the License.\n *\n You may obtain a copy of the\n License at\n *\n http://www.apache.org/licenses/LICENSE-2.0\n *\n Unless required by applicable law or\n agreed to in writing, software\n *\n distributed under the License is distributed on an "AS IS" BASIS,\n *\n WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n *\n See the License for\n the specific language governing permissions and\n limitations under the License.\n */\n\n=====\n*/\nimport {backend_util, KernelConfig, KernelFunc, MaxPool, MaxPoolAttrs, MaxPoolInputs, Tensor4D, util}\nfrom '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nlet\n\n wasmMaxPool: (\n   xId: number, batchSize: number, inputHeight: number, inputWidth: number,\n   filterHeight:\n     number, filterWidth: number, padTop: number, padRight: number,\n   padBottom: number, padLeft: number,\n     dilationHeight: number,\n     dilationWidth: number, strideHeight: number, strideWidth: number,\n   inputChannels:\n     number, outputChannels: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n\n   wasmMaxPool = backend.wasm.cwrap(MaxPool, null /* void */, [\n     'number', // xId\n     'number', // batchSize\n     'number', // inputHeight\n     'number', // inputWidth\n     'number', // filterHeight\n     'number', // filterWidth\n     'number', // padTop\n     'number', // padRight\n     'number', // padBottom\n     'number', // padLeft\n     'number', // dilationHeight\n     'number', // dilationWidth\n     'number', // strideHeight\n     'number', // strideWidth\n     'number', // inputChannels\n     'number', // outputChannels\n     'number', // outId\n   ]);\n\n   function maxPool(\n     args: {inputs: MaxPoolInputs, backend: BackendWasm, attrs: MaxPoolAttrs}) {\n       const {inputs, attrs, backend} = args;\n\n       const x = inputs.x as Tensor4D;\n       const xId =\n         backend.dataIdMap.get(x.dataId).id;\n\n       // TF API supports int32 input. CPU and WebGL backend also support\n       int32\n       // input. WASM backend doesn't support it because it uses xnnpack which only\n       // supports float32.\n       /\n\n       // Add the following assert only for the WASM backend instead of at core op\n       // level.\n       /\n       // TODO: add\n       support for int32 input.\n       util.assert(\n         x.dtype === 'float32',\n         () =>\n           `Error in MaxPool: only float32`
```

```

input is supported. Got ${x.dtype}.`);\n\n const {filterSize, strides, pad, dimRoundingMode} = attrs;\n const
convInfo = backend_util.computePool2DInfo(\n    x.shape, filterSize, strides, 1 /* dilations */, pad,
dimRoundingMode);\n\n const filterHeight = convInfo.filterHeight;\n const filterWidth = convInfo.filterWidth;\n
const padTop = convInfo.padInfo.top;\n const padRight = convInfo.padInfo.right;\n const padBottom =
convInfo.padInfo.bottom;\n const padLeft = convInfo.padInfo.left;\n const dilationHeight =
convInfo.dilationHeight;\n const dilationWidth = convInfo.dilationWidth;\n const strideHeight =
convInfo.strideHeight;\n const strideWidth = convInfo.strideWidth;\n const inputChannels =
convInfo.inChannels;\n const outputChannels = convInfo.outChannels;\n\n if (convInfo.dataFormat !==
'channelsLast') {\n    throw new Error(\n        `wasm backend does not support dataFormat: "${convInfo.dataFormat}"`. Please use 'channelsLast'.`);\n };\n\n const out =
backend.makeOutput(convInfo.outShape, 'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n
wasmMaxPool(\n    xId, x.shape[0], x.shape[1], x.shape[2], filterHeight, filterWidth,\n    padTop, padRight, padBottom, padLeft, dilationHeight, dilationWidth,\n    strideHeight, strideWidth, inputChannels, outputChannels,
outId);\n return out;\n}\n\nexport const maxPoolConfig: KernelConfig = {\n    kernelName: MaxPool,\n    backendName: 'wasm',\n    setupFunc: setup,\n    kernelFunc: maxPool as { } as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
"License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n */\n
=====
*\n\nimport {backend_util, KernelConfig, KernelFunc, Mean, MeanAttrs, MeanInputs,
TensorInfo, util} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\nimport {cast}
from './Cast';\n\nimport {permuteAxesAndTranspose} from './kernel_utils';\n\nlet wasmMean: (xId: number,
reduceSize: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n    wasmMean =\n        backend.wasm.cwrap(Mean, null /*void*/, ['number, number, number']);\n\n\nexport function mean(\n    args:
{backend: BackendWasm, inputs: MeanInputs, attrs: MeanAttrs});\n    TensorInfo {\n        const {backend, inputs,
attrs} = args;\n        const {axis, keepDims} = attrs;\n        const {x} = inputs;\n        const xId =
backend.dataIdMap.get(x.dataId).id;\n        let inputId = xId;\n        let input = x;\n\n        const {transposed, axes, originalAxes,
inputWasTransposed} =\n            permuteAxesAndTranspose(x, axis, backend);\n\n        let reductionAxes = axes;\n        if
(inputWasTransposed) {\n            const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n            if (transposedId
!== xId) {\n
                // transpose was not a no-op. We will need to dispose of this\n                // once we are done.\n                input = transposed;\n                inputId = transposedId;\n                reductionAxes = backend_util.getInnerMostAxes(\n                    reductionAxes.length,
input.shape.length);\n            }\n\n            backend_util.assertAxesAreInnerMostDims(\n                'mean', reductionAxes,
input.shape.length);\n            const [outShape, reduceShape] =\n                backend_util.computeOutAndReduceShapes(input.shape, reductionAxes);\n            const reduceSize =
util.sizeFromShape(reduceShape);\n            let castedInput = input;\n            if (input.dtype !== 'float32') {\n                castedInput =\n                    cast({backend, inputs: {x: input}, attrs: {dtype: 'float32'}});\n                inputId =
backend.dataIdMap.get(castedInput.dataId).id;\n            }\n\n            const out = backend.makeOutput(outShape, 'float32');\n            if
(util.sizeFromShape(input.shape) !== 0) {\n                const outId = backend.dataIdMap.get(out.dataId).id;\n                wasmMean(inputId, reduceSize, outId);\n            }\n\n            if (inputWasTransposed) {\n
                // dispose of the transposed tensor.\n                backend.disposeData(transposed.dataId);\n            }\n\n            if (keepDims) {\n                //
reshape\n                const newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n                out.shape =
newShape;\n            }\n\n            if (input.dtype !== 'float32') {\n                backend.disposeData(castedInput.dataId);\n            }\n\n            return
out;\n        }\n\n\nexport const meanConfig: KernelConfig = {\n    kernelName: Mean,\n    backendName: 'wasm',\n    setupFunc: setup,\n    kernelFunc: mean as { } as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2019 Google

```


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ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *

```
=====\n\n*\n\nimport {backend_util, KernelConfig, KernelFunc, Min, MinAttrs, MinInputs, TensorInfo, util} from\n '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport\n {permuteAxesAndTranspose} from './kernel_utils';\n\nimport {CppType} from './types';\n\nlet wasmMin: (xId:\n number, dtype: number, reduceSize: number, outId: number) =>\n void;\n\nfunction setup(backend:\n BackendWasm): void {\n  wasmMin = backend.wasm.cwrap(Min, null /*void*/, [\n    'number', // x_id\n    'number', // dtype\n    'number', // reduce_size\n    'number', // out_id\n  ]);\n\n  function min(args: {backend:\n BackendWasm, inputs: MinInputs, attrs: MinAttrs}): \n    TensorInfo {\n    const {backend, inputs, attrs} = args;\n    const {axis, keepDims} = attrs;\n    const {x}\n      = inputs;\n    const xId = backend.dataIdMap.get(x.dataId).id;\n    let inputId = xId;\n    let input = x;\n\n    const\n      {transposed, axes, originalAxes, inputWasTransposed} =\n      permuteAxesAndTranspose(x, axis, backend);\n\n    if\n      (inputWasTransposed) {\n      const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n      if (transposedId\n        !== xId) {\n      // transpose was not a no-op. We will need to dispose of this\n      // once we are done.\n      input =\n        transposed;\n      inputId = transposedId;\n      }\n    }\n\n    const inputRank = input.shape.length;\n\n    backend_util.assertAxesAreInnerMostDims('min', axes, inputRank);\n    const [outShape, reduceShape] =\n      backend_util.computeOutAndReduceShapes(input.shape, axes);\n    const reduceSize =\n      util.sizeFromShape(reduceShape);\n\n    const out = backend.makeOutput(outShape, input.dtype);\n\n    if\n      (util.sizeFromShape(input.shape) !== 0) {\n      const outId = backend.dataIdMap.get(out.dataId).id;\n      wasmMin(inputId, CCppType[x.dtype], reduceSize,\n        outId);\n    }\n\n    if (inputWasTransposed) {\n      // dispose of the transposed tensor.\n      backend.disposeData(transposed.dataId);\n    }\n\n    if (keepDims) {\n      // reshape\n      const newShape =\n        backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n      out.shape = newShape;\n    }\n\n    return\n      out;\n  }\n\n  export const minConfig: KernelConfig = {\n    kernelName: Min,\n    backendName: 'wasm',\n    setupFunc:\n      setup,\n    kernelFunc: min as {\n      } as KernelFunc\n  };\n\n  /**\n   * @license\n   * Copyright 2019 Google LLC. All Rights Reserved.\n   * Licensed under the Apache License, Version 2.0 (the \"License\");\n   * you may not use this file except in compliance with the License.\n   * You may obtain a copy of the License at\n   *  
http://www.apache.org/licenses/LICENSE-2.0\n   * Unless required by applicable law or agreed to in writing, software\n   * distributed under the License is distributed on an \"AS IS\" BASIS,\n   * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n
```

* See the License for the specific language governing permissions and\n * limitations under the License.\n *

```
=====\n\n*\n\nimport {KernelConfig, Minimum} from '@tensorflow/tfjs-core';\n\nimport {createBinaryKernelConfig} from\n './binary_kernel';\n\nconst supportsFullBroadcast = false;\n\nexport const minimumConfig: KernelConfig =\n  createBinaryKernelConfig(Minimum, supportsFullBroadcast);\n\n/**\n   * @license\n   * Copyright 2021 Google LLC. All Rights Reserved.\n   * Licensed under the Apache License, Version 2.0 (the \"License\");\n   * you may not use this file except in compliance with the License.\n   * You may obtain a copy of the License at\n   *  
http://www.apache.org/licenses/LICENSE-2.0\n   * Unless required by applicable law or agreed to in writing, software\n   * distributed under the License is distributed on an \"AS IS\" BASIS,\n   * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n   * See\n     the License for the specific language governing permissions and\n     limitations under the License.\n   */\n
```

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```

*\\n\\nimport { KernelConfig, KernelFunc, MirrorPad, MirrorPadAttrs, MirrorPadInputs } from '@tensorflow/tfjs-
core';\\n\\nimport { BackendWasm } from './backend_wasm';\\n\\nimport { CppDType } from './types';\\n\\n// Must match
enum in MirrorPad.cc\\nenum MirrorPaddingMode {\\n  reflect = 0,\\n  symmetric = 1\\n}\\n\\nlet wasmMirrorPad: (\\n
  xId: number, xShapeBytes: Uint8Array, xShapeLength: number, xDtype: number,\\n  prePaddingsBytes:
  Uint8Array, postPaddingsBytes: Uint8Array, mode: number,\\n  outId: number) => void;\\n\\nfunction
  setup(backend: BackendWasm) {\\n  wasmMirrorPad = backend.wasm.cwrap(MirrorPad, null /* void */, [\\n
    'number', // xId\\n    'array', // x.shape\\n    'number', // x.shape.length\\n    'number', // x.dtype\\n    'array', // pre-
    paddings\\n    'array', // post-paddings\\n    'number',
    // mode\\n    'number', // outId\\n  ]);\\n\\n\\nfunction mirrorPad(args: {\\n  inputs: MirrorPadInputs,\\n  backend:
  BackendWasm,\\n  attrs: MirrorPadAttrs\\n}) {\\n  const {inputs: {x}, backend, attrs: {paddings, mode}} = args;\\n\\n
  const outShape = paddings.map(\\n    (p, i) => p[0] /* beforePad */ + x.shape[i] + p[1] /* afterPad */);\\n  const xId =
  backend.dataIdMap.get(x.dataId).id;\\n  const out = backend.makeOutput(outShape, x.dtype);\\n  const outId =
  backend.dataIdMap.get(out.dataId).id;\\n  const xShapeBytes = new Uint8Array(new
  Int32Array(x.shape).buffer);\\n\\n  const prePaddingsFlat = paddings.map(padTuple => padTuple[0]);\\n  const
  postPaddingsFlat = paddings.map(padTuple => padTuple[1]);\\n  const prePaddingsBytes =\\n    new
  Uint8Array(new Int32Array(prePaddingsFlat).buffer);\\n  const postPaddingsBytes =\\n    new Uint8Array(new
  Int32Array(postPaddingsFlat).buffer);\\n\\n  wasmMirrorPad(\\n    xId, xShapeBytes, x.shape.length,
  CppDType[x.dtype], prePaddingsBytes,\\n    postPaddingsBytes,
  MirrorPaddingMode[mode], outId);\\n  return out;\\n}\\n\\n\\nexport const mirrorPadConfig: KernelConfig = {\\n
  kernelName: MirrorPad,\\n  backendName: 'wasm',\\n  kernelFunc: mirrorPad as { } as KernelFunc,\\n  setupFunc:
  setup\\n};\\n", "/*\\n * @license\\n * Copyright 2019 Google LLC. All Rights Reserved.\\n * Licensed under the
  Apache License, Version 2.0 (the 'License');\\n * you may not use this file except in compliance with the
  License.\\n * You may obtain a copy of the License at\\n * \\n * http://www.apache.org/licenses/LICENSE-2.0\\n *\\n *
  Unless required by applicable law or agreed to in writing, software\\n * distributed under the License is distributed
  on an 'AS IS' BASIS,\\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
  implied.\\n * See the License for the specific language governing permissions and\\n * limitations under the
  License.\\n *
  =====\\n
*\\n\\nimport { KernelConfig, Multiply } from '@tensorflow/tfjs-core';\\n\\nimport
  { createBinaryKernelConfig } from './binary_kernel';\\n\\nconst supportsFullBroadcast = true;\\nexport const
  multiplyConfig: KernelConfig =\\n  createBinaryKernelConfig(Multiply, supportsFullBroadcast);\\n", "/*\\n *
  @license\\n * Copyright 2020 Google LLC. All Rights Reserved.\\n * Licensed under the Apache License, Version
  2.0 (the 'License');\\n * you may not use this file except in compliance with the License.\\n * You may obtain a
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  WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\\n * See the License for
  the specific language governing permissions and\\n * limitations under the License.\\n *
  =====\\n
*\\nimport { KernelConfig, Neg } from '@tensorflow/tfjs-core';\\n\\nimport
  { createUnaryKernelConfig } from './unary_kernel';\\nexport const negConfig: KernelConfig =
  createUnaryKernelConfig(Neg);\\n", "/*\\n * @license\\n * Copyright 2019 Google LLC. All Rights Reserved.\\n *
  Licensed under the Apache License, Version 2.0 (the 'License');\\n * you may not use this file except in
  compliance with the License.\\n * You may obtain a copy of the License at\\n * \\n *
  http://www.apache.org/licenses/LICENSE-2.0\\n *\\n * Unless required by applicable law or agreed to in writing,
  software\\n * distributed under the License is distributed on an 'AS IS' BASIS,\\n * WITHOUT WARRANTIES
  OR CONDITIONS OF ANY KIND, either express or implied.\\n * See the License for the specific language
  governing permissions and\\n * limitations under the License.\\n *
  =====\\n

```

```

*\n\nimport { BackendWasm } from './backend_wasm';\n\n// Analogous to `struct Result` in
`non_max_suppression_impl.h`. \n\ninterface Result
{
  \n  pSelectedIndices: number;\n  selectedSize: number;\n  pSelectedScores: number;\n  pValidOutputs:
number;\n}\n/**\n * Parse the result of the c++ method, which has the shape equivalent to\n * `Result`. \n */\nexport
function parseResultStruct(\n  backend: BackendWasm, resOffset: number): Result {\n  const result = new
Int32Array(backend.wasm.HEAPU8.buffer, resOffset, 4);\n  const pSelectedIndices = result[0];\n  const
selectedSize = result[1];\n  const pSelectedScores = result[2];\n  const pValidOutputs = result[3];\n  // Since the
result was allocated on the heap, we have to delete it.\n  backend.wasm._free(resOffset);\n  return
{pSelectedIndices, selectedSize, pSelectedScores, pValidOutputs};\n}\n", "/*\n * @license\n * Copyright 2019
Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you
may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n
*\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is
distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n */
===== \n
*\n\nimport { KernelConfig, KernelFunc, NonMaxSuppressionV3, NonMaxSuppressionV3Attrs,
NonMaxSuppressionV3Inputs, TensorInfo } from '@tensorflow/tfjs-core';\n\nimport { BackendWasm } from
'./backend_wasm';\n\nimport { parseResultStruct } from './NonMaxSuppression_util';\n\nlet wasmFunc: (\n
boxesId: number, scoresId: number, maxOutputSize: number,\n  iouThreshold: number, scoreThreshold: number)
=> number;\n\nfunction setup(backend: BackendWasm): void {\n  wasmFunc = backend.wasm.cwrap(\n
NonMaxSuppressionV3,\n    'number', // Result*\n    [\n
      'number', // boxesId\n      'number', // scoresId\n      'number', // maxOutputSize\n      'number', //
iouThreshold\n      'number', // scoreThreshold\n    ]);\n\n  function kernelFunc(args: {\n    backend:
BackendWasm,\n    inputs: NonMaxSuppressionV3Inputs,\n    attrs: NonMaxSuppressionV3Attrs\n  }): TensorInfo {\n
const { backend, inputs, attrs } = args;\n  const { iouThreshold, maxOutputSize, scoreThreshold } = attrs;\n  const
{ boxes, scores } = inputs;\n  const boxesId = backend.dataIdMap.get(boxes.dataId).id;\n  const scoresId =
backend.dataIdMap.get(scores.dataId).id;\n  const resOffset =\n    wasmFunc(boxesId, scoresId, maxOutputSize,
iouThreshold, scoreThreshold);\n  const { pSelectedIndices, selectedSize, pSelectedScores, pValidOutputs } =\n
parseResultStruct(backend, resOffset);\n  // Since we are not using scores for V3, we have to delete it from the
heap.\n  backend.wasm._free(pSelectedScores);\n  backend.wasm._free(pValidOutputs);\n  const
selectedIndicesTensor
    =\n    backend.makeOutput([selectedSize, 'int32', pSelectedIndices]);\n  return
selectedIndicesTensor;\n}\n\nexport const nonMaxSuppressionV3Config: KernelConfig = {\n  kernelName:
NonMaxSuppressionV3,\n  backendName: 'wasm',\n  setupFunc: setup,\n  kernelFunc: kernelFunc as { } as
KernelFunc,\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
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distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n */
===== \n
*\n\nimport { KernelConfig, KernelFunc, NonMaxSuppressionV4, NonMaxSuppressionV4Attrs,
NonMaxSuppressionV4Inputs, TensorInfo } from '@tensorflow/tfjs-core';\n\nimport { BackendWasm } from
'./backend_wasm';\n\nimport { parseResultStruct } from './NonMaxSuppression_util';\n\nlet wasmFunc: (\n
boxesId: number, scoresId: number, maxOutputSize: number,\n  iouThreshold: number, scoreThreshold: number,\n

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    padToMaxOutputSize: boolean) => number;\n\nfunction setup(backend: BackendWasm): void {\n  wasmFunc =
  backend.wasm.cwrap(\n    NonMaxSuppressionV4,\n    'number', // Result*\n    [\n      'number', // boxesId\n      'number', // scoresId\n      'number', // maxOutputSize\n      'number', // iouThreshold\n      'number', //
  scoreThreshold\n      'bool', // padToMaxOutputSize\n    ]);\n}\n\nfunction nonMaxSuppressionV4(args: {\n  backend: BackendWasm,\n  inputs: NonMaxSuppressionV4Inputs,\n  attrs: NonMaxSuppressionV4Attrs\n}):
  TensorInfo[] {\n  const {backend, inputs, attrs} = args;\n  const {iouThreshold, maxOutputSize, scoreThreshold,
  padToMaxOutputSize} =\n    attrs;\n  const {boxes, scores} = inputs;\n\n  const boxesId =
  backend.dataIdMap.get(boxes.dataId).id;\n  const scoresId = backend.dataIdMap.get(scores.dataId).id;\n\n  const
  resOffset = wasmFunc(\n    boxesId, scoresId, maxOutputSize, iouThreshold, scoreThreshold,\n    padToMaxOutputSize);\n\n  const {pSelectedIndices, selectedSize, pSelectedScores, pValidOutputs} =\n    parseResultStruct(backend, resOffset);\n\n  // Since we are not using scores for V4, we have to delete it from the
  heap.\n  backend.wasm._free(pSelectedScores);\n\n  const selectedIndicesTensor =\n    backend.makeOutput([selectedSize], 'int32', pSelectedIndices);\n\n  const validOutputsTensor =
  backend.makeOutput([], 'int32', pValidOutputs);\n\n  return [selectedIndicesTensor,
  validOutputsTensor];\n}\n\nexport const nonMaxSuppressionV4Config: KernelConfig = {\n  kernelName:
  NonMaxSuppressionV4,\n  backendName: 'wasm',\n  setupFunc: setup,\n  kernelFunc: nonMaxSuppressionV4 as
  {\n    } as KernelFunc,\n  };\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed
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  required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
  on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
  implied.\n * See the License for the specific language governing permissions and\n * limitations under the
  License.\n */
  =====\n
  *\n\nimport {KernelConfig, KernelFunc, NonMaxSuppressionV5, NonMaxSuppressionV5Attrs,
  NonMaxSuppressionV5Inputs, TensorInfo} from '@tensorflow/tfjs-core';\n\nimport
  {BackendWasm} from '../backend_wasm';\n\nimport {parseResultStruct} from './NonMaxSuppression_util';\n\nlet
  wasmFunc:\n  (boxesId: number, scoresId: number, maxOutputSize: number,\n    iouThreshold: number,
  scoreThreshold: number, softNmsSigma: number) =>\n    number;\n\nfunction setup(backend: BackendWasm):
  void {\n  wasmFunc = backend.wasm.cwrap(\n    NonMaxSuppressionV5,\n    'number', // Result*\n    [\n
  'number', // boxesId\n      'number', // scoresId\n      'number', // maxOutputSize\n      'number', //
  iouThreshold\n      'number', // scoreThreshold\n      'number', // softNmsSigma\n    ]);\n}\n\nfunction
  kernelFunc(args: {\n  backend: BackendWasm,\n  inputs: NonMaxSuppressionV5Inputs,\n  attrs:
  NonMaxSuppressionV5Attrs\n}): TensorInfo[] {\n  const {backend, inputs, attrs} = args;\n  const {iouThreshold,
  maxOutputSize, scoreThreshold, softNmsSigma} = attrs;\n  const {boxes, scores} = inputs;\n\n  const boxesId =
  backend.dataIdMap.get(boxes.dataId).id;\n\n  const scoresId = backend.dataIdMap.get(scores.dataId).id;\n\n  const
  resOffset = wasmFunc(\n    boxesId,
  scoresId, maxOutputSize, iouThreshold, scoreThreshold,\n    softNmsSigma);\n\n  const {pSelectedIndices,
  selectedSize, pSelectedScores, pValidOutputs} =\n    parseResultStruct(backend, resOffset);\n\n  // Since we are
  not using validOutputs for V5, we have to delete it from the\n  // heap.\n  backend.wasm._free(pValidOutputs);\n\n  const
  selectedIndicesTensor =\n    backend.makeOutput([selectedSize], 'int32', pSelectedIndices);\n  const
  selectedScoresTensor =\n    backend.makeOutput([selectedSize], 'float32', pSelectedScores);\n\n  return
  [selectedIndicesTensor, selectedScoresTensor];\n}\n\nexport const nonMaxSuppressionV5Config: KernelConfig =
  {\n  kernelName: NonMaxSuppressionV5,\n  backendName: 'wasm',\n  setupFunc: setup,\n  kernelFunc: kernelFunc
  as {\n    } as KernelFunc,\n  };\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights
  Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file
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=====\n
*\nimport {KernelConfig, NotEqual} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from
'./binary_kernel';\nconst supportsFullBroadcast = false;\nexport const notEqualConfig: KernelConfig =\ncreateBinaryKernelConfig(NotEqual, supportsFullBroadcast, 'bool');\n"/**\n * @license\n * Copyright 2020
Google LLC. All
```

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```
=====\n
*\n\nimport {KernelConfig, KernelFunc, OneHot, OneHotAttrs, OneHotInputs} from '@tensorflow/tfjs-
core';\nimport {BackendWasm} from './backend_wasm';\n\nlet wasmOneHot: (\n  indicesId: number, depth:
number, onValue: number, offValue: number,\n  outId: number) => void;\n\nfunction setup(backend:
BackendWasm) {\n  wasmOneHot
    = backend.wasm.cwrap(OneHot, null /* void */, [\n    'number', // indices_id\n    'number', // depth,\n    'number', //
onValue\n    'number', // offValue\n    'number' // out_id\n  ]);\n\n  function oneHot(\n    args: {inputs:
OneHotInputs, attrs: OneHotAttrs, backend: BackendWasm}) {\n    const {inputs, backend, attrs} = args;\n    const
{indices} = inputs;\n    const {depth, onValue, offValue} = attrs;\n\n    const out =
backend.makeOutput([...indices.shape, depth], 'int32');\n    const outId = backend.dataIdMap.get(out.dataId).id;\n\n    const indicesData = backend.dataIdMap.get(indices.dataId);\n    const indicesId = indicesData.id;\n\n    wasmOneHot(indicesId, depth, onValue, offValue, outId);\n\n    return out;\n  }\n\n  export const oneHotConfig:
KernelConfig = {\n    kernelName: OneHot,\n    backendName: 'wasm',\n    setupFunc: setup,\n    kernelFunc: oneHot as
{ } as KernelFunc,\n  };\n  "/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed
under the Apache License, Version
```

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```
=====\n
*\n\nimport {KernelConfig, KernelFunc, OnesLike, OnesLikeInputs} from '@tensorflow/tfjs-core';\nimport
{BackendWasm} from './backend_wasm';\n\nfunction onesLike(args: {inputs: OnesLikeInputs, backend:
BackendWasm}) {\n  const {inputs: {x}, backend} = args;\n  const out = backend.makeOutput(x.shape, x.dtype);\n  const outVals = backend.toArrayFromHeap(out);\n  outVals.fill(1);\n  return
out;\n}\n\nexport const onesLikeConfig: KernelConfig = {\n  kernelName: OnesLike,\n  backendName: 'wasm',\n  kernelFunc: onesLike as { } as KernelFunc,\n};\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```

*\\n\\nimport { KernelConfig, KernelFunc, Pack, PackAttrs, PackInputs, TensorInfo, util } from '@tensorflow/tfjs-
core';\\nimport
{ BackendWasm } from '../backend_wasm';\\n\\nimport { concat } from './Concat';\\nimport { expandDims } from
'./ExpandDims';\\n\\nexport function pack(\\n  args: { inputs: PackInputs, backend: BackendWasm, attrs:
PackAttrs });\\n  TensorInfo {\\n    const { inputs, backend, attrs } = args;\\n    const { axis } = attrs;\\n\\n    if (inputs.length
=== 1) {\\n      return expandDims(\\n        { inputs: { input: inputs[0] }, backend, attrs: { dim: axis } });\\n    }\\n\\n    const
shape = inputs[0].shape;\\n    const dtype = inputs[0].dtype;\\n\\n    inputs.forEach(t => {\\n      util.assertShapesMatch(\\n
      shape, t.shape,\\n        'All tensors passed to stack must have matching shapes');\\n      util.assert(\\n        dtype ===
t.dtype,\\n        () => 'All tensors passed to stack must have matching dtypes');\\n    });\\n\\n    const
intermediateTensorInfos: TensorInfo[] = [];\\n    const expandedTensors = inputs.map(t => {\\n      const expandedT =\\n
      expandDims({ inputs: { input: t }, backend, attrs: { dim: axis } });\\n      intermediateTensorInfos.push(expandedT);\\n
      return expandedT;\\n    });\\n\\n    const result = concat({ inputs: expandedTensors, backend, attrs: { axis } });\\n\\n
intermediateTensorInfos.forEach(t => backend.disposeData(t.dataId));\\n\\n    return result;\\n}\\n\\nexport const
packConfig: KernelConfig = {\\n  kernelName: Pack,\\n  backendName: 'wasm',\\n  kernelFunc: pack as {} as
KernelFunc\\n};\\n"/**\\n * @license\\n * Copyright 2019 Google LLC. All Rights Reserved.\\n * Licensed under the
Apache License, Version 2.0 (the "License");\\n * you may not use this file except in compliance with the
License.\\n * You may obtain a copy of the License at\\n * http://www.apache.org/licenses/LICENSE-2.0\\n * Unless required by applicable law or agreed to in writing, software\\n * distributed under the License is distributed
on an "AS IS" BASIS,\\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\\n * See the License for the specific language governing permissions and\\n * limitations under the
License.\\n
* =====\\n
*\\n\\nimport { KernelConfig, KernelFunc, PadV2, PadV2Attrs, PadV2Inputs, util } from '@tensorflow/tfjs-
core';\\n\\nimport { BackendWasm } from '../backend_wasm';\\n\\nimport { fill } from './Fill';\\n\\nimport { CppDType }
from './types';\\n\\nlet wasmPadV2: (\\n  xId: number, xShapeBytes: Uint8Array, xShapeLength: number, xDtype:
number,\\n  prePaddingsBytes: Uint8Array, postPaddingsBytes: Uint8Array,\\n  constantValue: number, outId:
number) => void;\\n\\nfunction setup(backend: BackendWasm) {\\n  wasmPadV2 = backend.wasm.cwrap(PadV2, null
/* void */, [\\n    'number', // xId\\n    'array', // x.shape\\n    'number', // x.shape.length\\n    'number', // x.dtype\\n
'array', // pre-paddings\\n    'array', // post-paddings\\n    'number', // constantValue\\n    'number', // outId\\n
]);\\n}\\n\\nfunction pad(\\n  args: { inputs: PadV2Inputs, backend: BackendWasm, attrs: PadV2Attrs }) {\\n  const
{ inputs: { x }, backend,
  attrs: { paddings, constantValue } } = args;\\n\\n  const outShape = paddings.map(\\n    (p, i) => p[0] /* beforePad */ +
x.shape[i] + p[1] /* afterPad */);\\n\\n  if (util.sizeFromShape(x.shape) === 0) {\\n    // Short-circuit the computation,
since x doesn't have value, only\\n    // the shape is used to compute output shape to pad.\\n    return fill({\\n
      backend,\\n      attrs: { shape: outShape, value: constantValue, dtype: x.dtype }\\n    });\\n  }\\n\\n  const xId =
backend.dataIdMap.get(x.dataId).id;\\n  const out = backend.makeOutput(outShape, x.dtype);\\n  const
outTensorData = backend.dataIdMap.get(out.dataId);\\n  const outId = outTensorData.id;\\n\\n  const xShapeBytes =
new Uint8Array(new Int32Array(x.shape).buffer);\\n\\n  const prePaddingsFlat = paddings.map(padTuple =>
padTuple[0]);\\n  const postPaddingsFlat = paddings.map(padTuple => padTuple[1]);\\n  const prePaddingsBytes =\\n
new Uint8Array(new Int32Array(prePaddingsFlat).buffer);\\n  const postPaddingsBytes =\\n  new
Uint8Array(new
Int32Array(postPaddingsFlat).buffer);\\n\\n  wasmPadV2(\\n    xId, xShapeBytes, x.shape.length,
CppType[x.dtype], prePaddingsBytes,\\n    postPaddingsBytes, constantValue, outId);\\n  return out;\\n}\\n\\nexport
const padV2Config: KernelConfig = {\\n  kernelName: PadV2,\\n  backendName: 'wasm',\\n  kernelFunc: pad as {} as
KernelFunc,\\n  setupFunc: setup\\n};\\n"/**\\n * @license\\n * Copyright 2019 Google LLC. All Rights Reserved.\\n
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* =====\n*\nimport {KernelConfig, Pow} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from\n './binary_kernel';\nconst supportsFullBroadcast = false;\nexport const powConfig: KernelConfig =\n createBinaryKernelConfig(Pow, supportsFullBroadcast);\n"/**\n * @license\n * Copyright 2019 Google LLC. All\n * Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this\n * file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *\n
```

```
===== \n*\nimport {KernelConfig, KernelFunc, Prelu, PreluInputs} from '@tensorflow/tfjs-core';\nimport\n {BackendWasm} from './backend_wasm';\nimport {cast} from './Cast';\nlet wasmPrelu: (xId: number,\n weightsId: number, outId: number) => void;\nfunction setup(backend: BackendWasm) {\n  wasmPrelu =\n    backend.wasm.cwrap(Prelu, null /* void */, [\n      'number', // x_id\n      'number', // weights_id\n      'number' //\n      out_id\n    ]);\n  function prelu(args: {inputs: PreluInputs, backend: BackendWasm}) {\n    const {inputs, backend}\n    = args;\n    const {x, alpha} = inputs;\n    const xId = backend.dataIdMap.get(x.dataId).id;\n    const weightsId =\n      backend.dataIdMap.get(alpha.dataId).id;\n    let inputId = xId;\n    const input = x;\n    let castedInput = input;\n    if\n      (input.dtype !== 'float32') {\n        castedInput = cast({backend, inputs: {x}, attrs: {dtype: 'float32'}});\n        inputId =\n          backend.dataIdMap.get(castedInput.dataId).id;\n      }\n    const out = backend.makeOutput(x.shape, 'float32');\n    const outId = backend.dataIdMap.get(out.dataId).id;\n    wasmPrelu(inputId, weightsId, outId);\n    if (input.dtype !== 'float32') {\n      backend.disposeData(castedInput.dataId);\n    }\n    return out;\n  }\n  export const preluConfig: KernelConfig = {\n    kernelName: Prelu,\n    backendName: 'wasm',\n    setupFunc: setup,\n    kernelFunc: prelu as {} as\n    KernelFunc\n  };\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the\n * Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the\n * License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed\n * on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or\n * implied.\n * See the License for the specific language governing\n * permissions and\n * limitations under the License.\n *\n
```

```
===== \n*\nimport {backend_util, KernelConfig, KernelFunc, Prod, ProdAttrs, ProdInputs, TensorInfo, util} from\n '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nimport\n {permuteAxesAndTranspose} from './kernel_utils';\nimport {CppDType} from './types';\nlet wasmProd: (\n  xId: number, reduceSize: number,\n  dtype: number, outId: number) => void;\nfunction setup(backend:\n BackendWasm): void {\n  wasmProd = backend.wasm.cwrap(Prod, null /*void*/, [\n    'number',\n    'number',\n    'number',\n    'number'\n  ]);\n  function prod(args: {\n    backend: BackendWasm,\n    inputs: ProdInputs,\n    attrs:\n      ProdAttrs\n  }): TensorInfo {\n    const {backend, inputs, attrs} = args;\n    const {axis, keepDims} = attrs;\n    const {x}\n    = inputs;\n    const xId = backend.dataIdMap.get(x.dataId).id;\n    let inputId = xId;\n    let input = x;\n    const\n      {transposed, axes, originalAxes, inputWasTransposed} =\n        permuteAxesAndTranspose(x, axis, backend);\n    let reductionAxes = axes;\n    if (inputWasTransposed) {\n      const transposedId =\n        backend.dataIdMap.get(transposed.dataId).id;\n      if (transposedId !== xId) {\n        // transpose was not a no-op. We\n        will need to dispose of this\n        // once we are done.\n        input = transposed;\n        inputId = transposedId;\n        reductionAxes = backend_util.getInnerMostAxes(\n          reductionAxes.length, input.shape.length);\n      }\n    }\n  }\n
```

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backend_util.assertAxesAreInnerMostDims(\n    'prod', reductionAxes, input.shape.length);\n\nconst [outShape,\nreduceShape] =\n    backend_util.computeOutAndReduceShapes(input.shape, reductionAxes);\n\nconst reduceSize\n= util.sizeFromShape(reduceShape);\n\n\nconst out = backend.makeOutput(outShape, input.dtype);\n\nif\n(util.sizeFromShape(input.shape) !== 0) {\n    const outId = backend.dataIdMap.get(out.dataId).id;\n\nwasmProd(inputId, reduceSize,\n\nC++DType[out.dtype], outId);\n}\n\n\nif (inputWasTransposed) {\n    // dispose of the transposed tensor.\n\nbackend.disposeData(transposed.dataId);\n}\n\n\nif (keepDims) {\n    // reshape\n    const newShape =\nbackend_util.expandShapeToKeepDim(out.shape, originalAxes);\n    out.shape = newShape;\n}\n\n\nreturn\nout;\n}\n\n\nexport const prodConfig: KernelConfig = {\n    kernelName: Prod,\n    backendName: 'wasm',\n    setupFunc:\nsetup,\n    kernelFunc: prod as {} as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All\nRights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this\nfile except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,\nsoftware\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\nOR CONDITIONS OF ANY KIND, either\nexpress or implied.\n * See the License for the specific language governing permissions and\n * limitations under\nthe License.\n */\n\n\n=====\n\n*/\nimport {KernelConfig, KernelFunc, Range, RangeAttrs, TensorInfo} from '@tensorflow/tfjs-core';\nimport\n{BackendWasm} from '../backend_wasm';\nimport {rangeImplCPU} from '../kernel_utils/shared';\n\nexport const\nrange = (\nargs: {backend: BackendWasm, attrs: RangeAttrs}): TensorInfo => {\n    const {backend, attrs} =\nargs;\n    const {start, stop, step, dtype} = attrs;\n    const values = rangeImplCPU(start, stop, step, dtype);\n\nconst out = backend.makeOutput([values.length], dtype);\n    const outVals =\nbackendtypedArrayFromHeap(out);\n    outVals.set(values);\n    return out;\n};\n\nexport const rangeConfig:\nKernelConfig = {\n    kernelName: Range,\n    backendName: 'wasm',\n    kernelFunc: range as {} as\nKernelFunc\n};\n\n"/**\n * @license\n * \nCopyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n\"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\nLicense at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or\nagreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *\nWITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\nthe specific language governing permissions and\n * limitations under the License.\n */\n\n\n=====\n\n*/\nimport {util} from '@tensorflow/tfjs-core';\n\nexport function rangeImpl(start, stop, step, dtype) {\n    const\nsameStartStop = start === stop;\n    const increasingRangeNegativeStep = start < stop && step < 0;\n    const\ndecreasingRangePositiveStep = stop < start && step > 1;\n    if (sameStartStop\n|| increasingRangeNegativeStep ||\ndecreasingRangePositiveStep) {\n        return util.zerosTypedArray(0,\ndtype);\n    }\n    const numElements = Math.abs(Math.ceil((stop - start) / step));\n    const values =\nutil.zerosTypedArray(numElements, dtype);\n    if (stop < start && step === 1) {\n        // Auto adjust the\nstep's sign if it hasn't been set\n        // (or was set to 1)\n        step = -1;\n    }\n    values[0] = start;\n    for (let i = 1; i\n< values.length; i++) {\n        values[i] = values[i - 1] + step;\n    }\n    return values;\n}\n\n//\nsourceMappingURL=data:application/json;base64,eyJJZXZjaW9uIjozLCJmaXIIjoiUmFuZ2VfaW1wbC5qcycIsIn\nNvdXJjZVZjb3QioiOiLiLCJzb3VyY2VZljpbi4uLy4uLy4uLy4uL3RmanMtYmFJa2VuZC1jcHUvc3JlL2tlc\nm5lbHMvUumFuZ2VfaW1wbC50cyJdLCJuYW1lcyI6W710slmhHBpbmdzIjoiQUFBQTs7Ozs7Ozs7Ozs7O0\noBZUc7QUFFSCxPQUFPLEVBQWMsSUFBSxxFQUFDLE1BQU0sdUBQBXXVCLENBQUM7QUFFeEQsTUFBB\nTSxVQUFVLFNBNQVMsQ0FDcklsS0FBYSxFQUFFLEIBQVksRUFBRSxJUUFZFLEVBQ3pDLEtBQXdCO0IBQz\nFCLE1BQU0sYUFBYSxHQUFHLEtBQUssS0FBSSyxJUUFJLENBQUM7SUFDckMsTUFBTSwyQkFBMkIsR0F\nBRyXLQUFLLEDuBQUcsSUFBSsxJUUFJLEIBQUksR0FBRYxDQUFDLENBQUM7SUFDNDQsTUFBTSwyQkF
```


,"/**\n

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```

*\n\nimport { KernelConfig, RealDiv } from '@tensorflow/tfjs-core';\n\nimport { createBinaryKernelConfig } from
'./binary_kernel';\n\nconst supportsFullBroadcast = true;\n\nexport const realDivConfig: KernelConfig =\ncreateBinaryKernelConfig(RealDiv, supportsFullBroadcast);\n", "/**\n * @license\n * Copyright 2019 Google LLC.
All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *

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=====\n
*\n\nimport { KernelConfig, Relu } from '@tensorflow/tfjs-core';\n\nimport { createUnaryKernelConfig } from
'./unary_kernel';\n\nexport const reluConfig: KernelConfig = createUnaryKernelConfig(Relu);\n", "/**\n * @license\n
* Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
\"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *

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=====\n
*\n\nimport { KernelConfig, Relu6 } from '@tensorflow/tfjs-core';\n\nimport
{ createUnaryKernelConfig } from './unary_kernel';\n\nexport const relu6Config: KernelConfig =
createUnaryKernelConfig(Relu6);\n", "/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n *
Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in
compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *

```

```

=====\n
*\n\nimport { KernelConfig, KernelFunc, ResizeBilinear, ResizeBilinearAttrs, ResizeBilinearInputs, TensorInfo,
util } from '@tensorflow/tfjs-core';\n\nimport
{ BackendWasm } from '../backend_wasm';\n\nimport { cast } from './Cast';\n\nlet wasmResizeBilinear: (\n  xId:
number, batch: number, oldHeight: number, oldWidth: number,\n  numChannels: number, newHeight: number,
newWidth: number,\n  alignCorners: number, halfPixelCenters: number, outId: number) => void;\n\nfunction
setup(backend: BackendWasm): void {\n  wasmResizeBilinear = backend.wasm.cwrap(ResizeBilinear, null
/*void*/, [\n    'number', // xId\n    'number', // batch\n    'number', // oldHeight\n    'number', // oldWidth\n
'number', // numChannels\n    'number', // newHeight\n    'number', // newWidth\n    'number', // alignCorners\n
'number', // halfPixelCenters\n    'number' // outId\n  ]);\n\n  function resizeBilinear(args: {\n    backend:
BackendWasm,\n    inputs: ResizeBilinearInputs,\n    attrs: ResizeBilinearAttrs\n  }): TensorInfo {\n    const {backend,
inputs, attrs} = args;\n\n    const {images} = inputs;\n    const {alignCorners, halfPixelCenters,
size} = attrs;\n    const [newHeight, newWidth] = size;\n    const [batch, oldHeight, oldWidth, numChannels] =
images.shape;\n    const outShape = [batch, newHeight, newWidth, numChannels];\n\n    let xData =
backend.dataIdMap.get(images.dataId);\n    let castedData;\n    if (xData.dtype !== 'float32') {\n      castedData =\n        cast({backend, inputs: {x: images}, attrs: {dtype: 'float32'}});\n      xData =
backend.dataIdMap.get(castedData.dataId);\n    }\n    const xId = xData.id;\n\n    const out =
backend.makeOutput(outShape, 'float32');\n    if (util.sizeFromShape(images.shape) === 0) {\n      return out;\n    }\n
const outId = backend.dataIdMap.get(out.dataId).id;\n\n    wasmResizeBilinear(\n      xId, batch, oldHeight,
oldWidth, numChannels, newHeight, newWidth,\n      alignCorners ? 1 : 0, halfPixelCenters ? 1 : 0, outId);\n\n    if

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(castedData != null) {\n  backend.disposeData(castedData.dataId);\n }\n\n return out;\n}\n\nexport const
resizeBilinearConfig: KernelConfig = {\n  kernelName: ResizeBilinear,\n
  backendName: 'wasm',\n  setupFunc: setup,\n  kernelFunc: resizeBilinear as {} as KernelFunc\n};\n\n"/**\n *
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport { KernelConfig, KernelFunc, Reverse, ReverseAttrs, ReverseInputs, TensorInfo, util } from
'@tensorflow/tfjs-core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nimport
{ identity } from './Identity';\n\nimport { reshape } from './Reshape';\n\nlet wasmReverse: (\n  xId: number, axes:
Uint8Array, axesLength: number, outShape: Uint8Array,\n  outShapeLength: number, outId: number) =>
void;\n\nfunction setup(backend: BackendWasm) {\n  wasmReverse = backend.wasm.cwrap(Reverse, null, [\n
'number', // x_id\n 'array', // axes\n 'number', // axes_length\n 'array', // out_shape\n 'number', //
out_shape_length\n 'number' // out_id\n ]);\n}\n\nexport function reverse(\n  args: {inputs: ReverseInputs,
backend: BackendWasm, attrs: ReverseAttrs}): TensorInfo {\n  const {inputs, backend, attrs} = args;\n  const
{x} = inputs;\n  const {dims} = attrs;\n\n  const axes = util.parseAxisParam(dims, x.shape);\n\n  if (x.shape.length
=== 0) {\n    return identity({inputs: {x}, backend});\n  }\n\n  const out = backend.makeOutput(x.shape, x.dtype);\n
const xId = backend.dataIdMap.get(x.dataId).id;\n  const outId = backend.dataIdMap.get(out.dataId).id;\n\n
const axesBytes = new Uint8Array(new Int32Array(axes).buffer);\n  const outShapeBytes = new Uint8Array(new
Int32Array(x.shape).buffer);\n\n  wasmReverse(\n    xId, axesBytes, axes.length, outShapeBytes, x.shape.length,
outId);\n\n  const reshaped =\n    reshape({inputs: {x: out}, attrs: {shape: x.shape}, backend});\n\n
backend.disposeData(out.dataId);\n  return reshaped;\n}\n\nexport const reverseConfig: KernelConfig = {\n
kernelName: Reverse,\n  backendName: 'wasm',\n  kernelFunc: reverse as {} as KernelFunc,\n  setupFunc:
setup\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
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on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
=====
*\n\nimport { KernelConfig, KernelFunc, RotateWithOffset, RotateWithOffsetAttrs, RotateWithOffsetInputs,
TensorInfo } from '@tensorflow/tfjs-core';\n\nimport { backend_util } from '@tensorflow/tfjs-core';\n\nimport
{ BackendWasm } from '../backend_wasm';\n\nlet wasmRotate: (\n  xId: number, batch: number, imageHeight:
number, imageWidth: number,\n  numChannels: number, radians: number, centerX: number, centerY: number,\n
fillBytes: Uint8Array, fillLength: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n
wasmRotate = backend.wasm.cwrap(RotateWithOffset, null /* void */, [\n  'number', // xId\n 'number', //
batch\n 'number', // imageHeight\n 'number', //
imageWidth\n 'number', // numChannels\n 'number', // radians\n 'number', // centerX\n 'number', //
centerY\n 'array', // fillBytes\n 'number', // fillLength\n 'number', // outId\n ]);\n}\n\nexport function
rotateWithOffset(args: {\n  inputs: RotateWithOffsetInputs,\n  backend: BackendWasm,\n  attrs:
RotateWithOffsetAttrs\n}): TensorInfo {\n  const {inputs, backend, attrs} = args;\n  const {image} = inputs;\n  const
{radians, fillValue, center} = attrs;\n\n  const out = backend.makeOutput(image.shape, image.dtype);\n  const
imageId = backend.dataIdMap.get(image.dataId).id;\n  const outId = backend.dataIdMap.get(out.dataId).id;\n\n
const [batch, imageHeight, imageWidth, numChannels] = image.shape;\n\n  const [centerX, centerY] =\n

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backend_util.getImageCenter(center, imageHeight, imageWidth);\n\n const fillIsBlack = fillValue === 0;\n const
fullOpacityValue = 255;\n\n const fillValues = typeof fillValue === 'number' ?\n    [fillValue, fillValue,
fillValue, fillIsBlack ? 0 : fullOpacityValue] :\n    [...fillValue, fullOpacityValue];\n const fillBytes = new
Uint8Array(new Int32Array(fillValues).buffer);\n\n wasmRotate(\n    imageId, batch, imageHeight, imageWidth,
numChannels, radians, centerX,\n    centerY, fillBytes, fillValues.length, outId);\n return out;\n\n\n\nexport const
rotateWithOffsetConfig: KernelConfig = {\n kernelName: RotateWithOffset,\n backendName: 'wasm',\n
kernelFunc: rotateWithOffset as {} as KernelFunc,\n setupFunc: setup\n};\n\n","/*\n * @license\n * Copyright 2021
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CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing
permissions and\n * limitations under the License.\n *

```

=====
*\nimport {KernelConfig, Round} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from
'/unary_kernel';\n\nexport const roundConfig: KernelConfig = createUnaryKernelConfig(Round);\n\n","/*\n *
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the

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specific language governing permissions and\n * limitations under the License.\n *

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=====
*\nimport {KernelConfig, Rsqrt} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from
'/unary_kernel';\n\nexport const rsqrtConfig: KernelConfig = createUnaryKernelConfig(Rsqrt);\n\n","/*\n *
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2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a
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the specific language governing permissions and\n * limitations under the License.\n

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* =====
*\n\nimport {KernelConfig, KernelFunc, scatter_util, ScatterNd, ScatterNdAttrs, ScatterNdInputs, TensorInfo, util}
from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from './backend_wasm';\n\nimport {CppType} from
'/types';\n\nlet wasmScatterNd: (\n    indicesId: number, updatesId: number, dtype: CppDType, sliceRank:
number,\n    numUpdates: number, sliceSize: number, strides: Uint8Array,\n    outputSize: number, outId: number)
=> void;\n\nfunction setup(backend: BackendWasm): void {\n    wasmScatterNd = backend.wasm.cwrap(ScatterNd,
null /*void*/, [\n        'number', // indicesId\n        'number', // updatesId\n        'number', // dtype\n        'number', //
sliceRank\n        'number', // numUpdates\n        'number', // sliceSize\n        'array', // strides\n        'number', // outputSize\n        'number' // outId\n    ]);\n\n    function scatterNd(\n        args:\n            {backend: BackendWasm, inputs:
ScatterNdInputs,
attrs: ScatterNdAttrs});\n        TensorInfo {\n            const {backend, inputs, attrs} = args;\n            const {indices, updates} =
inputs;\n            const {shape} = attrs;\n\n            const out = backend.makeOutput(shape, updates.dtype);\n            if
(util.sizeFromShape(shape) === 0) {\n                return out;\n            }\n\n            const {sliceRank, numUpdates, sliceSize, strides,
outputSize} =\n                scatter_util.calculateShapes(updates, indices, shape);\n\n            const indicesData =
backend.dataIdMap.get(indices.dataId);\n            const indicesId = indicesData.id;\n\n            const updatesData =

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backend.dataIdMap.get(updates.dataId);\n const updatesId = updatesData.id;\n\n const stridesBytes = new
  Uint8Array(new Int32Array(strides).buffer);\n\n const outId = backend.dataIdMap.get(out.dataId).id;\n
  wasmScatterNd(\n    indicesId, updatesId, CppDType[updates.dtype], sliceRank, numUpdates,\n    sliceSize,
    stridesBytes, outputSize, outId);\n\n return out;\n}\n\nexport const scatterNdConfig: KernelConfig = {\n
  kernelName: ScatterNd,\n  backendName: 'wasm',\n  setupFunc: setup,\n  kernelFunc: scatterNd as { } as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2020
  Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you
  may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
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  software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
  OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
  governing permissions and\n * limitations under the License.\n *
  =====\n
  *\n\nimport { KernelConfig, KernelFunc, Select, SelectInputs, util } from '@tensorflow/tfjs-core';\n\nimport
  { BackendWasm } from '../backend_wasm';\n\nlet wasmSelect: (\n  conditionId: number, tId: number,
  eId: number, offset: number,\n  outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n
  wasmSelect = backend.wasm.cwrap('SelectV2', null, [\n    'number', // conditionId\n    'number', // tId\n    'number',
    // eId\n    'number', // offset\n    'number', // outId\n  ]);\n\nfunction select(args: { inputs: SelectInputs, backend:
  BackendWasm }) {\n  const { inputs, backend } = args;\n  const { condition, t, e } = inputs;\n\n  const conditionId =
  backend.dataIdMap.get(condition.dataId).id;\n  const tId = backend.dataIdMap.get(t.dataId).id;\n  const eId =
  backend.dataIdMap.get(e.dataId).id;\n  const out = backend.makeOutput(t.shape, t.dtype);\n  const outId =
  backend.dataIdMap.get(out.dataId).id;\n\n  const cRank = condition.shape.length;\n  const tRank =
  t.shape.length;\n\n  const offset = cRank === 0 || cRank > 1 || tRank === 1 ?\n    1 : \n
  util.sizeFromShape(t.shape.slice(1));\n\n  wasmSelect(conditionId, tId, eId, offset, outId);\n  return out;\n}\n\nexport
  const
  selectConfig: KernelConfig = {\n  kernelName: Select,\n  backendName: 'wasm',\n  kernelFunc: select as { } as
  KernelFunc,\n  setupFunc: setup\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n
  * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in
  compliance with the License.\n * You may obtain a copy of the License at\n *\n
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  software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
  OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
  governing permissions and\n * limitations under the License.\n *
  =====\n
  *\n\nimport { KernelConfig, KernelFunc, Sigmoid, SigmoidInputs, TensorInfo, util } from '@tensorflow/tfjs-
  core';\n\nimport { BackendWasm }
  from '../backend_wasm';\n\nlet wasmFunc: (xId: number, outId: number) => void;\n\nfunction setup(backend:
  BackendWasm): void {\n  wasmFunc = backend.wasm.cwrap(Sigmoid, null /* void */, ['number',
  'number']);\n\nfunction sigmoid(args: { backend: BackendWasm, inputs: SigmoidInputs }):\n  TensorInfo {\n
  const { backend, inputs: { x } } = args;\n  const xId = backend.dataIdMap.get(x.dataId).id;\n  const out =
  backend.makeOutput(x.shape, x.dtype);\n  const outId = backend.dataIdMap.get(out.dataId).id;\n\n  // Short-circuit
  zero-sized tensors.\n  if (util.sizeFromShape(out.shape) === 0) {\n    return out;\n  }\n\n  wasmFunc(xId, outId);\n
  return out;\n}\n\nexport const sigmoidConfig: KernelConfig = {\n  kernelName: 'Sigmoid',\n  backendName:
  'wasm',\n  setupFunc: setup,\n  kernelFunc: sigmoid as { } as KernelFunc\n};\n", "/*\n * @license\n * Copyright
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=====
*\nimport {KernelConfig, Sin} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from
'./unary_kernel';\n\nexport const sinConfig: KernelConfig = createUnaryKernelConfig(Sin);\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
'License');\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
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WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific
language governing permissions and\n * limitations under the License.\n *
```

```
=====
*\n\nimport {KernelConfig, KernelFunc, Softmax, SoftmaxAttrs, SoftmaxInputs, TensorInfo, util} from
'@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nlet wasmFunc: (xId: number, outId:
number, channels: number, batch: number) =>\n  void;\n\nfunction setup(backend: BackendWasm): void {\n
wasmFunc = backend.wasm.cwrap(Softmax, null /* void */, [\n  'number', // xId\n  'number', // outId\n
'number', // channels\n  'number' // batch\n]);\n}\n\nfunction softmax(\n  args: {backend: BackendWasm,
inputs: SoftmaxInputs, attrs: SoftmaxAttrs}): \n  TensorInfo {\n  const {backend, inputs: {logits}, attrs: {dim}} =
args;\n  const xId = backend.dataIdMap.get(logits.dataId).id;\n  const out = backend.makeOutput(logits.shape,
logits.dtype);\n  const outId = backend.dataIdMap.get(out.dataId).id;\n  const channels = logits.shape[dim];\n
const batch = util.sizeFromShape(logits.shape) / channels;\n\n  // Short-circuit zero-sized tensors.\n  if
(util.sizeFromShape(out.shape) === 0) {\n    return out;\n  }\n\n  wasmFunc(xId, outId, channels, batch);\n  return
out;\n}\n\nexport const softmaxConfig: KernelConfig = {\n  kernelName: Softmax,\n  backendName: 'wasm',\n
setupFunc: setup,\n  kernelFunc: softmax as {} as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2021 Google
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use this file except in compliance with the License.\n * You may obtain a copy of the License at\n
 * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in
writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT
WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific
language governing permissions and\n * limitations under the License.\n *
```

```
=====
*\n\nimport {backend_util, KernelConfig, KernelFunc, ReshapeAttrs, ReshapeInputs, SpaceToBatchND,
SpaceToBatchNDAttrs, SpaceToBatchNDInputs, TensorInfo, TransposeAttrs, TransposeInputs, util} from
'@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport {padV2Config} from
'./PadV2';\n\nimport {reshape} from './Reshape';\n\nimport {transpose} from './Transpose';\n\nfunction
spaceToBatchND(args: {\n  inputs: SpaceToBatchNDInputs,\n  backend: BackendWasm,\n  attrs:
SpaceToBatchNDAttrs\n}) {\n  const {inputs,\n    backend, attrs} = args;\n  const {x} = inputs;\n  const {blockShape, paddings} = attrs;\n  const prod =
util.sizeFromShape(blockShape);\n  const completePaddings: Array<[number, number]> = [[0, 0]];\n
completePaddings.push(...(paddings as Array<[number, number]>));\n  for (let i = 1 + blockShape.length; i <
x.shape.length; ++i) {\n    completePaddings.push([0, 0]);\n  }\n  const paddedX = padV2Config.kernelFunc({\n
inputs: {x},\n  backend,\n  attrs: {paddings: completePaddings, constantValue: 0}\n}) as TensorInfo;\n  const
reshapedPaddedShape =\n    backend_util.getReshaped(paddedX.shape, blockShape, prod, false);\n  const
permutedReshapedPaddedPermutation = backend_util.getPermuted(\n    reshapedPaddedShape.length,\n
blockShape.length, false);\n  const flattenShape =\n    backend_util.getReshapedPermuted(paddedX.shape,\n
blockShape, prod, false);\n  const reshapeInputs: ReshapeInputs = {x: paddedX};\n  const reshapeAttrs:
```

```

ReshapeAttrs = {shape: reshapedPaddedShape};\n
  const paddedXReshaped =\n    reshape({inputs: reshapeInputs, backend, attrs: reshapeAttrs});\n\n  const
transposeInputs: TransposeInputs = {x: paddedXReshaped};\n  const transposeAttrs:\n    TransposeAttrs = {perm:
permutedReshapedPaddedPermutation};\n  const paddedXT =\n    transpose({inputs: transposeInputs, backend,
attrs: transposeAttrs});\n\n  const resultReshapeInputs: ReshapeInputs = {x: paddedXT};\n  const
resultReshapeAttrs: ReshapeAttrs = {shape: flattenShape};\n  const result = reshape(\n    {inputs:
resultReshapeInputs, backend, attrs: resultReshapeAttrs});\n\n  backend.disposeData(paddedX.dataId);\n
backend.disposeData(paddedXReshaped.dataId);\n  backend.disposeData(paddedXT.dataId);\n\n  return
result;\n}\n\nexport const spaceToBatchNDConfig: KernelConfig = {\n  kernelName: SpaceToBatchND,\n
backendName: 'wasm',\n  kernelFunc: spaceToBatchND as { } as KernelFunc\n};\n", "/*\n * @license\n *
Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed
under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with
the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n
*\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is
distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n */\n
=====\n
*\n\nimport { KernelConfig, KernelFunc, SplitV, SplitVAttrs, SplitVInputs, util } from '@tensorflow/tfjs-
core';\nimport { backend_util } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from
'./backend_wasm';\n\nimport { slice } from './Slice';\n\nexport function splitV(\n  args: {inputs: SplitVInputs, attrs:
SplitVAttrs, backend: BackendWasm}) {\n  const
{inputs, attrs, backend} = args;\n  const {x} = inputs;\n  const {numOrSizeSplits, axis} = attrs;\n\n  const $axis =
util.parseAxisParam(axis, x.shape)[0];\n\n  const splitSizes = backend_util.prepareSplitSize(x, numOrSizeSplits,
$axis);\n  const begin = new Array(x.shape.length).fill(0);\n  const size = x.shape.slice();\n  return splitSizes.map(s
=> {\n    const xSliceSize = [...size];\n    xSliceSize[$axis] = s;\n    const xSlice =\n      slice({inputs: {x}, attrs:
{begin, size: xSliceSize}, backend});\n    begin[$axis] += s;\n    return xSlice;\n  });\n}\n\nexport const
splitVConfig: KernelConfig = {\n  kernelName: SplitV,\n  backendName: 'wasm',\n  kernelFunc: splitV as { } as
KernelFunc\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n
*\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is
distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n */\n
=====\n
*\n\nimport { KernelConfig, Sqrt } from '@tensorflow/tfjs-core';\n\nimport { createUnaryKernelConfig } from
'./unary_kernel';\n\nexport const sqrtConfig: KernelConfig = createUnaryKernelConfig(Sqrt);\n", "/*\n * @license\n
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\"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or
agreed to in writing, software\n
* distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR
CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing
permissions and\n * limitations under the License.\n */\n
=====\n
*\n\nimport { KernelConfig, Square } from '@tensorflow/tfjs-core';\n\nimport { createUnaryKernelConfig } from
'./unary_kernel';\n\nexport const squareConfig: KernelConfig = createUnaryKernelConfig(Square);\n", "/*\n *

```

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```
=====
*\nimport {KernelConfig, SquaredDifference} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from './binary_kernel';\nconst supportsFullBroadcast = true;\nexport const squaredDifferenceConfig: KernelConfig =\n  createBinaryKernelConfig(SquaredDifference, supportsFullBroadcast);\n\n\", \"/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on\n * an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or\n * implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====
*\nimport {KernelConfig, KernelFunc, Step, StepAttrs, StepInputs, TensorInfo} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nimport {CppType} from './types';\nlet wasmStep:\n  (xId: number, alpha: number, dtype: number, outId: number) => void;\nfunction setup(backend: BackendWasm): void {\n  wasmStep = backend.wasm.cwrap(Step, null /*void*/, [\n    'number', // x_id\n    'number', // alpha\n    'number', // dtype\n    'number', // out_id\n  ]);\n  function step(\n    args: {\n      backend: BackendWasm,\n      inputs: StepInputs,\n      attrs: StepAttrs\n    }): TensorInfo {\n    const {backend, inputs, attrs} = args;\n    const {alpha} = attrs;\n    const {x} = inputs;\n    const\n      xId = backend.dataIdMap.get(x.dataId).id;\n    const out = backend.makeOutput(x.shape, x.dtype);\n    const outId = backend.dataIdMap.get(out.dataId).id;\n    wasmStep(xId, alpha, CCppType[x.dtype], outId);\n    return out;\n  }\n  export const stepConfig: KernelConfig = {\n    kernelName: Step,\n    backendName: 'wasm',\n    setupFunc: setup,\n    kernelFunc: step as {} as KernelFunc\n  };\n\n\", \"/*\n * @license\n * Copyright 2021 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====
*\nimport {KernelConfig, KernelFunc, slice_util, StridedSlice, StridedSliceAttrs, StridedSliceInputs, TensorInfo, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nimport {reshape} from './Reshape';\nimport {slice} from './Slice';\nlet wasmStridedSlice: (\n  xId: number, xStridesBytes: Uint8Array, xRank: number,\n  beginBytes: Uint8Array, endBytes: Uint8Array, stridesBytes: Uint8Array,\n  outShapeBytes: Uint8Array, outStridesBytes: Uint8Array,\n  outShapeLength: number, outId: number) => void;\nfunction setup(backend: BackendWasm): void {\n  wasmStridedSlice = backend.wasm.cwrap(StridedSlice, null /*void*/, [\n    'number', // xId\n    'array', // xStrides\n    'number', // xRank\n    'array', // beginBytes\n    'array', // endBytes\n    'array', // stridesBytes\n    'array', // outShapeBytes\n    'array', // outStridesBytes\n    'number', // outShapeLength\n    'number', // outId\n  ]);\n  export function stridedSlice(\n    args: {\n      backend: BackendWasm,\n      inputs: StridedSliceInputs,\n      attrs: StridedSliceAttrs\n    }): TensorInfo {\n    const {backend, inputs, attrs} = args;\n    const {x} = inputs;\n    const {\n      begin,\n      end,\n      strides,\n      beginMask,\n      endMask,\n
```



```

ellipsisMask,\n newAxisMask,\n shrinkAxisMask\n } = attrs;\n\n const {\n  finalShapeSparse,\n  finalShape,\n  isIdentity,\n  sliceDim0,\n  isSimpleSlice,\n  begin: $begin,\n  end: $end,\n  strides: $strides\n } =\n  slice_util.sliceInfo(\n    x.shape, begin, end, strides, beginMask, endMask, ellipsisMask,\n    newAxisMask, shrinkAxisMask);\n\n let result;\n\n if (isIdentity) {\n  // Optimization #1, slice is a no-op plus\n  reshape\n  result = reshape({inputs: {x}, backend, attrs: {shape: finalShape}});\n } else if (sliceDim0 ||\n isSimpleSlice) {\n  // Optimization #2, slice is memory contiguous\n  (only occurs in dim 0)\n  util.assert(\n    x.shape.length >= 1,\n    () => `Input must have rank at least 1, got:\n    ${x.shape.length}`);\n\n  const size = slice_util.computeOutShape($begin, $end, $strides);\n  // To tolerate\n  begin[0] > end[0] (a 0-output slice), we min(begin, end).\n  const sliced = slice({inputs: {x}, backend, attrs:\n  {begin: $begin, size}});\n  result =\n    reshape({inputs: {x: sliced}, backend, attrs: {shape: finalShape}});\n  backend.disposeData(sliced.dataId);\n } else {\n  const out = backend.makeOutput(finalShapeSparse,\n  'float32');\n\n  const xId = backend.dataIdMap.get(x.dataId).id;\n  const xStridesBytes =\n    new\n    Uint8Array(new Int32Array(util.computeStrides(x.shape)).buffer);\n  const beginBytes = new Uint8Array(new Int32Array($begin).buffer);\n  const endBytes = new Uint8Array(new Int32Array($end).buffer);\n  const\n  stridesBytes = new Uint8Array(new Int32Array($strides).buffer);\n\n  const outputShapeBytes\n  =\n    new Uint8Array(new Int32Array(finalShapeSparse).buffer);\n  const outStridesBytes = new\n  Uint8Array(\n    new Int32Array(util.computeStrides(finalShapeSparse)).buffer);\n  const outId =\n  backend.dataIdMap.get(out.dataId).id;\n\n  wasmStridedSlice(\n    xId, xStridesBytes, x.shape.length,\n    beginBytes, endBytes, stridesBytes,\n    outputShapeBytes, outStridesBytes, finalShapeSparse.length, outId);\n\n  result = reshape({inputs: {x: out}, backend, attrs: {shape: finalShape}});\n\n  backend.disposeData(out.dataId);\n }\n\n return result;\n}\n\nexport const stridedSliceConfig: KernelConfig = {\n  kernelName: StridedSlice,\n  backendName: 'wasm',\n  setupFunc: setup,\n  kernelFunc: stridedSlice as { } as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version\n 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a\n  copy of the License\n  at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in\n  writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT\n  WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific\n  language governing permissions and\n * limitations under the License.\n *\n  =====\n\n  *\n  import {KernelConfig, Sub} from '@tensorflow/tfjs-core';\n  import {createBinaryKernelConfig} from\n  './binary_kernel';\n  const supportsFullBroadcast = true;\n  export const subConfig: KernelConfig =\n  createBinaryKernelConfig(Sub, supportsFullBroadcast);\n\n  "/**\n  *\n  @license\n  *\n  Copyright 2019 Google LLC. All\n  Rights Reserved.\n  *\n  Licensed under the Apache License, Version 2.0 (the "License");\n  *\n  you may not use this\n  file except in compliance with the License.\n  *\n  You may obtain a copy of the License at\n  *\n  http://www.apache.org/licenses/LICENSE-2.0\n\n  *\n  *\n  Unless required by applicable law or agreed to in writing, software\n  *\n  distributed under the License is\n  distributed on an "AS IS" BASIS,\n  *\n  WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either\n  express or implied.\n  *\n  See the License for the specific language governing permissions and\n  *\n  limitations under\n  the License.\n  *\n  =====\n\n  *\n\n  import {backend_util, KernelConfig, KernelFunc, Sum, SumAttrs, SumInputs, TensorInfo, util} from\n  '@tensorflow/tfjs-core';\n  import {BackendWasm} from './backend_wasm';\n  import\n  {permuteAxesAndTranspose} from './kernel_utils';\n  import {CppType} from './types';\n\n  let wasmSum: (xId:\n  number, reduceSize: number, dtype: number, outId: number) =>\n  void;\n\n  function setup(backend:\n  BackendWasm): void {\n    wasmSum = backend.wasm.cwrap(Sum, null /*void*/, [\n      'number', // input_id\n      'number', // reduce_size\n      'number', //

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dtype\n 'number', // out_id\n ]);\n}\n\nfunction sum(args: {backend: BackendWasm, inputs: SumInputs, attrs: SumAttrs});\n  TensorInfo {\n    const {backend, inputs, attrs} = args;\n    const {axis, keepDims} = attrs;\n    const {x} = inputs;\n    const xId = backend.dataIdMap.get(x.dataId).id;\n    let inputId = xId;\n    let input = x;\n\n    const {transposed, axes, originalAxes, inputWasTransposed} =\n      permuteAxesAndTranspose(x, axis, backend);\n\n    let reductionAxes = axes;\n    if (inputWasTransposed) {\n      const transposedId =\n        backend.dataIdMap.get(transposed.dataId).id;\n      if (transposedId !== xId) {\n        // transpose was not a no-op. We\n        // will need to dispose of this\n        // once we are done.\n        input = transposed;\n        inputId = transposedId;\n        reductionAxes = backend_util.getInnerMostAxes(\n          reductionAxes.length, input.shape.length);\n      }\n    }\n\n    backend_util.assertAxesAreInnerMostDims(\n      'sum', reductionAxes, input.shape.length);\n    const [outShape, reduceShape] =\n      backend_util.computeOutAndReduceShapes(input.shape, reductionAxes);\n    const reduceSize = util.sizeFromShape(reduceShape);\n\n    const out = backend.makeOutput(outShape, input.dtype);\n    if (util.sizeFromShape(input.shape) !== 0) {\n      const outId = backend.dataIdMap.get(out.dataId).id;\n      wasmSum(inputId, reduceSize, CppDType[out.dtype], outId);\n    }\n\n    if (inputWasTransposed) {\n      // dispose of the transposed tensor.\n      backend.disposeData(transposed.dataId);\n    }\n\n    if (keepDims) {\n      // reshape\n      const newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n      out.shape = newShape;\n    }\n\n    return out;\n  }\n\nexport const sumConfig: KernelConfig = {\n  kernelName: Sum,\n  backendName: 'wasm',\n  setupFunc: setup,\n  kernelFunc: sum as {} as KernelFunc\n};\n\n", "/*\n * @license\n * Copyright 2021 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file
```

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```

```
=====\n\n*/\nimport {KernelConfig, Tan} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from\n './unary_kernel';\nexport const tanConfig: KernelConfig = createUnaryKernelConfig(Tan);\n\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n\n*/\nimport {KernelConfig, Tanh} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from\n './unary_kernel';\nexport const tanhConfig: KernelConfig = createUnaryKernelConfig(Tanh);\n\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n\n*/\nimport {KernelConfig, Tile, TileAttrs, TileInputs} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nimport {CppType} from '../types';\nlet wasmTile: (\n  xId: number, xShape: Uint8Array, xShapeSize: number, newShape: Uint8Array,\n  newShapeSize: number, dtype: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n  wasmTile =
```

```
=====\n\n*/\nimport {KernelConfig, KernelFunc, Tile, TileAttrs, TileInputs} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nimport {CppType} from '../types';\nlet wasmTile: (\n  xId: number, xShape: Uint8Array, xShapeSize: number, newShape: Uint8Array,\n  newShapeSize: number, dtype: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n  wasmTile =
```



```

=====\\n
*/\\n\\nimport {KernelConfig, KernelFunc, ZerosLike, ZerosLikeInputs} from '@tensorflow/tfjs-core';\\n\\nimport
{BackendWasm} from '../backend_wasm';\\n\\nfunction zerosLike(args: {inputs: ZerosLikeInputs, backend:
BackendWasm}) {\\n  const {inputs: {x}, backend} = args;\\n  const out = backend.makeOutput(x.shape, x.dtype);\\n
const outVals = backend.typedArrayFromHeap(out);\\n  outVals.fill(0);\\n  return out;\\n}\\n\\nexport const
zerosLikeConfig: KernelConfig = {\\n  kernelName: ZerosLike,\\n  backendName: 'wasm',\\n  kernelFunc: zerosLike
as { } as KernelFunc,\\n};\\n"/**\\n * @license\\n * Copyright 2020 Google LLC. All Rights Reserved.\\n * Licensed
under the Apache License, Version 2.0 (the "License");\\n * you may not use this file except in compliance with the
License.\\n * You may obtain a copy of the License at\\n * \\n * http://www.apache.org/licenses/LICENSE-2.0\\n * \\n *
Unless required by applicable law or agreed to in writing, software\\n * distributed under the License is distributed
on an "AS IS" BASIS,\\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\\n * See the License
for the specific language governing permissions and\\n * limitations under the License.\\n *
=====\\n */\\n//

```

We explicitly import the modular kernels so they get registered in the\\n// global registry when we compile the library. A modular build would replace\\n// the contents of this file and import only the kernels that are needed.

```

\\nimport {KernelConfig, registerKernel} from '@tensorflow/tfjs-core';\\n\\nimport {fusedMatMulConfig}
from './kernels/_FusedMatMul';\\nimport {absConfig} from './kernels/Abs';\\nimport {addConfig} from
 './kernels/Add';\\nimport {addNConfig} from './kernels/AddN';\\nimport {allConfig} from './kernels/All';\\nimport
{anyConfig} from './kernels/Any';\\nimport {argMaxConfig} from './kernels/ArgMax';\\nimport {avgPoolConfig}
from './kernels/AvgPool';\\nimport {batchMatMulConfig} from './kernels/BatchMatMul';\\nimport
{batchToSpaceNDConfig} from './kernels/BatchToSpaceND';\\nimport {castConfig} from './kernels/Cast';\\nimport
{ceilConfig} from './kernels/Ceil';\\nimport {clipByValueConfig} from './kernels/ClipByValue';\\nimport
{concatConfig} from './kernels/Concat';\\nimport {conv2DConfig} from './kernels/Conv2D';\\nimport
{conv2DBackpropInputConfig} from './kernels/Conv2DBackpropInput';\\nimport {cosConfig} from
 './kernels/Cos';\\nimport {coshConfig} from './kernels/Cosh';\\nimport {cropAndResizeConfig} from
 './kernels/CropAndResize';\\nimport {cumsumConfig} from './kernels/Cumsum';\\nimport {depthToSpaceConfig}
from './kernels/DepthToSpace';\\nimport {depthwiseConv2dNativeConfig} from
 './kernels/DepthwiseConv2dNative';\\nimport {eluConfig} from './kernels/Elu';\\nimport {equalConfig} from
 './kernels/Equal';\\nimport {expConfig} from './kernels/Exp';\\nimport {expandDimsConfig} from
 './kernels/ExpandDims';\\nimport {fillConfig} from './kernels/Fill';\\nimport {flipLeftRightConfig} from
 './kernels/FlipLeftRight';\\nimport {floorConfig} from './kernels/Floor';\\nimport {floorDivConfig} from
 './kernels/FloorDiv';\\nimport
{fusedBatchNormConfig} from './kernels/FusedBatchNorm';\\nimport {fusedConv2DConfig} from
 './kernels/FusedConv2D';\\nimport {fusedDepthwiseConv2DConfig} from
 './kernels/FusedDepthwiseConv2D';\\nimport {gatherNdConfig} from './kernels/GatherNd';\\nimport
{gatherV2Config} from './kernels/GatherV2';\\nimport {greaterConfig} from './kernels/Greater';\\nimport
{greaterEqualConfig} from './kernels/GreaterEqual';\\nimport {identityConfig} from './kernels/Identity';\\nimport
{leakyReluConfig} from './kernels/LeakyRelu';\\nimport {lessConfig} from './kernels/Less';\\nimport
{lessEqualConfig} from './kernels/LessEqual';\\nimport {logConfig} from './kernels/Log';\\nimport
{logicalAndConfig} from './kernels/LogicalAnd';\\nimport {maxConfig} from './kernels/Max';\\nimport
{maximumConfig} from './kernels/Maximum';\\nimport {maxPoolConfig} from './kernels/MaxPool';\\nimport
{meanConfig} from './kernels/Mean';\\nimport {minConfig} from './kernels/Min';\\nimport {minimumConfig} from
 './kernels/Minimum';\\nimport
{mirrorPadConfig} from './kernels/MirrorPad';\\nimport {multiplyConfig} from './kernels/Multiply';\\nimport
{negConfig} from './kernels/Neg';\\nimport {nonMaxSuppressionV3Config} from
 './kernels/NonMaxSuppressionV3';\\nimport {nonMaxSuppressionV4Config} from
 './kernels/NonMaxSuppressionV4';\\nimport {nonMaxSuppressionV5Config} from

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./kernels/NonMaxSuppressionV5';\nimport {notEqualConfig} from './kernels/NotEqual';\nimport {oneHotConfig}
from './kernels/OneHot';\nimport {onesLikeConfig} from './kernels/OnesLike';\nimport {packConfig} from
./kernels/Pack';\nimport {padV2Config} from './kernels/PadV2';\nimport {powConfig} from
./kernels/Pow';\nimport {preluConfig} from './kernels/Prelu';\nimport {prodConfig} from './kernels/Prod';\nimport
{rangeConfig} from './kernels/Range';\nimport {realDivConfig} from './kernels/RealDiv';\nimport {reluConfig}
from './kernels/Relu';\nimport {relu6Config} from './kernels/Relu6';\nimport {reshapeConfig} from
./kernels/Reshape';\nimport {resizeBilinearConfig}
from './kernels/ResizeBilinear';\nimport {reverseConfig} from './kernels/Reverse';\nimport
{rotateWithOffsetConfig} from './kernels/RotateWithOffset';\nimport {roundConfig} from
./kernels/Round';\nimport {rsqrtConfig} from './kernels/Rsqrt';\nimport {scatterNdConfig} from
./kernels/ScatterNd';\nimport {selectConfig} from './kernels/Select';\nimport {sigmoidConfig} from
./kernels/Sigmoid';\nimport {sinConfig} from './kernels/Sin';\nimport {sliceConfig} from './kernels/Slice';\nimport
{softmaxConfig} from './kernels/Softmax';\nimport {spaceToBatchNDConfig} from
./kernels/SpaceToBatchND';\nimport {splitVConfig} from './kernels/SplitV';\nimport {sqrtConfig} from
./kernels/Sqrt';\nimport {squareConfig} from './kernels/Square';\nimport {squaredDifferenceConfig} from
./kernels/SquaredDifference';\nimport {stepConfig} from './kernels/Step';\nimport {stridedSliceConfig} from
./kernels/StridedSlice';\nimport {subConfig} from './kernels/Sub';\nimport {sumConfig} from
./kernels/Sum';\nimport
{tanConfig} from './kernels/Tan';\nimport {tanhConfig} from './kernels/Tanh';\nimport {tileConfig} from
./kernels/Tile';\nimport {topKConfig} from './kernels/TopK';\nimport {transformConfig} from
./kernels/Transform';\nimport {transposeConfig} from './kernels/Transpose';\nimport {unpackConfig} from
./kernels/Unpack';\nimport {zerosLikeConfig} from './kernels/ZerosLike';\n\n// List all kernel configs here\nconst
kernelConfigs: KernelConfig[] = [\n  absConfig,\n  addConfig,\n  addNConfig,\n  allConfig,\n  anyConfig,\n  argMaxConfig,\n  avgPoolConfig,\n  batchMatMulConfig,\n  batchToSpaceNDConfig,\n  castConfig,\n  ceilConfig,\n  clipByValueConfig,\n  concatConfig,\n  conv2DConfig,\n  conv2DBackpropInputConfig,\n  cosConfig,\n  coshConfig,\n  cropAndResizeConfig,\n  cumsumConfig,\n  depthToSpaceConfig,\n  depthwiseConv2dNativeConfig,\n  eluConfig,\n  equalConfig,\n  expConfig,\n  expandDimsConfig,\n  fillConfig,\n  flipLeftRightConfig,\n  floorConfig,\n  floorDivConfig,\n  fusedMatMulConfig,\n  fusedBatchNormConfig,\n  fusedConv2DConfig,\n  fusedDepthwiseConv2DConfig,\n  gatherNdConfig,\n  gatherV2Config,\n  greaterConfig,\n  greaterEqualConfig,\n  identityConfig,\n  leakyReluConfig,\n  lessConfig,\n  lessEqualConfig,\n  logConfig,\n  logicalAndConfig,\n  maxConfig,\n  maximumConfig,\n  maxPoolConfig,\n  meanConfig,\n  minConfig,\n  minimumConfig,\n  mirrorPadConfig,\n  multiplyConfig,\n  negConfig,\n  nonMaxSuppressionV3Config,\n  nonMaxSuppressionV4Config,\n  nonMaxSuppressionV5Config,\n  notEqualConfig,\n  oneHotConfig,\n  onesLikeConfig,\n  packConfig,\n  padV2Config,\n  powConfig,\n  preluConfig,\n  prodConfig,\n  rangeConfig,\n  realDivConfig,\n  reluConfig,\n  relu6Config,\n  reshapeConfig,\n  resizeBilinearConfig,\n  reverseConfig,\n  rotateWithOffsetConfig,\n  rsqrtConfig,\n  roundConfig,\n  scatterNdConfig,\n  selectConfig,\n  sigmoidConfig,\n  sinConfig,\n  sliceConfig,\n  softmaxConfig,\n  spaceToBatchNDConfig,\n  splitVConfig,\n  sqrtConfig,\n  squareConfig,\n  squaredDifferenceConfig,\n  stepConfig,\n  stridedSliceConfig,\n  subConfig,\n  sumConfig,\n  tanConfig,\n  tanhConfig,\n  tileConfig,\n  topKConfig,\n  transformConfig,\n  transposeConfig,\n  unpackConfig,\n  zerosLikeConfig\n];\n\nfor (const kernelConfig of kernelConfigs) {\n  registerKernel(kernelConfig);\n}\n\n", "/*\n *
@license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version
2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n */
=====

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*/\n\nimport { env } from '@tensorflow/tfjs-core';\n\nconst ENV = env();\n\n/**\n * True if SIMD is supported.\n */\n// From: https://github.com/GoogleChromeLabs/wasm-feature-detect\nENV.registerFlag(\n  // This typed array passed in to WebAssembly.validate is WebAssembly binary\n  // code. In this case it is a small program that contains SIMD\n  // instructions.\n  'WASM_HAS_SIMD_SUPPORT', async () => WebAssembly.validate(new\n    Uint8Array([\n      0, 97, 115, 109, 1, 0, 0, 0, 1, 4, 1, 96, 0, 0, 3,\n      2, 1, 0, 10, 9, 1, 7, 0, 65, 0, 253, 15, 26, 11\n    ])));\n\n/**\n * True if threads are supported.\n */\n// From: https://github.com/GoogleChromeLabs/wasm-feature-detect\nENV.registerFlag('WASM_HAS_MULTITHREAD_SUPPORT', async () => {\n  //\n  // TODO(annxingyuan): Enable node support once this is resolved.\n  //\n  // https://github.com/tensorflow/tfjs/issues/3830\n  if (ENV.get('IS_NODE')) {\n    return false;\n  }\n  // Test for transferability of SABs (needed for Firefox)\n  //\n  // https://groups.google.com/forum/#!msg/mozilla.dev.platform/IHkBZIHETpA/dwsMNchWEQAJ\n  new\n    MessageChannel().port1.postMessage(new SharedArrayBuffer(1));\n  // This typed array is a WebAssembly program containing threaded\n  // instructions.\n  return WebAssembly.validate(new Uint8Array([\n    0, 97, 115, 109, 1, 0, 0, 0, 1, 4, 1, 96, 0, 0, 3, 2, 1, 0, 5,\n    4, 1, 3, 1, 1, 10, 11, 1, 9, 0, 65, 0, 254, 16, 2, 0, 26, 11\n  ]));\n} catch (e) {\n  return false;\n});\n\n", "\nvar WasmBackendModuleThreadedSimd = (function() {\n  var _scriptDir = typeof document !== 'undefined' && document.currentScript ? document.currentScript.src :\n    undefined;\n  if (typeof __filename !== 'undefined') _scriptDir = _scriptDir || __filename;\n  return\n    (function(WasmBackendModuleThreadedSimd) {\n      WasmBackendModuleThreadedSimd =\n        WasmBackendModuleThreadedSimd || {};\n    })(function\n      GROWABLE_HEAP_I8() {\n        if (wasmMemory.buffer !== buffer) {\n          updateGlobalBufferAndViews(wasmMemory.buffer);\n        }\n        return\n          HEAP8;\n      } function\n      GROWABLE_HEAP_U8() {\n        if (wasmMemory.buffer !== buffer) {\n          updateGlobalBufferAndViews(wasmMemory.buffer);\n        }\n        return\n          HEAPU8;\n      } function\n      GROWABLE_HEAP_I32() {\n        if (wasmMemory.buffer !== buffer) {\n          updateGlobalBufferAndViews(wasmMemory.buffer);\n        }\n        return\n          HEAP32;\n      } function\n      GROWABLE_HEAP_U32() {\n        if (wasmMemory.buffer !== buffer) {\n          updateGlobalBufferAndViews(wasmMemory.buffer);\n        }\n        return\n          HEAPU32;\n      } function\n      GROWABLE_HEAP_F64() {\n        if (wasmMemory.buffer !== buffer) {\n          updateGlobalBufferAndViews(wasmMemory.buffer);\n        }\n        return\n          HEAPF64;\n      }\n      var Module =\n        typeof\n        WasmBackendModuleThreadedSimd !==\n        'undefined' ?\n        WasmBackendModuleThreadedSimd : {};\n      var\n        readyPromiseResolve, readyPromiseReject;\n      Module['ready'] =\n        new\n        Promise(function(resolve, reject) {\n          readyPromiseResolve = resolve;\n          readyPromiseReject = reject;\n        });\n      var\n        moduleOverrides = {};\n      for (key in\n        Module) {\n        if (Module.hasOwnProperty(key)) {\n          moduleOverrides[key] = Module[key];\n        }\n      }\n      var arguments_ = [];\n      var\n        thisProgram =\n        \"/.this.program";\n      var\n        quit_ =\n        function(status, toThrow) {\n          throw\n            toThrow;\n        };\n      var\n        ENVIRONMENT_IS_WEB =\n        false;\n      var\n        ENVIRONMENT_IS_WORKER =\n        false;\n      var\n        ENVIRONMENT_IS_NODE =\n        false;\n      var\n        ENVIRONMENT_IS_SHELL =\n        false;\n      ENVIRONMENT_IS_WEB =\n        typeof\n        window ===\n        'object';\n      ENVIRONMENT_IS_WORKER =\n        typeof\n        importScripts ===\n        'function';\n      ENVIRONMENT_IS_NODE =\n        typeof\n        process ===\n        'object' &&\n        typeof\n        process.versions ===\n        'object' &&\n        typeof\n        process.versions.node ===\n        'string';\n      ENVIRONMENT_IS_SHELL =\n        !ENVIRONMENT_IS_WEB &&\n        !ENVIRONMENT_IS_NODE &&\n        !ENVIRONMENT_IS_WORKER;\n      var\n        ENVIRONMENT_IS_PTHREAD =\n        Module['ENVIRONMENT_IS_PTHREAD'] ||\n        false;\n      if (ENVIRONMENT_IS_PTHREAD) {\n        buffer = Module['buffer'];\n        var\n          scriptDirectory =\n          \"\";\n        function\n          locateFile(path) {\n            if (Module['locateFile']) {\n              return\n                Module['locateFile'](\n                  path,\n                  scriptDirectory);\n            }\n            return\n              scriptDirectory +\n              path;\n          }\n        var\n          read_, readAsync, readBinary,\n          setWindowTitle;\n        var\n          nodeFS;\n        var\n          nodePath;\n        if (ENVIRONMENT_IS_NODE) {\n          if (ENVIRONMENT_IS_WORKER) {\n            scriptDirectory =\n              require('path').

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dirname(scriptDirectory)+"^"}else{scriptDirectory=__dirname+"^"}read_=function
shell_read(filename,binary){if(!nodeFS)nodeFS=require("fs");if(!nodePath)nodePath=require("path");filename=n
odePath["normalize"](filename);return
nodeFS["readFileSync"](filename,binary?null:"utf8");readBinary=function readBinary(filename){var
ret=read_(filename,true);if(!ret.buffer){ret=new Uint8Array(ret)}assert(ret.buffer);return
ret};if(process["argv"].length>1){thisProgram=process["argv"][1].replace(/\\/g,"^")}arguments_=process["arg
v"].slice(2);process["on"]("uncaughtException",function(ex){if(!(ex instanceof ExitStatus)){throw
ex}});process["on"]("unhandledRejection",abort);quit_=function(status){process["exit"](status)};Module["insp
ect"]=function(){return"[Emscripten Module object]"};var
nodeWorkerThreads;try{nodeWorkerThreads=require("worker_threads")}catch(e){console.error("The
\"worker_threads\" module is not supported in this node.js build - perhaps a newer version is needed?");throw
e}global.Worker=nodeWorkerThreads.Worker}else if(ENVIRONMENT_IS_SHELL){if(typeof
read!="undefined"){read_=function shell_read(f){return read(f)}readBinary=function readBinary(f){var
data;if(typeof readbuffer==="function"){return new
Uint8Array(readbuffer(f))}data=read(f,"binary");assert(typeof data==="object");return data};if(typeof
scriptArgs!="undefined"){arguments_=scriptArgs}else if(typeof
arguments!="undefined"){arguments_=arguments}if(typeof
quit==="function"){quit_=function(status){quit(status)}}if(typeof print!="undefined"){if(typeof
console==="undefined")console={};console.log=print;console.warn=console.error=typeof
printErr!="undefined"?printErr:print}}else
if(ENVIRONMENT_IS_WEB||ENVIRONMENT_IS_WORKER){if(ENVIRONMENT_IS_WORKER){scriptDire
ctory=self.location.href}else if(typeof
document!="undefined"&&document.currentScript){scriptDirectory=document.currentScript.src}if(typeof
_scriptDir != "undefined" &&
_scriptDir){scriptDirectory=_scriptDir}if(scriptDirectory.indexOf("blob:")!==0){scriptDirectory=scriptDirectory.s
ubstr(0,scriptDirectory.lastIndexOf("^")+1)}else{scriptDirectory="/" }if(ENVIRONMENT_IS_NODE){read_=fun
ction
shell_read(filename,binary){if(!nodeFS)nodeFS=require("fs");if(!nodePath)nodePath=require("path");filename=n
odePath["normalize"](filename);return
nodeFS["readFileSync"](filename,binary?null:"utf8");readBinary=function readBinary(filename){var
ret=read_(filename,true);if(!ret.buffer){ret=new Uint8Array(ret)}assert(ret.buffer);return
ret}}else{read_=function(url){var xhr=new XMLHttpRequest;xhr.open("GET",url,false);xhr.send(null);return
xhr.responseText};if(ENVIRONMENT_IS_WORKER){readBinary=function(url){var xhr=new
XMLHttpRequest;xhr.open("GET",url,false);xhr.responseType="arraybuffer";xhr.send(null);return new
Uint8Array(xhr.response)}}readAsync=function(url,onload,onerror){var xhr=new
XMLHttpRequest;xhr.open("GET",url,true);xhr.responseType="arraybuffer";xhr.onload=function(){if(xhr.status
==200||xhr.status==0&&xhr.response){onload(xhr.response);return}onerror();}xhr.onerror=onerror;xhr.send(null)}
}setWindowTitle=function(title){document.title=title}}else{if(ENVIRONMENT_IS_NODE){if(typeof
performance==="undefined"){global.performance=require("perf_hooks").performance}}var
out=Module["print"]||console.log.bind(console);var err=Module["printErr"]||console.warn.bind(console);for(key
in
moduleOverrides){if(moduleOverrides.hasOwnProperty(key)){Module[key]=moduleOverrides[key]}}moduleOverr
ides=null;if(Module["arguments"]){arguments_=Module["arguments"]}if(Module["thisProgram"]){thisProgram=
Module["thisProgram"]}if(Module["quit"]){quit_=Module["quit"]}function
warnOnce(text){if(!warnOnce.shown)warnOnce.shown={};if(!warnOnce.shown[text]){warnOnce.shown[text]=1;er
r(text)}}var Atomics_load=Atomics.load;var Atomics_store=Atomics.store;var
Atomics_compareExchange=Atomics.compareExchange;var
wasmBinary;if(Module["wasmBinary"]){wasmBinary=Module["wasmBinary"]}var

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noExitRuntime=Module["noExitRuntime"]||true;if(typeof WebAssembly!=="object"){abort("no
native wasm support detected")}var wasmMemory;var wasmModule;var ABORT=false;var
EXITSTATUS;function assert(condition,text){if(!condition){abort("Assertion failed: "+text)}}function
getCFunc(ident){var func=Module["_"]+ident;assert(func,"Cannot call unknown function "+ident+", make sure
it is exported");return func}function ccall(ident,returnType,argTypes,args,opts){var
toC={"string":function(str){var ret=0;if(str!==null&&str!==undefined&&str!==0){var
len=(str.length<<2)+1;ret=stackAlloc(len);stringToUTF8(str,ret,len)}return ret},"array":function(arr){var
ret=stackAlloc(arr.length);writeArrayToMemory(arr,ret);return ret}};function
convertReturnValue(ret){if(returnType==="string")return UTF8ToString(ret);if(returnType==="boolean")return
Boolean(ret);return ret}var func=getCFunc(ident);var cArgs=[];var stack=0;if(args){for(var
i=0;i<args.length;i++){var
converter=toC[argTypes[i]];if(converter){if(stack===0)stack=stackSave();cArgs[i]=converter(args[i])}else{cArgs[i
]=args[i]}}var
ret=func.apply(null,cArgs);ret=convertReturnValue(ret);if(stack!==0)stackRestore(stack);return ret}function
cwrap(ident,returnType,argTypes,opts){argTypes=argTypes||[];var
numericArgs=argTypes.every(function(type){return type==="number"});var
numericRet=returnType!=="string";if(numericRet&&numericArgs&&!opts){return getCFunc(ident)}return
function(){return ccall(ident,returnType,argTypes,arguments,opts)}}function
UTF8ArrayToString(heap,idx,maxBytesToRead){var endIdx=idx+maxBytesToRead;var
str="";while(!(idx>=endIdx)){var u0=heap[idx++];if(!u0)return
str;if(!(u0&128)){str+=String.fromCharCode(u0);continue}var
u1=heap[idx++]&63;if((u0&224)==192){str+=String.fromCharCode((u0&31)<<6|u1);continue}var
u2=heap[idx++]&63;if((u0&240)==224){u0=(u0&15)<<12|u1<<6|u2}else{u0=(u0&7)<<18|u1<<12|u2<<6|heap[id
x++]&63}if(u0<65536){str+=String.fromCharCode(u0)}else{var ch=u0-
65536;str+=String.fromCharCode(55296|ch>>10,56320|ch&1023)}}return str}function
UTF8ToString(ptr,maxBytesToRead){return
ptr?UTF8ArrayToString(GROWABLE_HEAP_U8(),ptr,maxBytesToRead):""}function
stringToUTF8Array(str,heap,outIdx,maxBytesToWrite){if(!(maxBytesToWrite>0))return 0;var startIdx=outIdx;var
endIdx=outIdx+maxBytesToWrite-1;for(var i=0;i<str.length;++i){var
u=str.charCodeAt(i);if(u>=55296&&u<=57343){var
u1=str.charCodeAt(++i);u=65536+((u&1023)<<10|u1&1023)}if(u<=127){if(outIdx>=endIdx)break;heap[outIdx++]
=u}else if(u<=2047){if(outIdx+1>=endIdx)break;heap[outIdx++]=192|u>>6;heap[outIdx++]=128|u&63}else
if(u<=65535){if(outIdx+2>=endIdx)break;heap[outIdx++]=224|u>>12;heap[outIdx++]=128|u>>6&63;heap[outIdx
++]=128|u&63}else{if(outIdx+3>=endIdx)break;heap[outIdx++]=240|u>>18;heap[outIdx++]=128|u>>12&63;heap[
outIdx++]=128|u>>6&63;heap[outIdx++]=128|u&63}}heap[outIdx]=0;return outIdx-startIdx}function
stringToUTF8(str,outPtr,maxBytesToWrite){return
stringToUTF8Array(str,GROWABLE_HEAP_U8(),outPtr,maxBytesToWrite)}function lengthBytesUTF8(str){var
len=0;for(var i=0;i<str.length;++i){var
u=str.charCodeAt(i);if(u>=55296&&u<=57343)u=65536+((u&1023)<<10|str.charCodeAt(++i)&1023);if(u<=127)+
+len;else if(u<=2047)len+=2;else if(u<=65535)len+=3;else len+=4}return len}function
writeArrayToMemory(array,buffer){GROWABLE_HEAP_I8().set(array,buffer)}function
alignUp(x,multiple){if(x%multiple>0){x+=multiple-x%multiple}return x}var
buffer,HEAP8,HEAPU8,HEAP16,HEAPU16,HEAP32,HEAPU32,HEAPF32,HEAPF64;function
updateGlobalBufferAndViews(buf){buffer=buf;Module["HEAP8"]=HEAP8=new
Int8Array(buf);Module["HEAP16"]=HEAP16=new Int16Array(buf);Module["HEAP32"]=HEAP32=new
Int32Array(buf);Module["HEAPU8"]=HEAPU8=new Uint8Array(buf);Module["HEAPU16"]=HEAPU16=new
Uint16Array(buf);Module["HEAPU32"]=HEAPU32=new
Uint32Array(buf);Module["HEAPF32"]=HEAPF32=new

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Float32Array(buf);Module["HEAPF64"]=HEAPF64=new Float64Array(buf)}var
INITIAL_MEMORY=Module["INITIAL_MEMORY"]||16777216;if(ENVIRONMENT_IS_PTHREAD){wasmmem
ory=Module["wasmMemory"];buffer=Module["buffer"]}else{if(Module["wasmMemory"]){wasmMemory=
Module["wasmMemory"]}else{wasmMemory=new
WebAssembly.Memory({"initial":INITIAL_MEMORY/65536,"maximum":2147483648/65536,"shared":true});
if(!(wasmMemory.buffer instanceof SharedArrayBuffer)){err("requested a shared WebAssembly.Memory but the
returned buffer is not a SharedArrayBuffer, indicating that while the browser has SharedArrayBuffer it does not
have WebAssembly threads support - you may need to set a
flag");if(ENVIRONMENT_IS_NODE){console.log("(on node you may need: --experimental-wasm-threads --
experimental-wasm-bulk-memory and also use a recent version)")}throw Error("bad
memory")}}if(wasmMemory){buffer=wasmMemory.buffer}INITIAL_MEMORY=buffer.byteLength;updateGlob
alBufferAndViews(buffer);var wasmTable;var __ATPRERUN__=[];var __ATINIT__=[];var __ATMAIN__=[];var
__ATEXIT__=[];var __ATPOSTRUN__=[];var runtimeInitialized=false;var
runtimeExited=false;if(!ENVIRONMENT_IS_PTHREAD)__ATINIT__.push({func:function(){__wasm_call_ctors
()}});function
preRun(){if(ENVIRONMENT_IS_PTHREAD)return;if(Module["preRun"]){if(typeof
Module["preRun"]=="function")Module["preRun"]=[Module["preRun"]];while(Module["preRun"].length){a
ddOnPreRun(Module["preRun"].shift())}callRuntimeCallbacks(__ATPRERUN__)}function
initRuntime(){runtimeInitialized=true;if(ENVIRONMENT_IS_PTHREAD)return;callRuntimeCallbacks(__ATINIT
__)function
preMain(){if(ENVIRONMENT_IS_PTHREAD)return;callRuntimeCallbacks(__ATMAIN__)}function
exitRuntime(){if(ENVIRONMENT_IS_PTHREAD)return;runtimeExited=true}function
postRun(){if(ENVIRONMENT_IS_PTHREAD)return;if(Module["postRun"]){if(typeof
Module["postRun"]=="function")Module["postRun"]=[Module["postRun"]];while(Module["postRun"].lengt
h){addOnPostRun(Module["postRun"].shift())}callRuntimeCallbacks(__ATPOSTRUN__)}function
addOnPreRun(cb){__ATPRERUN__.unshift(cb)}function addOnPostRun(cb){__ATPOSTRUN__.unshift(cb)}var
runDependencies=0;var runDependencyWatcher=null;var dependenciesFulfilled=null;function
addRunDependency(id){assert(!ENVIRONMENT_IS_PTHREAD,"addRunDependency cannot be used in a
pthread
worker");runDependencies++;if(Module["monitorRunDependencies"]){Module["monitorRunDependencies"](ru
nDependencies)}}function removeRunDependency(id){runDependencies--
;if(Module["monitorRunDependencies"]){Module["monitorRunDependencies"](runDependencies)}if(runDepend
encies==0){if(runDependencyWatcher!=null){clearInterval(runDependencyWatcher);runDependencyWatcher=null}
if(dependenciesFulfilled){var
callback=dependenciesFulfilled;dependenciesFulfilled=null;callback()}}Module["preloadedImages"]={};Module
["preloadedAudios"]={};function
abort(what){if(Module["onAbort"]){Module["onAbort"](what)}if(ENVIRONMENT_IS_PTHREAD)console.err
or("Pthread aborting at "+(new
Error).stack);what+="\n";err(what);ABORT=true;EXITSTATUS=1;what+="abort("+what+"). Build with -s
ASSERTIONS=1 for more info.";var e=new WebAssembly.RuntimeError(what);readyPromiseReject(e);throw
e}function
hasPrefix(str,prefix){return String.prototype.startsWith?str.startsWith(prefix):str.indexOf(prefix)===0}var
dataURIPrefix="data:application/octet-stream;base64,";function isDataURI(filename){return
hasPrefix(filename,dataURIPrefix)}var fileURIPrefix="file://";function isFileURI(filename){return
hasPrefix(filename,fileURIPrefix)}var wasmBinaryFile="tfjs-backend-wasm-threaded-
simd.wasm";if(!isDataURI(wasmBinaryFile)){wasmBinaryFile=locateFile(wasmBinaryFile)}function
getBinary(file){try{if(file===wasmBinaryFile&&wasmBinary){return new
Uint8Array(wasmBinary)}}if(readBinary){return readBinary(file)}else{throw"both async and sync fetching of the

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wasm failed\"} }catch(err){ abort(err)} }function
getBinaryPromise(){if(!wasmBinary&&(ENVIRONMENT_IS_WEB||ENVIRONMENT_IS_WORKER)){if(typeof
fetch===\"function\"&&!isFileURI(wasmBinaryFile)){return fetch(wasmBinaryFile,{credentials:\"same-
origin\"}),then(function(response){if(!response[\"ok\"]){throw\"failed to load wasm binary file at
\"+wasmBinaryFile+\"\"})return
response[\"arrayBuffer\"]()).catch(function(){return getBinary(wasmBinaryFile)}})else{if(readAsync){return new
Promise(function(resolve,reject){readAsync(wasmBinaryFile,function(response){resolve(new
Uint8Array(response)),reject}))})}return Promise.resolve().then(function(){return
getBinary(wasmBinaryFile)})}function createWasm(){var info={\"a\":asmLibraryArg};function
receiveInstance(instance,module){var
exports=instance.exports;Module[\"asm\"]=exports;wasmTable=Module[\"asm\"][\"I\"];wasmModule=module;if(!E
NVIRONMENT_IS_PTHREAD){var
numWorkersToLoad=PThread.unusedWorkers.length;PThread.unusedWorkers.forEach(function(w){PThread.load
WasmModuleToWorker(w,function(){if(!--numWorkersToLoad)removeRunDependency(\"wasm-
instantiate\")}))}if(!ENVIRONMENT_IS_PTHREAD){addRunDependency(\"wasm-instantiate\")}function
receiveInstantiatedSource(output){receiveInstance(output[\"instance\"],output[\"module\"])}function
instantiateArrayBuffer(receiver){return getBinaryPromise().then(function(binary){return
WebAssembly.instantiate(binary,info)).then(receiver,function(reason){err(\"failed to asynchronously prepare
wasm: \" +reason);abort(reason)})}function instantiateAsync(){if(!wasmBinary&&typeof
WebAssembly.instantiateStreaming===\"function\"&&!isDataURI(wasmBinaryFile)&&!isFileURI(wasmBinaryFil
e)&&typeof fetch===\"function\"){return fetch(wasmBinaryFile,{credentials:\"same-
origin\"}),then(function(response){var result=WebAssembly.instantiateStreaming(response,info);return
result.then(receiveInstantiatedSource,function(reason){err(\"wasm streaming compile failed: \" +reason);err(\"falling
back to ArrayBuffer instantiation\");return instantiateArrayBuffer(receiveInstantiatedSource)}))}else{return
instantiateArrayBuffer(receiveInstantiatedSource)}if(Module[\"instantiateWasm\"]){try{var
exports=Module[\"instantiateWasm\"](info,receiveInstance);return exports}catch(e){err(\"Module.instantiateWasm
callback failed with error: \" +e);return false}}instantiateAsync().catch(PromiseReject);return{}}var
ASM_CONSTS={10520:function(){throw\"Canceled!\"},10538:function($0,$1){setTimeout(function(){__emscript
en_do_dispatch_to_thread($0,$1),0}});function initPthreadsJS(){PThread.initRuntime()}function
callRuntimeCallbacks(callbacks){while(callbacks.length>0){var callback=callbacks.shift();if(typeof
callback===\"function\")callback(Module);continue}var func=callback.func;if(typeof
func===\"number\")if(callback.arg===undefined){wasmTable.get(func)}else{wasmTable.get(func)(callback.arg)
}}else{func(callback.arg===undefined?null:callback.arg)}}}var
ERRNO_CODES={EPERM:63,ENOENT:44,ESRCH:71,EINTR:27,EIO:29,ENXIO:60,E2BIG:1,ENOEXEC:45,E
BADF:8,ECHILD:12,EAGAIN:6,EWOULDBLOCK:6,ENOMEM:48,EACCES:2,EFAULT:21,ENOTBLK:105,EB
USY:10,EEXIST:20,EXDEV:75,ENODEV:43,ENOTDIR:54,EISDIR:31,EINVAL:28,ENFILE:41,EMFILE:33,EN
OTTY:59,ETXTBSY:74,EFBIG:22,ENOSPC:51,ESPIPE:70,EROFS:69,EMLINK:34,EPIPE:64,EDOM:18,ERAN
GE:68,ENOMSG:49,EIDRM:24,ECHRNA:106,EL2NSYNC:156,EL3HLT:107,EL3RST:108,ELNRNG:109,EUNA
TCH:110,ENOSCSI:111,EL2HLT:112,EDEADLK:16,ENOLCK:46,EBADE:113,EBADR:114,EXFULL:115,ENOA
NO:104,EBADRQC:103,EBADSLT:102,EDEADLOCK:16,EBFONT:101,ENOSTR:100,ENODATA:116,ETIME:
117,ENOSR:118,ENONET:119,ENOPKG:120,EREMOTE:121,ENOLINK:47,EADV:122,ESRMNT:123,ECOMM
:124,EPROTO:65,EMULTIHOP:36,EDOTDOT:125,EBADMSG:9,ENOTUNIQ:126,EBADFD:127,EREMCHG:1
28,ELIBACC:129,ELIBBAD:130,ELIBSCN:131,ELIBMAX:132,ELIBEXEC:133,ENOSYS:52,ENOTEMPTY:55,
ENAMETOOLONG:37,ELOOP:32,EOPNOTSUPP:138,EPFNOSUPPORT:139,ECONNRESET:15,ENOBUFS:42,
EAFNOSUPPORT:5,EPROTOTYPE:67,ENOTSOCK:57,ENOPROTOOPT:50,ESHUTDOWN:140,ECONNREFU
SED:14,EADDRINUSE:3,ECONNABORTED:13,ENETUNREACH:40,ENETDOWN:38,ETIMEDOUT:73,EHOS
TDOWN:142,EHOSTUNREACH:23,EINPROGRESS:26,EALREADY:7,EDESTADDRREQ:17,EMSGSIZE:35,E
PROTONOSUPPORT:66,ESOCKTNOSUPPORT:137,EADDRNOTAVAIL:4,ENETRESET:39,EISCONN:30,EN

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OTCONN:53,ETOOMANYREFS:141,EUSERS:136,EDQUOT:19,ESTALE:72,ENOTSUP:138,ENOMEDIUM:14
8,EILSEQ:25,E_OVERFLOW:61,ECANCELED:11,ENOTRECOVERABLE:56,EOWNERDEAD:62,ESTRPIPE:13
5};function
_emsripten_futex_wake(addr,count){if(addr<=0||addr>GROWABLE_HEAP_I8().length||addr&3!=0||count<0)retu
rn-28;if(count==0)return 0;if(count>=2147483647)count=Infinity;var
mainThreadWaitAddress=Atomics.load(GROWABLE_HEAP_I32(),__emsripten_main_thread_futex>>2);var
mainThreadWoken=0;if(mainThreadWaitAddress==addr){var
loadedAddr=Atomics.compareExchange(GROWABLE_HEAP_I32(),__emsripten_main_thread_futex>>2,mainTh
readWaitAddress,0);if(loadedAddr==mainThreadWaitAddress){--count;mainThreadWoken=1;if(count<=0)return
1}}var ret=Atomics.notify(GROWABLE_HEAP_I32(),addr>>2,count);if(ret>=0)return
ret+mainThreadWoken;throw\"Atomics.notify returned an unexpected value
\"+ret}Module[\"_emsripten_futex_wake\"]=_emsripten_futex_wake;function
killThread(pthread_ptr){if(ENVIRONMENT_IS_PTHREAD)throw\"Internal Error! killThread() can only ever be
called from main application thread!\";if(!pthread_ptr)throw\"Internal Error! Null pthread_ptr in
killThread!\";GROWABLE_HEAP_I32()[pthread_ptr+12>>2]=0;var
pthread=PThread.threads[pthread_ptr];pthread.worker.terminate();PThread.freeThreadData(pthread);PThread.runni
ngWorkers.splice(PThread.runningWorkers.indexOf(pthread.worker),1);pthread.worker.pthread=undefined}functio
n cancelThread(pthread_ptr){if(ENVIRONMENT_IS_PTHREAD)throw\"Internal Error! cancelThread() can only
ever be called from main application thread!\";if(!pthread_ptr)throw\"Internal Error! Null pthread_ptr in
cancelThread!\";var
pthread=PThread.threads[pthread_ptr];pthread.worker.postMessage({\"cmd\":\"cancel\"})}function
cleanupThread(pthread_ptr){if(ENVIRONMENT_IS_PTHREAD)throw\"Internal Error! cleanupThread() can only
ever be called from main application thread!\";if(!pthread_ptr)throw\"Internal Error! Null pthread_ptr in
cleanupThread!\";var
pthread=PThread.threads[pthread_ptr];if(pthread){GROWABLE_HEAP_I32()[pthread_ptr+12>>2]=0;var
worker=pthread.worker;PThread.returnWorkerToPool(worker)}}var
PThread={unusedWorkers:[],runningWorkers:[],initMainThreadBlock:function(){var
pthreadPoolSize=8;for(var
i=0;i<pthreadPoolSize;++i){PThread.allocateUnusedWorker()}},initRuntime:function(){var
tb=_malloc(228);for(var
i=0;i<228/4;++i)GROWABLE_HEAP_U32()[tb/4+i]=0;GROWABLE_HEAP_I32()[tb+12>>2]=tb;var
headPtr=tb+152;GROWABLE_HEAP_I32()[headPtr>>2]=headPtr;var tlsMemory=_malloc(512);for(var
i=0;i<128;++i)GROWABLE_HEAP_U32()[tlsMemory/4+i]=0;Atomics.store(GROWABLE_HEAP_U32(),tb+100
>>2,tlsMemory);Atomics.store(GROWABLE_HEAP_U32(),tb+40>>2,tb);__emsripten_thread_init(tb,1,ENVIRON
MENT_IS_WORKER,1);__emsripten_register_main_browser_thread_id(tb);initWorker:function(){},threads:{},t
hreadExitHandlers:[],setThreadStatus:function(){},runExitHandlers:function(){while(PThread.threadExitHandlers.l
ength>0){PThread.threadExitHandlers.pop()()}if(ENVIRONMENT_IS_PTHREAD&&_pthread_self())__pthread
_tsd_run_dtors()},runExitHandlersAndDeinitThread:function(tb,exitCode){Atomics.store(GROWABLE_HEAP_U
32(),tb+56>>2,1);Atomics.store(GROWABLE_HEAP_U32(),tb+60>>2,0);PThread.runExitHandlers();Atomics.stor
e(GROWABLE_HEAP_U32(),tb+4>>2,exitCode);Atomics.store(GROWABLE_HEAP_U32(),tb+0>>2,1);_emscri
pten_futex_wake(tb+0,2147483647);__emsripten_thread_init(0,0,0)},threadExit:function(exitCode){var
tb=_pthread_self();if(tb){PThread.runExitHandlersAndDeinitThread(tb,exitCode);if(ENVIRONMENT_IS_PTHRE
AD){postMessage({\"cmd\":\"exit\"})}},threadCancel:function(){PThread.runExitHandlersAndDeinitThread(_pthr
ead_self(),-1);postMessage({\"cmd\":\"cancelDone\"})},terminateAllThreads:function(){for(var t in
PThread.threads){var
pthread=PThread.threads[t];if(pthread&&pthread.worker){PThread.returnWorkerToPool(pthread.worker)}}PThre
ad.threads={};for(var i=0;i<PThread.unusedWorkers.length;++i){var
worker=PThread.unusedWorkers[i];worker.terminate()}PThread.unusedWorkers=[];for(var

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i=0;i<PThread.runningWorkers.length;++i){ var worker=PThread.runningWorkers[i];var
pthread=worker.pthread;PThread.freeThreadData(pthread);worker.terminate()}PThread.runningWorkers=[],freeTh
readData:function(pthread){ if(!pthread)return;if(pthread.threadInfoStruct){ var
tlsMemory=GROWABLE_HEAP_I32()[pthread.threadInfoStruct+100>>2];GROWABLE_HEAP_I32()[pthread.thr
eadInfoStruct+100>>2]=0;_free(tlsMemory);_free(pthread.threadInfoStruct)}pthread.threadInfoStruct=0;if(pthread.
allocatedOwnStack&&pthread.stackBase)_free(pthread.stackBase);pthread.stackBase=0;if(pthread.worker)pthread.
worker.pthread=null},returnWorkerToPool:function(worker){PThread.runWithoutMainThreadQueuedCalls(funcio
n){ delete
PThread.pthreads[worker.pthread.threadInfoStruct];PThread.unusedWorkers.push(worker);PThread.runningWorker
s.splice(PThread.runningWorkers.indexOf(worker),1);PThread.freeThreadData(worker.pthread);worker.pthread=un
defined}}},runWithoutMainThreadQueuedCalls:function(func){ GROWABLE_HEAP_I32()[__emscripten_allow_m
ain_runtime_queued_calls>>2]=0;try{ func()} finally{ GROWABLE_HEAP_I32()[__emscripten_allow_runti
me_queued_calls>>2]=1 }},receiveObjectTransfer:function(data){ },loadWasmModuleToWorker:function(worker,o
nFinishedLoading){ worker.onmessage=function(e){ var
d=e["data"];var
cmd=d["cmd"];if(worker.pthread)PThread.currentProxiedOperationCallerThread=worker.pthread.threadInfoStruct;
if(d["targetThread"]&&d["targetThread"]!=_pthread_self()){ var
thread=PThread.pthreads[d.targetThread];if(thread){ thread.worker.postMessage(e.data,d["transferList"]);}else{ con
sole.error('Internal error! Worker sent a message \''+cmd+'\" to target pthread '+d["targetThread"]+', but that
thread no longer
exists!')}PThread.currentProxiedOperationCallerThread=undefined;return}if(cmd===\"processQueuedMainThread
Work\"){__emscripten_main_thread_process_queued_calls()}else
if(cmd===\"spawnThread\"){ spawnThread(e.data)}else
if(cmd===\"cleanupThread\"){ cleanupThread(d[\"thread\"])}else
if(cmd===\"killThread\"){ killThread(d[\"thread\"])}else
if(cmd===\"cancelThread\"){ cancelThread(d[\"thread\"])}else
if(cmd===\"loaded\"){ worker.loaded=true;if(onFinishedLoading)onFinishedLoading(worker);if(worker.runPthread)
{ worker.runPthread();delete
worker.runPthread } else if(cmd===\"print\"){ out(\"Thread \"+d[\"threadId\"]+\": \"+d[\"text\"])}else
if(cmd===\"printErr\"){ err(\"Thread \"+d[\"threadId\"]+\": \"+d[\"text\"])}else if(cmd===\"alert\"){ alert(\"Thread
\"+d[\"threadId\"]+\": \"+d[\"text\"])}else if(cmd===\"exit\"){ var
detached=worker.pthread&&Atomics.load(GROWABLE_HEAP_U32(),worker.pthread.threadInfoStruct+64>>2);if
(detached){ PThread.returnWorkerToPool(worker)} }else
if(cmd===\"exitProcess\"){ try{ exit(d[\"returnCode\"])}catch(e){ if(e instanceof ExitStatus)return;throw e } }else
if(cmd===\"cancelDone\"){ PThread.returnWorkerToPool(worker)}else
if(cmd===\"objectTransfer\"){ PThread.receiveObjectTransfer(e.data)}else
if(e.data.target===\"setImmediate\"){ worker.postMessage(e.data)}else{ err(\"worker sent an unknown command
\'+cmd)\'}PThread.currentProxiedOperationCallerThread=undefined;worker.onerror=function(e){ err(\"pthread sent
an error! \"+e.filename+\": \"+e.lineno+\":
\'+e.message)};if(ENVIRONMENT_IS_NODE){ worker.on(\"message\",function(data){ worker.onmessage({ data:d
ata})});worker.on(\"error\",function(data){ worker.onerror(data)});worker.on(\"exit\",function(data){ })}worker.post
Message({\"cmd\": \"load\", \"urlOrBlob\": Module[\"mainScriptUrlOrBlob\"]||_scriptDir, \"wasmMemory\": wasmMe
memory, \"wasmModule\": wasmModule}),allocateUnusedWorker:function(){ var
pthreadMainJs=locateFile(\"tfjs-backend-wasm-threaded-simd.worker.js\");PThread.unusedWorkers.push(new
Worker(pthreadMainJs)),getNewWorker:function(){ if(PThread.unusedWorkers.length==0){ PThread.allocateUnus
edWorker();PThread.loadWasmModuleToWorker(PThread.unusedWorkers[0])} if(PThread.unusedWorkers.length>
0)return PThread.unusedWorkers.pop();else return null},busySpinWait:function(msecs){ var
t=performance.now()+msecs;while(performance.now()<t){ } };function

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establishStackSpace(stackTop,stackMax){_emscripten_stack_set_limits(stackTop,stackMax);stackRestore(stackTop
)}Module[\"establishStackSpace\"]=establishStackSpace;function
getNoExitRuntime(){return noExitRuntime}Module[\"getNoExitRuntime\"]=getNoExitRuntime;function
invokeEntryPoint(ptr,arg){return
wasmTable.get(ptr)(arg)}Module[\"invokeEntryPoint\"]=invokeEntryPoint;function
__assert_fail(condition,filename,line,func){abort(\"Assertion failed: \"+UTF8ToString(condition)+\", at:
\"+[filename?UTF8ToString(filename):\"unknown filename\",line,func?UTF8ToString(func):\"unknown
function\"])}function __call_main(argc,argv){var returnCode=_main(argc,argv)}var
_emscripten_get_now;if(ENVIRONMENT_IS_NODE){_emscripten_get_now=function(){var
t=process[\"hrtime\"]();return t[0]*1e3+t[1]/1e6}}else
if(ENVIRONMENT_IS_PTHREAD){_emscripten_get_now=function(){return performance.now()-
Module[\"__performance_now_clock_drift\"]}}else if(typeof
dateNow!=\"undefined\"){_emscripten_get_now=dateNow}else _emscripten_get_now=function(){return
performance.now()};function setErrNo(value){GROWABLE_HEAP_I32()[__errno_location()>>2]=value;return
value}function _atexit(func,arg){if(ENVIRONMENT_IS_PTHREAD)return
_emscripten_proxy_to_main_thread_js(1,1,func,arg)}function
_emscripten_notify_thread_queue(targetThreadId,mainThreadId){if(targetThreadId==mainThreadId){postMessag
e({\"cmd\\\": \"processQueuedMainThreadWork\"})}}else
if(ENVIRONMENT_IS_PTHREAD){postMessage({\"targetThread\\\":targetThreadId,\"cmd\\\": \"processThreadQueu
e\\\"})}}else {var pthread=PThread.pthreads[targetThreadId];var
worker=pthread&&pthread.worker;if(!worker){return}worker.postMessage({\"cmd\\\": \"processThreadQueue\\\"})}ret
urn 1}function _abort(){abort()}function _emscripten_asm_const_int(code,sigPtr,argbuf){var
args=readAsmConstArgs(sigPtr,argbuf);return ASM_CONSTS[code].apply(null,args)}function
_emscripten_conditional_set_current_thread_status(expectedStatus,newStatus){}function
_emscripten_futex_wait(addr,val,timeout){if(addr<=0||addr>GROWABLE_HEAP_I8().length||addr&3!=0)return-
28;if(!ENVIRONMENT_IS_WEB){var
ret=Atomics.wait(GROWABLE_HEAP_I32(),addr>>2,val,timeout);if(ret===\"timed-out\")return-
73;if(ret===\"not-equal\")return-6;if(ret===\"ok\")return
0;throw\"Atomics.wait returned an unexpected value
\"+ret}else {if(Atomics.load(GROWABLE_HEAP_I32(),addr>>2)!=val){return-6}var
tNow=performance.now();var tEnd=tNow+timeout;var
lastAddr=Atomics.exchange(GROWABLE_HEAP_I32(),__emscripten_main_thread_futex>>2,addr);while(1){tNo
w=performance.now();if(tNow>tEnd){lastAddr=Atomics.exchange(GROWABLE_HEAP_I32(),__emscripten_mai
n_thread_futex>>2,0);return-
73}lastAddr=Atomics.exchange(GROWABLE_HEAP_I32(),__emscripten_main_thread_futex>>2,0);if(lastAddr==
0){break}_emscripten_main_thread_process_queued_calls();if(Atomics.load(GROWABLE_HEAP_I32(),addr>>2)!
=val){return-
6}lastAddr=Atomics.exchange(GROWABLE_HEAP_I32(),__emscripten_main_thread_futex>>2,addr)}return
0}}function
_emscripten_memcpy_big(dest,src,num){GROWABLE_HEAP_U8().copyWithin(dest,src,src+num)}function
_emscripten_num_logical_cores(){if(ENVIRONMENT_IS_NODE)return require(\"os\").cpus().length;return
navigator[\"hardwareConcurrency\"]}function
_emscripten_proxy_to_main_thread_js(index,sync){var numCallArgs=arguments.length-2;var
stack=stackSave();var serializedNumCallArgs=numCallArgs;var args=stackAlloc(serializedNumCallArgs*8);var
b=args>>3;for(var i=0;i<numCallArgs;i++){var arg=arguments[2+i];GROWABLE_HEAP_F64()[b+i]=arg}var
ret=_emscripten_run_in_main_runtime_thread_js(index,serializedNumCallArgs,args,sync);stackRestore(stack);retur
n ret}var _emscripten_receive_on_main_thread_js_callArgs=[];var readAsmConstArgsArray=[];function
readAsmConstArgs(sigPtr,buf){readAsmConstArgsArray.length=0;var

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ch;buf>>=2;while(ch=GROWABLE_HEAP_U8()[sigPtr++){var
double=ch<105;if(double&&buf&&1)buf++;readAsmConstArgsArray.push(double?GROWABLE_HEAP_F64()[buf
++>>1]:GROWABLE_HEAP_I32()[buf]);++buf}return readAsmConstArgsArray}function
_emscripten_receive_on_main_thread_js(index,numCallArgs,args){_emscripten_receive_on_main_thread_js_callA
rgs.length=numCallArgs;var b=args>>3;for(var
i=0;i<numCallArgs;i++){_emscripten_receive_on_main_thread_js_callArgs[i]=GROWABLE_HEAP_F64()[b+i]}v
ar
isEmAsmConst=index<0;var func=!isEmAsmConst?proxiedFunctionTable[index]:ASM_CONSTS[-index-
1];return func.apply(null,_emscripten_receive_on_main_thread_js_callArgs)}function
_emscripten_get_heap_size(){return GROWABLE_HEAP_U8().length}function
emscripten_realloc_buffer(size){try{wasmmemory.grow(size-
buffer.byteLength+65535>>>16);updateGlobalBufferAndViews(wasmmemory.buffer);return
1}catch(e){}}function _emscripten_resize_heap(requestedSize){var
oldSize=_emscripten_get_heap_size();if(requestedSize<=oldSize){return false}var
maxHeapSize=2147483648;if(requestedSize>maxHeapSize){return false}for(var
cutDown=1;cutDown<=4;cutDown*=2){var
overGrownHeapSize=oldSize*(1+.2/cutDown);overGrownHeapSize=Math.min(overGrownHeapSize,requestedSize
+100663296);var
newSize=Math.min(maxHeapSize,alignUp(Math.max(requestedSize,overGrownHeapSize),65536));var
replacement=emscripten_realloc_buffer(newSize);if(replacement){return true}}return false}var
JSEvents={inEventHandler:0,removeAllEventListeners:function(){for(var
i=JSEvents.eventHandlers.length-1;i>=0;--
i){JSEvents._removeHandler(i)}JSEvents.eventHandlers=[];JSEvents.deferredCalls=[]},registerRemoveEventListen
ers:function(){if(!JSEvents.removeEventListenersRegistered){__ATEXIT__.push(JSEvents.removeAllEventListene
rs);JSEvents.removeEventListenersRegistered=true}},deferredCalls:[],deferCall:function(targetFunction,precedence
,argsList){function arraysHaveEqualContent(arrA,arrB){if(arrA.length!=arrB.length)return false;for(var i in
arrA){if(arrA[i]!=arrB[i])return false}return true}for(var i in JSEvents.deferredCalls){var
call=JSEvents.deferredCalls[i];if(call.targetFunction==targetFunction&&arraysHaveEqualContent(call.argsList,args
List)){return}}JSEvents.deferredCalls.push({targetFunction:targetFunction,precedence:precedence,argsList:argsList
});JSEvents.deferredCalls.sort(function(x,y){return
x.precedence<y.precedence})},removeDeferredCalls:function(targetFunction){for(var
i=0;i<JSEvents.deferredCalls.length;++i){if(JSEvents.deferredCalls[i].targetFunction==targetFunction){JSEvents.d
eferredCalls.splice(i,1);--i}},canPerformEventHandlerRequests:function(){return
JSEvents.inEventHandler&&JSEvents.currentEventHandler.allowsDeferredCalls},runDeferredCalls:function(){if(!J
SEvents.canPerformEventHandlerRequests()){return}for(var i=0;i<JSEvents.deferredCalls.length;++i){var
call=JSEvents.deferredCalls[i];JSEvents.deferredCalls.splice(i,1);--
i;call.targetFunction.apply(null,call.argsList)},eventHandlers:[],removeAllHandlersOnTarget:function(target,event
TypeString){for(var
i=0;i<JSEvents.eventHandlers.length;++i){if(JSEvents.eventHandlers[i].target==target&&(!eventTypeString||event
TypeString==JSEvents.eventHandlers[i].eventTypeString)){JSEvents._removeHandler(i--
)}}},_removeHandler:function(i){var
h=JSEvents.eventHandlers[i];h.target.removeEventListener(h.eventTypeString,h.eventListenerFunc,h.useCapture);J
SEvents.eventHandlers.splice(i,1)},registerOrRemoveHandler:function(eventHandler){var
jsEventHandler=function
jsEventHandler(event){++JSEvents.inEventHandler;JSEvents.currentEventHandler=eventHandler;JSEvents.runDef
erredCalls();eventHandler.handlerFunc(event);JSEvents.runDeferredCalls();--
JSEvents.inEventHandler};if(eventHandler.callbackfunc){eventHandler.eventListenerFunc=jsEventHandler;eventH
andler.target.addEventListener(eventHandler.eventTypeString,jsEventHandler,eventHandler.useCapture);JSEvents.e

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ventHandlers.push(eventHandler);JSEvents.registerRemoveEventListeners()}else{for(var
i=0;i<JSEvents.eventHandlers.length;++i){if(JSEvents.eventHandlers[i].target==eventHandler.target&&JSEvents.e
ventHandlers[i].eventTypeString==eventHandler.eventTypeString){JSEvents._removeHandler(i--
)}}},queueEventHandlerOnThread_iiii:function(targetThread,eventHandlerFunc,eventTypeId,eventData,userData)
{var stackTop=stackSave();var
varargs=stackAlloc(12);GROWABLE_HEAP_I32()[varargs>>2]=eventTypeId;GROWABLE_HEAP_I32()[varargs
+4>>2]=eventData;GROWABLE_HEAP_I32()[varargs+8>>2]=userData;__emscripten_call_on_thread(0,targetThr
ead,637534208,eventHandlerFunc,eventData,varargs);stackRestore(stackTop)},getTargetThreadForEventCallback:f
unction(targetThread){switch(targetThread){case
1:return 0;case 2:return PThread.currentProxiedOperationCallerThread;default:return
targetThread}},getNodeNameForTarget:function(target){if(!target)return\"\";if(target==window)return\"#window\";
if(target==screen)return\"#screen\";return
target&&target.nodeName?target.nodeName:\"\"},fullscreenEnabled:function(){return
document.fullscreenEnabled||document.webkitFullscreenEnabled}};function stringToNewUTF8(jsString){var
length=lengthBytesUTF8(jsString)+1;var cString=_malloc(length);stringToUTF8(jsString,cString,length);return
cString}function
_emsripten_set_offscreencanvas_size_on_target_thread_js(targetThread,targetCanvas,width,height){var
stackTop=stackSave();var varargs=stackAlloc(12);var
targetCanvasPtr=0;if(targetCanvas){targetCanvasPtr=stringToNewUTF8(targetCanvas)}GROWABLE_HEAP_I32(
)[varargs>>2]=targetCanvasPtr;GROWABLE_HEAP_I32()[varargs+4>>2]=width;GROWABLE_HEAP_I32()[var
args+8>>2]=height;__emscripten_call_on_thread(0,targetThread,657457152,0,targetCanvasPtr,varargs);stackRestor
e(stackTop)}function
_emsripten_set_offscreencanvas_size_on_target_thread(targetThread,targetCanvas,width,height){targetCanvas=tar
getCanvas?UTF8ToString(targetCanvas):\"\";_emsripten_set_offscreencanvas_size_on_target_thread_js(targetThr
ead,targetCanvas,width,height)}function maybeCStringToJsString(cString){return
cString>2?UTF8ToString(cString):cString}var specialHTMLTargets=[0,typeof
document!=\"undefined\"?document:0,typeof window!=\"undefined\"?window:0];function
findEventTarget(target){target=maybeCStringToJsString(target);var
domElement=specialHTMLTargets[target]||(typeof
document!=\"undefined\"?document.querySelector(target):undefined);return domElement}function
findCanvasEventTarget(target){return findEventTarget(target)}function
_emsripten_set_canvas_element_size_calling_thread(target,width,height){var
canvas=findCanvasEventTarget(target);if(!canvas)return-
4;if(canvas.canvasSharedPtr){GROWABLE_HEAP_I32()[canvas.canvasSharedPtr>>2]=width;GROWABLE_HEA
P_I32()[canvas.canvasSharedPtr+4>>2]=height;if(canvas.offscreenCanvas||!canvas.controlTransferredOffscreen){if
(canvas.offscreenCanvas)canvas=canvas.offscreenCanvas;var
autoResizeViewport=false;if(canvas.GLctxObject&&canvas.GLctxObject.GLctx){var
prevViewport=canvas.GLctxObject.GLctx.getParameter(2978);autoResizeViewport=prevViewport[0]==0&&prev
Viewport[1]==0&&prevViewport[2]==canvas.width&&prevViewport[3]==canvas.height}canvas.width=width;
canvas.height=height;if(autoResizeViewport){canvas.GLctxObject.GLctx.viewport(0,0,width,height)}}else
if(canvas.canvasSharedPtr){var
targetThread=GROWABLE_HEAP_I32()[canvas.canvasSharedPtr+8>>2];_emsripten_set_offscreencanvas_size_o
n_target_thread(targetThread,target,width,height);return 1}else{return-4}return 0}function
_emsripten_set_canvas_element_size_main_thread(target,width,height){if(ENVIRONMENT_IS_PTHREAD)retur
n
_emsripten_proxy_to_main_thread_js(2,1,target,width,height);return
_emsripten_set_canvas_element_size_calling_thread(target,width,height)}function
_emsripten_set_canvas_element_size(target,width,height){var

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canvas=findCanvasEventTarget(target);if(canvas){return
_emsripten_set_canvas_element_size_calling_thread(target,width,height)}else{return
_emsripten_set_canvas_element_size_main_thread(target,width,height)} }function
_emsripten_set_current_thread_status(newStatus){ }function
_emsripten_set_thread_name(threadId,name){ }function __webgl_enable_ANGLE_instanced_arrays(ctx){ var
ext=ctx.getExtension("ANGLE_instanced_arrays");if(ext){ctx["vertexAttribDivisor"]=function(index,divisor){ex
t["vertexAttribDivisorANGLE"](index,divisor)};ctx["drawArraysInstanced"]=function(mode,first,count,primcou
nt){ext["drawArraysInstancedANGLE"](mode,first,count,primcount)};ctx["drawElementsInstanced"]=function(
mode,count,type,indices,primcount){ext["drawElementsInstancedANGLE"](mode,count,type,indices,primcount)};
return
1 } }function __webgl_enable_OES_vertex_array_object(ctx){ var
ext=ctx.getExtension("OES_vertex_array_object");if(ext){ctx["createVertexArray"]=function(){return
ext["createVertexArrayOES"]();};ctx["deleteVertexArray"]=function(vao){ext["deleteVertexArrayOES"](vao)};
ctx["bindVertexArray"]=function(vao){ext["bindVertexArrayOES"](vao)};ctx["isVertexArray"]=function(vao)
{return ext["isVertexArrayOES"](vao)};return 1 } }function __webgl_enable_WEBGL_draw_buffers(ctx){ var
ext=ctx.getExtension("WEBGL_draw_buffers");if(ext){ctx["drawBuffers"]=function(n,bufs){ext["drawBuffers
WEBGL"](n,bufs)};return 1 } }function
__webgl_enable_WEBGL_multi_draw(ctx){return!(ctx.multiDrawWebgl=ctx.getExtension("WEBGL_multi_dra
w"))}var
GL={ counter:1,buffers:[],programs:[],framebuffers:[],renderbuffers:[],textures:[],uniforms:[],shaders:[],vaos:[],cont
exts:{ },offscreenCanvases:{ },timerQueriesEXT:[],programInfos:{ },stringCache:{ },unpackAlignment:4,recordError:
function
recordError(errorCode){if(!GL.lastError){GL.lastError=errorCode}},getNewId:function(table){ var
ret=GL.counter++;for(var i=table.length;i<ret;i++){ table[i]=null}return
ret},getSource:function(shader,count,string,length){ var source="";for(var i=0;i<count;++i){ var
len=length?GROWABLE_HEAP_I32()[length+i*4>>2]:-
1;source+=UTF8ToString(GROWABLE_HEAP_I32()[string+i*4>>2],len<0?undefined:len)}return
source},createContext:function(canvas,webGLContextAttributes){ var
ctx=canvas.getContext("webgl",webGLContextAttributes);if(!ctx)return 0;var
handle=GL.registerContext(ctx,webGLContextAttributes);return
handle},registerContext:function(ctx,webGLContextAttributes){ var
handle=_malloc(8);GROWABLE_HEAP_I32()[handle+4>>2]=_pthread_self();var
context={ handle:handle,attributes:webGLContextAttributes,version:webGLContextAttributes.majorVersion,GLctx:
ctx };if(ctx.canvas)ctx.canvas.GLctxObject=context;GL.contexts[handle]=context;if(typeof
webGLContextAttributes.enableExtensionsByDefault==="undefined"||webGLContextAttributes.enableExtensions
ByDefault){GL.initExtensions(context)}return
handle},makeContextCurrent:function(contextHandle){GL.currentContext=GL.contexts[contextHandle];Module.ctx
=GLctx=GL.currentContext&&GL.currentContext.GLctx;return!(contextHandle&&!GLctx)},getContext:function(c
ontextHandle){return
GL.contexts[contextHandle]},deleteContext:function(contextHandle){if(GL.currentContext===GL.contexts[context
Handle])GL.currentContext=null;if(typeof
JSEvents==="object")JSEvents.removeAllHandlersOnTarget(GL.contexts[contextHandle].GLctx.canvas);if(GL.co
ntexts[contextHandle]&&GL.contexts[contextHandle].GLctx.canvas)GL.contexts[contextHandle].GLctx.canvas.GL
ctxObject=undefined;_free(GL.contexts[contextHandle].handle);GL.contexts[contextHandle]=null},initExtensions:f
unction(context){if(!context)context=GL.currentContext;if(context.initExtensionsDone)return;context.initExtension
sDone=true;var
GLctx=context.GLctx;__webgl_enable_ANGLE_instanced_arrays(GLctx);__webgl_enable_OES_vertex_array_obj
ect(GLctx);__webgl_enable_WEBGL_draw_buffers(GLctx);GLctx.disjointTimerQueryExt=GLctx.getExtension("

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EXT_disjoint_timer_query\");__webgl_enable_WEBGL_multi_draw(GLctx);var
exts=GLctx.getSupportedExtensions()||[];exts.forEach(function(ext){if(ext.indexOf("\lose_context\")==0&&ext.inde
xOf("\debug\")==0){GLctx.getExtension(ext)}}),populateUniformTable:function(program){var
p=GL.programs[program];var
ptable=GL.programInfos[program]={uniforms:{},maxUniformLength:0,maxAttributeLength:-
1,maxUniformBlockNameLength:-1};var utable=ptable.uniforms;var
numUniforms=GLctx.getProgramParameter(p,35718);for(var i=0;i<numUniforms;++i){var
u=GLctx.getActiveUniform(p,i);var
name=u.name;ptable.maxUniformLength=Math.max(ptable.maxUniformLength,name.length+1);if(name.slice(-
1)!="\"){name=name.slice(0,name.lastIndexOf("\"))}var loc=GLctx.getUniformLocation(p,name);if(loc){var
id=GLctx.getNewId(GL.uniforms);utable[name]=[u.size,id];GL.uniforms[id]=loc;for(var
j=1;j<u.size;++j){var
n=name+"\["+j+"\]";loc=GLctx.getUniformLocation(p,n);id=GLctx.getNewId(GL.uniforms);GL.uniforms[id]=loc}}
};var __emscripten_webgl_power_preferences=["default","low-power","high-performance"];function
__emscripten_webgl_do_create_context(target,attributes){var a=attributes>>2;var
powerPreference=GROWABLE_HEAP_I32()[a+(24>>2)];var
contextAttributes={"alpha\":"!!GROWABLE_HEAP_I32()[a+(0>>2)],"depth\":"!!GROWABLE_HEAP_I32()[a+(4
>>2)],"stencil\":"!!GROWABLE_HEAP_I32()[a+(8>>2)],"antialias\":"!!GROWABLE_HEAP_I32()[a+(12>>2)],"p
remultipliedAlpha\":"!!GROWABLE_HEAP_I32()[a+(16>>2)],"preserveDrawingBuffer\":"!!GROWABLE_HEAP_
I32()[a+(20>>2)],"powerPreference\":"__emscripten_webgl_power_preferences[powerPreference],"\failIfMajorPerf
ormanceCaveat\":"!!GROWABLE_HEAP_I32()[a+(28>>2)],majorVersion:GROWABLE_HEAP_I32()[a+(32>>2)],
minorVersion:GROWABLE_HEAP_I32()[a+(36>>2)],enableExtensionsByDefault:GROWABLE_HEAP_I32()[a+(
40>>2)],explicitSwapControl:GROWABLE_HEAP_I32()[a+(44>>2)],proxyContextToMainThread:GROWABLE_
HEAP_I32()[a+(48>>2)],renderViaOffscreenBackBuffer:GROWABLE_HEAP_I32()[a+(52>>2)]};var
canvas=findCanvasEventTarget(target);if(!canvas){return 0}if(contextAttributes.explicitSwapControl){return
0}var contextHandle=GL.createContext(canvas,contextAttributes);return contextHandle}function
__emscripten_webgl_create_context(a0,a1){return __emscripten_webgl_do_create_context(a0,a1)}var
SYSCALLS={mappings:{},buffers:[null,[],[]],printChar:function(stream,curr){var
buffer=SYSCALLS.buffers[stream];if(curr===0||curr===10){(stream===1?out:err)(UTF8ArrayToString(buffer,0));
buffer.length=0}else{buffer.push(curr)}},varargs:undefined,get:function(){SYSCALLS.varargs+=4;var
ret=GROWABLE_HEAP_I32()[SYSCALLS.varargs-4>>2];return ret},getStr:function(ptr){var
ret=UTF8ToString(ptr);return ret},get64:function(low,high){return low}};function
__fd_close(fd){if(ENVIRONMENT_IS_PTHREAD)return __emscripten_proxy_to_main_thread_js(3,1,fd);return
0}function __fd_seek(fd,offset_low,offset_high,whence,newOffset){if(ENVIRONMENT_IS_PTHREAD)return
__emscripten_proxy_to_main_thread_js(4,1,fd,offset_low,offset_high,whence,newOffset)}function
__fd_write(fd,iiov,iiovcnt,pnum){if(ENVIRONMENT_IS_PTHREAD)return
__emscripten_proxy_to_main_thread_js(5,1,fd,iiov,iiovcnt,pnum);var num=0;for(var i=0;i<iiovcnt;i++){var
ptr=GROWABLE_HEAP_I32()[iiov+i*8>>2];var len=GROWABLE_HEAP_I32()[iiov+(i*8+4)>>2];for(var
j=0;j<len;j++){SYSCALLS.printChar(fd,GROWABLE_HEAP_U8)[ptr+j]}num+=len}GROWABLE_HEAP_I32
()[pnum>>2]=num;return 0}function __pthread_cleanup_pop(execute){var
routine=PThread.threadExitHandlers.pop();if(execute)routine()}function
__pthread_cleanup_push(routine,arg){PThread.threadExitHandlers.push(function(){wasnTable.get(routine)(arg)})}f
unction spawnThread(threadParams){if(ENVIRONMENT_IS_PTHREAD)throw"Internal Error! spawnThread()
can only ever be called from main application thread!";var
worker=PThread.getNewWorker();if(worker.pthread!==undefined)throw"Internal
error!";if(!threadParams.pthread_ptr)throw"Internal
error, no pthread ptr!";PThread.runningWorkers.push(worker);var tlsMemory=_malloc(128*4);for(var
i=0;i<128;++i){GROWABLE_HEAP_I32()[tlsMemory+i*4>>2]=0}var

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stackHigh=threadParams.stackBase+threadParams.stackSize;var
pthread=PThread.pthreads[threadParams.pthread_ptr]={ worker:worker,stackBase:threadParams.stackBase,stackSize
:threadParams.stackSize,allocatedOwnStack:threadParams.allocatedOwnStack,threadInfoStruct:threadParams.pthread
d_ptr};var
tis=pthread.threadInfoStruct>>2;Atomics.store(GROWABLE_HEAP_U32(),tis+(64>>2),threadParams.detached);A
tomics.store(GROWABLE_HEAP_U32(),tis+(100>>2),tlsMemory);Atomics.store(GROWABLE_HEAP_U32(),tis
+(40>>2),pthread.threadInfoStruct);Atomics.store(GROWABLE_HEAP_U32(),tis+(80>>2),threadParams.stackSiz
e);Atomics.store(GROWABLE_HEAP_U32(),tis+(76>>2),stackHigh);Atomics.store(GROWABLE_HEAP_U32(),t
is+(104>>2),threadParams.stackSize);Atomics.store(GROWABLE_HEAP_U32(),tis+(104+8>>2),stackHigh);Atom
ics.store(GROWABLE_HEAP_U32(),tis+(104+12>>2),threadParams.detached);var
global_libc=_emscripten_get_global_libc();var
global_locale=global_libc+40;Atomics.store(GROWABLE_HEAP_U32(),tis+(172>>2),global_locale);worker.pthr
ead=pthread;var
msg={"cmd\\":\\"run\\",\\"start_routine\\":threadParams.startRoutine,\\"arg\\":threadParams.arg,\\"threadInfoStruct\\":thre
adParams.pthread_ptr,\\"stackBase\\":threadParams.stackBase,\\"stackSize\\":threadParams.stackSize};worker.runPthre
ad=function(){msg.time=performance.now();worker.postMessage(msg,threadParams.transferList)};if(worker.loaded
){worker.runPthread();delete worker.runPthread}}function
_pthread_create(pthread_ptr,attr,start_routine,arg){if(typeof SharedArrayBuffer===\\"undefined\\"){err(\\"Current
environment does not support SharedArrayBuffer, pthreads are not available!\\");return
6}if(!pthread_ptr){err(\\"pthread_create called with a null thread pointer!\\");return 28}var transferList=[];var
error=0;if(ENVIRONMENT_IS_PTHREAD&&(transferList.length===0||error)){return
_emscripten_sync_run_in_main_thread_4(687865856,pthread_ptr,attr,start_routine,arg)}if(error)return
error;var stackSize=0;var stackBase=0;var detached=0;if(attr&&attr!=
1){stackSize=GROWABLE_HEAP_I32()[attr>>2];stackSize+=81920;stackBase=GROWABLE_HEAP_I32()[attr+
8>>2];detached=GROWABLE_HEAP_I32()[attr+12>>2]!==0}else{stackSize=2097152}var
allocatedOwnStack=stackBase===0;if(allocatedOwnStack){stackBase=_memalign(16,stackSize)}else{stackBase=
stackSize;assert(stackBase>0)}var threadInfoStruct=_malloc(228);for(var
i=0;i<228>>2;+=i)GROWABLE_HEAP_U32()[threadInfoStruct>>2+i]=0;GROWABLE_HEAP_I32()[pthread_p
tr>>2]=threadInfoStruct;GROWABLE_HEAP_I32()[threadInfoStruct+12>>2]=threadInfoStruct;var
headPtr=threadInfoStruct+152;GROWABLE_HEAP_I32()[headPtr>>2]=headPtr;var
threadParams={stackBase:stackBase,stackSize:stackSize,allocatedOwnStack:allocatedOwnStack,detached:detached
,startRoutine:start_routine,pthread_ptr:threadInfoStruct,arg:arg,transferList:transferList};if(ENVIRONMENT_IS_P
THREAD){threadParams.cmd=\\"spawnThread\\";postMessage(threadParams,transferList)}else{spawnThread(thread
Params)}return
0}function __pthread_testcancel_js(){if(!ENVIRONMENT_IS_PTHREAD)return;var
tb=__pthread_self();if(!tb)return;var
cancelDisabled=Atomics.load(GROWABLE_HEAP_U32(),tb+56>>2);if(cancelDisabled)return;var
canceled=Atomics.load(GROWABLE_HEAP_U32(),tb+0>>2);if(canceled===2)throw\\"Canceled!\\"}function
_emscripten_check_blocking_allowed(){if(ENVIRONMENT_IS_NODE)return;if(ENVIRONMENT_IS_WORKE
R)return;warnOnce(\\"Blocking on the main thread is very dangerous, see
https://emscripten.org/docs/porting/pthreads.html#blocking-on-the-main-browser-thread\\");}function
__emscripten_do_pthread_join(thread,status,block){if(!thread){err(\\"pthread_join attempted on a null thread
pointer!\\");return
ERRNO_CODES.ESRCH}if(ENVIRONMENT_IS_PTHREAD&&__pthread_self()===thread){err(\\"PThread
\\"+thread+\\" is attempting to join to itself!\\");return ERRNO_CODES.EDEADLK}else
if(!ENVIRONMENT_IS_PTHREAD&&_emscripten_main_browser_thread_id()===thread){err(\\"Main
thread \\"+thread+\\" is attempting to join to itself!\\");return ERRNO_CODES.EDEADLK}var
self=GROWABLE_HEAP_I32()[thread+12>>2];if(self!==thread){err(\\"pthread_join attempted on thread

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\"+thread+\", which does not point to a valid thread, or does not exist anymore!\");return
ERRNO_CODES.ESRCH}var
detached=Atomics.load(GROWABLE_HEAP_U32(),thread+64>>2);if(detached){err(\"Attempted to join thread
\"+thread+\", which was already detached!\");return
ERRNO_CODES.EINVAL}if(block){_emscripten_check_blocking_allowed()}for(;;){var
threadStatus=Atomics.load(GROWABLE_HEAP_U32(),thread+0>>2);if(threadStatus==1){var
threadExitCode=Atomics.load(GROWABLE_HEAP_U32(),thread+4>>2);if(status)GROWABLE_HEAP_I32()[sta
tus>>2]=threadExitCode;Atomics.store(GROWABLE_HEAP_U32(),thread+64>>2,1);if(!ENVIRONMENT_IS_PT
HREAD)cleanupThread(thread);else postMessage({\"cmd\": \"cleanupThread\", \"thread\": thread});return
0}if(!block){return
ERRNO_CODES.EBUSY}__pthread_testcancel_js();if(!ENVIRONMENT_IS_PTHREAD)_emscripten_main_thre
ad_process_queued_calls();_emscripten_futex_wait(thread+0,threadStatus,ENVIRONMENT_IS_PTHREAD?100:1
)}}function
_pthread_join(thread,status){return __emscripten_do_pthread_join(thread,status,true)}function
_sysconf(name){if(ENVIRONMENT_IS_PTHREAD)return
_emscripten_proxy_to_main_thread_js(6,1,name);switch(name){case 30:return 16384;case 85:var
maxHeapSize=2147483648;return maxHeapSize/16384;case 132:case 133:case 12:case 137:case 138:case 15:case
235:case 16:case 17:case 18:case 19:case 20:case 149:case 13:case 10:case 236:case 153:case 9:case 21:case 22:case
159:case 154:case 14:case 77:case 78:case 139:case 82:case 68:case 67:case 164:case 11:case 29:case 47:case
48:case 95:case 52:case 51:case 46:return 200809;case 27:case 246:case 127:case 128:case 23:case 24:case 160:case
161:case 181:case 182:case 242:case 183:case 184:case 243:case 244:case 245:case 165:case 178:case 179:case
49:case 50:case 168:case 169:case 175:case 170:case 171:case 172:case
97:case 76:case 32:case 173:case 35:case 80:case 81:case 79:return -1;case 176:case 177:case 7:case 155:case 8:case
157:case 125:case 126:case 92:case 93:case 129:case 130:case 131:case 94:case 91:return 1;case 74:case 60:case
69:case 70:case 4:return 1024;case 31:case 42:case 72:return 32;case 87:case 26:case 33:return 2147483647;case
34:case 1:return 47839;case 38:case 36:return 99;case 43:case 37:return 2048;case 0:return 2097152;case 3:return
65536;case 28:return 32768;case 44:return 32767;case 75:return 16384;case 39:return 1e3;case 89:return 700;case
71:return 256;case 40:return 255;case 2:return 100;case 180:return 64;case 25:return 20;case 5:return 16;case
6:return 6;case 73:return 4;case 84:{if(typeof navigator===\"object\")return
navigator[\"hardwareConcurrency\"]||1;return 1}}setErrNo(28);return-
1}if(!ENVIRONMENT_IS_PTHREAD)PThread.initMainThreadBlock();var GLctx;var
proxiedFunctionTable=[null,_atexit,_emscripten_set_canvas_element_size_main_thread,_fd_close,_fd_seek,_fd_wr
ite,_sysconf];var
asmLibraryArg={\"e\":__assert_fail,\"r\":__call_main,\"x\":__emscripten_notify_thread_queue,\"b\":_abort,\"y\":
_emscripten_asm_const_int,\"j\":_emscripten_conditional_set_current_thread_status,\"d\":_emscripten_futex_wait,\"
c\":_emscripten_futex_wake,\"f\":_emscripten_get_now,\"p\":_emscripten_memcpy_big,\"A\":_emscripten_num_l
ogical_cores,\"u\":_emscripten_receive_on_main_thread_js,\"q\":_emscripten_resize_heap,\"v\":_emscripten_set_ca
nvas_element_size,\"i\":_emscripten_set_current_thread_status,\"s\":_emscripten_set_thread_name,\"w\":_emscript
en_webgl_create_context,\"l\":_fd_close,\"n\":_fd_seek,\"g\":_fd_write,\"o\":initPthreadsJS,\"a\":wasmMemory||Mo
dule[\"wasmMemory\"],\"z\":_pthread_cleanup_pop,\"k\":_pthread_cleanup_push,\"h\":_pthread_create,\"m\":_pthr
ead_join,\"t\":_sysconf};var asm=createWasm();var
__wasm_call_ctors=Module[\"__wasm_call_ctors\"]=function(){return(__wasm_call_ctors=Module[\"__wasm
_call_ctors\"]=Module[\"asm\"][\"B\"]).apply(null,arguments)};var
_init=Module[\"_init\"]=function(){return(_init=Module[\"_init\"]=Module[\"asm\"][\"C\"]).apply(null,arguments)};
var
_init_with_threads_count=Module[\"_init_with_threads_count\"]=function(){return(_init_with_threads_count=Mod
ule[\"_init_with_threads_count\"]=Module[\"asm\"][\"D\"]).apply(null,arguments)};var
_get_threads_count=Module[\"_get_threads_count\"]=function(){return(_get_threads_count=Module[\"_get_threads

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_count"]="Module["asm\"][\"E\").apply(null,arguments)};var
_register_tensor=Module["_register_tensor"]=function(){return(_register_tensor=Module["_register_tensor"]="Module["asm\"][\"F\").apply(null,arguments)};var
_dispose_data=Module["_dispose_data"]=function(){return(_dispose_data=Module["_dispose_data"]="Module["asm\"][\"G\").apply(null,arguments)};var
_dispose=Module["_dispose"]=function(){return(_dispose=Module["_dispose"]="Module["asm\"][\"H\").apply(null,arguments)};var
_Abs=Module["_Abs"]=function(){return(_Abs=Module["_Abs"]="Module["asm\"][\"J\").apply(null,arguments)};var
_Add=Module["_Add"]=function(){return(_Add=Module["_Add"]="Module["asm\"][\"K\").apply(null,arguments)};var
_AddN=Module["_AddN"]=function(){return(_AddN=Module["_AddN"]="Module["asm\"][\"L\").apply(null,arguments)};var
_All=Module["_All"]=function(){return(_All=Module["_All"]="Module["asm\"][\"M\").apply(null,arguments)};var
_Any=Module["_Any"]=function(){return(_Any=Module["_Any"]="Module["asm\"][\"N\").apply(null,arguments)};var
_ArgMax=Module["_ArgMax"]=function(){return(_ArgMax=Module["_ArgMax"]="Module["asm\"][\"O\").apply(null,arguments)};var
_AvgPool=Module["_AvgPool"]=function(){return(_AvgPool=Module["_AvgPool"]="Module["asm\"][\"P\").apply(null,arguments)};var
_BatchMatMul=Module["_BatchMatMul"]=function(){return(_BatchMatMul=Module["_BatchMatMul"]="Module["asm\"][\"Q\").apply(null,arguments)};var
_Ceil=Module["_Ceil"]=function(){return(_Ceil=Module["_Ceil"]="Module["asm\"][\"R\").apply(null,arguments)};var
_ClipByValue=Module["_ClipByValue"]=function(){return(_ClipByValue=Module["_ClipByValue"]="Module["asm\"][\"S\").apply(null,arguments)};var
_Conv2D=Module["_Conv2D"]=function(){return(_Conv2D=Module["_Conv2D"]="Module["asm\"][\"T\").apply(null,arguments)};var
_Conv2DBackpropInput=Module["_Conv2DBackpropInput"]=function(){return(_Conv2DBackpropInput=Module["_Conv2DBackpropInput"]="Module["asm\"][\"U\").apply(null,arguments)};var
_Cos=Module["_Cos"]=function(){return(_Cos=Module["_Cos"]="Module["asm\"][\"V\").apply(null,arguments)};var
_Cosh=Module["_Cosh"]=function(){return(_Cosh=Module["_Cosh"]="Module["asm\"][\"W\").apply(null,arguments)};var
_CropAndResize=Module["_CropAndResize"]=function(){return(_CropAndResize=Module["_CropAndResize"]="Module["asm\"][\"X\").apply(null,arguments)};var
_Cumsum=Module["_Cumsum"]=function(){return(_Cumsum=Module["_Cumsum"]="Module["asm\"][\"Y\").apply(null,arguments)};var
_DepthToSpace=Module["_DepthToSpace"]=function(){return(_DepthToSpace=Module["_DepthToSpace"]="Module["asm\"][\"Z\").apply(null,arguments)};var
_DepthwiseConv2dNative=Module["_DepthwiseConv2dNative"]=function(){return(_DepthwiseConv2dNative=Module["_DepthwiseConv2dNative"]="Module["asm\"][\"_\").apply(null,arguments)};var
_Elu=Module["_Elu"]=function(){return(_Elu=Module["_Elu"]="Module["asm\"][\"$\").apply(null,arguments)};var
_Equal=Module["_Equal"]=function(){return(_Equal=Module["_Equal"]="Module["asm\"][\"aa\").apply(null,arguments)};var
_Exp=Module["_Exp"]=function(){return(_Exp=Module["_Exp"]="Module["asm\"][\"ba\").apply(null,arguments)};

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s));var
_FlipLeftRight=Module["_FlipLeftRight"]=function(){return(_FlipLeftRight=Module["_FlipLeftRight"]=Module["asm"][_"ca"]).apply(null,arguments));var
_Floor=Module["_Floor"]=function(){return(_Floor=Module["_Floor"]=Module["asm"][_"da"]).apply(null,arguments));var
_FloorDiv=Module["_FloorDiv"]=function(){return(_FloorDiv=Module["_FloorDiv"]=Module["asm"][_"ea"]).apply(null,arguments));var
_FusedBatchNorm=Module["_FusedBatchNorm"]=function(){return(_FusedBatchNorm=Module["_FusedBatchNorm"]=Module["asm"][_"fa"]).apply(null,arguments));var
_FusedConv2D=Module["_FusedConv2D"]=function(){return(_FusedConv2D=Module["_FusedConv2D"]=Module["asm"][_"ga"]).apply(null,arguments));var
_FusedDepthwiseConv2D=Module["_FusedDepthwiseConv2D"]=function(){return(_FusedDepthwiseConv2D=Module["_FusedDepthwiseConv2D"]=Module["asm"][_"ha"]).apply(null,arguments));var
_Gather=Module["_Gather"]=function(){return(_Gather=Module["_Gather"]=Module["asm"][_"ia"]).apply(null,arguments));var
_GatherNd=Module["_GatherNd"]=function(){return(_GatherNd=Module["_GatherNd"]=Module["asm"][_"ja"]).apply(null,arguments));var
_Greater=Module["_Greater"]=function(){return(_Greater=Module["_Greater"]=Module["asm"][_"ka"]).apply(null,arguments));var
_GreaterEqual=Module["_GreaterEqual"]=function(){return(_GreaterEqual=Module["_GreaterEqual"]=Module["asm"][_"la"]).apply(null,arguments));var
_LeakyRelu=Module["_LeakyRelu"]=function(){return(_LeakyRelu=Module["_LeakyRelu"]=Module["asm"][_"ma"]).apply(null,arguments));var
_Less=Module["_Less"]=function(){return(_Less=Module["_Less"]=Module["asm"][_"na"]).apply(null,arguments));var
_LessEqual=Module["_LessEqual"]=function(){return(_LessEqual=Module["_LessEqual"]=Module["asm"][_"oa"]).apply(null,arguments));var
_Log=Module["_Log"]=function(){return(_Log=Module["_Log"]=Module["asm"][_"pa"]).apply(null,arguments));var
_LogicalAnd=Module["_LogicalAnd"]=function(){return(_LogicalAnd=Module["_LogicalAnd"]=Module["asm"][_"qa"]).apply(null,arguments));var
_Max=Module["_Max"]=function(){return(_Max=Module["_Max"]=Module["asm"][_"ra"]).apply(null,arguments));var
_MaxPool=Module["_MaxPool"]=function(){return(_MaxPool=Module["_MaxPool"]=Module["asm"][_"sa"]).apply(null,arguments));var
_Maximum=Module["_Maximum"]=function(){return(_Maximum=Module["_Maximum"]=Module["asm"][_"ta"]).apply(null,arguments));var
_Mean=Module["_Mean"]=function(){return(_Mean=Module["_Mean"]=Module["asm"][_"ua"]).apply(null,arguments));var
_Min=Module["_Min"]=function(){return(_Min=Module["_Min"]=Module["asm"][_"va"]).apply(null,arguments));var
_Minimum=Module["_Minimum"]=function(){return(_Minimum=Module["_Minimum"]=Module["asm"][_"wa"]).apply(null,arguments));var
_MirrorPad=Module["_MirrorPad"]=function(){return(_MirrorPad=Module["_MirrorPad"]=Module["asm"][_"xa"]).apply(null,arguments));var
_Multiply=Module["_Multiply"]=function(){return(_Multiply=Module["_Multiply"]=Module["asm"][_"ya"]).apply(null,arguments));var
_Neg=Module["_Neg"]=function(){return(_Neg=Module["_Neg"]=Module["asm"][_"za"]).apply(null,arguments));var

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ts));var
_NonMaxSuppressionV3=Module["_NonMaxSuppressionV3"]=function(){return(_NonMaxSuppressionV3=Module["_NonMaxSuppressionV3"]=Module["asm"][_"Aa"]).apply(null,arguments));var
_NonMaxSuppressionV4=Module["_NonMaxSuppressionV4"]=function(){return(_NonMaxSuppressionV4=Module["_NonMaxSuppressionV4"]=Module["asm"][_"Ba"]).apply(null,arguments));var
_NonMaxSuppressionV5=Module["_NonMaxSuppressionV5"]=function(){return(_NonMaxSuppressionV5=Module["_NonMaxSuppressionV5"]=Module["asm"][_"Ca"]).apply(null,arguments));var
_NotEqual=Module["_NotEqual"]=function(){return(_NotEqual=Module["_NotEqual"]=Module["asm"][_"Da"]).apply(null,arguments));var
_OneHot=Module["_OneHot"]=function(){return(_OneHot=Module["_OneHot"]=Module["asm"][_"Ea"]).apply(null,arguments));var
_PadV2=Module["_PadV2"]=function(){return(_PadV2=Module["_PadV2"]=Module["asm"][_"Fa"]).apply(null,arguments));var
_Pow=Module["_Pow"]=function(){return(_Pow=Module["_Pow"]=Module["asm"][_"Ga"]).apply(null,arguments));var
_Prelu=Module["_Prelu"]=function(){return(_Prelu=Module["_Prelu"]=Module["asm"][_"Ha"]).apply(null,arguments));var
_Prod=Module["_Prod"]=function(){return(_Prod=Module["_Prod"]=Module["asm"][_"Ia"]).apply(null,arguments));var
_RealDiv=Module["_RealDiv"]=function(){return(_RealDiv=Module["_RealDiv"]=Module["asm"][_"Ja"]).apply(null,arguments));var
_Relu=Module["_Relu"]=function(){return(_Relu=Module["_Relu"]=Module["asm"][_"Ka"]).apply(null,arguments));var
_Relu6=Module["_Relu6"]=function(){return(_Relu6=Module["_Relu6"]=Module["asm"][_"La"]).apply(null,arguments));var
_ResizeBilinear=Module["_ResizeBilinear"]=function(){return(_ResizeBilinear=Module["_ResizeBilinear"]=Module["asm"][_"Ma"]).apply(null,arguments));var
_Reverse=Module["_Reverse"]=function(){return(_Reverse=Module["_Reverse"]=Module["asm"][_"Na"]).apply(null,arguments));var
_RotateWithOffset=Module["_RotateWithOffset"]=function(){return(_RotateWithOffset=Module["_RotateWithOffset"]=Module["asm"][_"Oa"]).apply(null,arguments));var
_Round=Module["_Round"]=function(){return(_Round=Module["_Round"]=Module["asm"][_"Pa"]).apply(null,arguments));var
_Rsqrt=Module["_Rsqrt"]=function(){return(_Rsqrt=Module["_Rsqrt"]=Module["asm"][_"Qa"]).apply(null,arguments));var
_ScatterNd=Module["_ScatterNd"]=function(){return(_ScatterNd=Module["_ScatterNd"]=Module["asm"][_"Ra"]).apply(null,arguments));var
_SelectV2=Module["_SelectV2"]=function(){return(_SelectV2=Module["_SelectV2"]=Module["asm"][_"Sa"]).apply(null,arguments));var
_Sigmoid=Module["_Sigmoid"]=function(){return(_Sigmoid=Module["_Sigmoid"]=Module["asm"][_"Ta"]).apply(null,arguments));var
_Sin=Module["_Sin"]=function(){return(_Sin=Module["_Sin"]=Module["asm"][_"Ua"]).apply(null,arguments));var
_Softmax=Module["_Softmax"]=function(){return(_Softmax=Module["_Softmax"]=Module["asm"][_"Va"]).apply(null,arguments));var
_Sqrt=Module["_Sqrt"]=function(){return(_Sqrt=Module["_Sqrt"]=Module["asm"][_"Wa"]).apply(null,arguments));var
_Square=Module["_Square"]=function(){return(_Square=Module["_Square"]=Module["asm"][_"Xa"]).apply(n

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ull,arguments));var
_SquaredDifference=Module["_SquaredDifference"]=function(){return(_SquaredDifference=Module["_SquaredDifference"]=Module["_asm"][_"Ya"]).apply(null,arguments));var
_Step=Module["_Step"]=function(){return(_Step=Module["_Step"]=Module["_asm"][_"Za"]).apply(null,arguments));var
_StridedSlice=Module["_StridedSlice"]=function(){return(_StridedSlice=Module["_StridedSlice"]=Module["_asm"][_"a"]).apply(null,arguments));var
_Sub=Module["_Sub"]=function(){return(_Sub=Module["_Sub"]=Module["_asm"][_"$a"]).apply(null,arguments));var
_Sum=Module["_Sum"]=function(){return(_Sum=Module["_Sum"]=Module["_asm"][_"ab"]).apply(null,arguments));var
_Tan=Module["_Tan"]=function(){return(_Tan=Module["_Tan"]=Module["_asm"][_"bb"]).apply(null,arguments));var
_Tanh=Module["_Tanh"]=function(){return(_Tanh=Module["_Tanh"]=Module["_asm"][_"cb"]).apply(null,arguments));var
_Tile=Module["_Tile"]=function(){return(_Tile=Module["_Tile"]=Module["_asm"][_"db"]).apply(null,arguments));var
_TopK=Module["_TopK"]=function(){return(_TopK=Module["_TopK"]=Module["_asm"][_"eb"]).apply(null,arguments));var
_Transform=Module["_Transform"]=function(){return(_Transform=Module["_Transform"]=Module["_asm"][_"fb"]).apply(null,arguments));var
_Transpose=Module["_Transpose"]=function(){return(_Transpose=Module["_Transpose"]=Module["_asm"][_"gb"]).apply(null,arguments));var
__FusedMatMul=Module["__FusedMatMul"]=function(){return(__FusedMatMul=Module["__FusedMatMul"]=Module["_asm"][_"hb"]).apply(null,arguments));var
_malloc=Module["_malloc"]=function(){return(_malloc=Module["_malloc"]=Module["_asm"][_"ib"]).apply(null,arguments));var
_free=Module["_free"]=function(){return(_free=Module["_free"]=Module["_asm"][_"jb"]).apply(null,arguments));var
__errno_location=Module["__errno_location"]=function(){return(__errno_location=Module["__errno_location"]=Module["_asm"][_"kb"]).apply(null,arguments));var
_emscripten_get_global_libc=Module["_emscripten_get_global_libc"]=function(){return(_emscripten_get_global_libc=Module["_emscripten_get_global_libc"]=Module["_asm"][_"lb"]).apply(null,arguments));var
_thread_self=Module["_thread_self"]=function(){return(_thread_self=Module["_thread_self"]=Module["_asm"][_"mb"]).apply(null,arguments));var
__pthread_tsd_run_dtors=Module["__pthread_tsd_run_dtors"]=function(){return(__pthread_tsd_run_dtors=Module["__pthread_tsd_run_dtors"]=Module["_asm"][_"nb"]).apply(null,arguments));var
_emscripten_main_thread_process_queued_calls=Module["_emscripten_main_thread_process_queued_calls"]=function(){return(_emscripten_main_thread_process_queued_calls=Module["_emscripten_main_thread_process_queued_calls"]=Module["_asm"][_"ob"]).apply(null,arguments));var
_emscripten_current_thread_process_queued_calls=Module["_emscripten_current_thread_process_queued_calls"]=function(){return(_emscripten_current_thread_process_queued_calls=Module["_emscripten_current_thread_process_queued_calls"]=Module["_asm"][_"pb"]).apply(null,arguments));var
_emscripten_register_main_browser_thread_id=Module["_emscripten_register_main_browser_thread_id"]=function(){return(_emscripten_register_main_browser_thread_id=Module["_emscripten_register_main_browser_thread_id"]=Module["_asm"][_"qb"]).apply(null,arguments));var
_emscripten_main_browser_thread_id=Module["_emscripten_main_browser_thread_id"]=function(){return(_emscripten_main_browser_thread_id=Module["_emscripten_main_browser_thread_id"]=Module["_asm"][_"rb"]).app

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ly(null,arguments));var
__emscripten_do_dispatch_to_thread=Module["__emscripten_do_dispatch_to_thread"]=function(){return(__emsc
ripten_do_dispatch_to_thread=Module["__emscripten_do_dispatch_to_thread"]=Module["asm"]["sb"]).apply(n
ull,arguments));var
__emscripten_sync_run_in_main_thread_4=Module["__emscripten_sync_run_in_main_thread_4"]=function(){retur
n(__emscripten_sync_run_in_main_thread_4=Module["__emscripten_sync_run_in_main_thread_4"]=Module["asm\
"]["tb"]).apply(null,arguments));var
__emscripten_run_in_main_runtime_thread_js=Module["__emscripten_run_in_main_runtime_thread_js"]=function(
){return(__emscripten_run_in_main_runtime_thread_js=Module["__emscripten_run_in_main_runtime_thread_js"]=
Module["asm"]["ub"]).apply(null,arguments));var
__emscripten_call_on_thread=Module["__emscripten_call_on_thread"]=function(){return(__emscripten_call_on_t
hread=Module["__emscripten_call_on_thread"]=Module["asm"]["vb"]).apply(null,arguments));var
__emscripten_tls_init=Module["__emscripten_tls_init"]=function(){return(__emscripten_tls_init=Module["_emsc
ripten_tls_init"]=Module["asm"]["wb"]).apply(null,arguments));var
__emscripten_thread_init=Module["__emscripten_thread_init"]=function(){return(__emscripten_thread_init=Mod
ule["__emscripten_thread_init"]=Module["asm"]["xb"]).apply(null,arguments));var
stackSave=Module["stackSave"]=function(){return(stackSave=Module["stackSave"]=Module["asm"]["yb"]).a
pply(null,arguments));var
stackRestore=Module["stackRestore"]=function(){return(stackRestore=Module["stackRestore"]=Module["asm\
"]["zb"]).apply(null,arguments));var
stackAlloc=Module["stackAlloc"]=function(){return(stackAlloc=Module["stackAlloc"]=Module["asm"]["Ab\
"]).apply(null,arguments));var
__emscripten_stack_set_limits=Module["__emscripten_stack_set_limits"]=function(){return(__emscripten_stack_set
limits=Module["__emscripten_stack_set_limits"]=Module["asm"]["Bb"]).apply(null,arguments));var
__memalign=Module["__memalign"]=function(){return(__memalign=Module["__memalign"]=Module["asm"]["Cb\
"]).apply(null,arguments));var
__emscripten_allow_main_runtime_queued_calls=Module["__emscripten_allow_main_runtime_queued_calls"]=1
0512;var
__emscripten_main_thread_futex=Module["__emscripten_main_thread_futex"]=12148;Module["cwrap"]=cwrap
;Module["PThread"]=PThread;Module["PThread"]=PThread;Module["wasmMemory"]=wasmMemory;Module
["ExitStatus"]=ExitStatus;var
calledRun;function ExitStatus(status){this.name="ExitStatus";this.message="Program terminated with
exit(\"+status+\")";this.status=status}dependenciesFulfilled=function
runCaller(){if(!calledRun)run();if(!calledRun)dependenciesFulfilled=runCaller};function
run(args){args=args||arguments_;if(runDependencies>0){return}if(ENVIRONMENT_IS_PTHREAD){readyPromis
eResolve(Module);initRuntime();postMessage({"cmd":"loaded"});return}preRun();if(runDependencies>0){retur
n}function
doRun(){if(calledRun)return;calledRun=true;Module["calledRun"]=true;if(ABORT)return;initRuntime();preMain(
);readyPromiseResolve(Module);if(Module["onRuntimeInitialized"]){Module["onRuntimeInitialized"]();}postRun(
)}if(Module["setStatus"]){Module["setStatus"]("Running...");setTimeout(function(){setTimeout(function(){Mo
dule["setStatus"](""),1);doRun(),1})else{doRun()}}Module["run"]=run;function
exit(status,implicit){if(implicit&&noExitRuntime&&status===0){return}if(!implicit){if(ENVIRONMENT_IS_PT
HREAD){postMessage({"cmd":"exitProcess","returnCode":status});throw
new
ExitStatus(status)}else{}if(noExitRuntime){}else{PThread.terminateAllThreads();EXITSTATUS=status;exitRunti
me();if(Module["onExit"]){Module["onExit"](status);ABORT=true}quit_(status,new
ExitStatus(status))}if(Module["preInit"]){if(typeof
Module["preInit"]=="function")Module["preInit"]=[Module["preInit"]];while(Module["preInit"].length>0){

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[illegible]

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xhr.responseText};if(ENVIRONMENT_IS_WORKER){readBinary=function(url){var xhr=new
XMLHttpRequest;xhr.open("\GET",url,false);xhr.responseType="arraybuffer";xhr.send(null);return new
Uint8Array(xhr.response)}}readAsync=function(url,onload,onerror){var xhr=new
XMLHttpRequest;xhr.open("\GET",url,true);xhr.responseType="arraybuffer";xhr.onload=function(){if(xhr.status
==200||xhr.status==0&&xhr.response){onload(xhr.response);return}onerror();}xhr.onerror=onerror;xhr.send(null)}
}setWindowTitle=function(title){document.title=title}else{var
out=Module["print"]||console.log.bind(console);var err=Module["printErr"]||console.warn.bind(console);for(key
in
moduleOverrides){if(moduleOverrides.hasOwnProperty(key)){Module[key]=moduleOverrides[key]}}moduleOverr
ides=null;if(Module["arguments"]){arguments_=Module["arguments"];if(Module["thisProgram"]){thisProgram=
Module["thisProgram"];if(Module["quit"]){quit_=Module["quit"];var
wasmBinary;if(Module["wasmBinary"]){wasmBinary=Module["wasmBinary"];var
noExitRuntime=Module["noExitRuntime"]||true;if(typeof WebAssembly!="object"){abort("no native wasm
support detected")}}var wasmMemory;var ABORT=false;var EXITSTATUS;function
assert(condition,text){if(!condition){abort("Assertion failed: "+text)}}function getCFunc(ident){var
func=Module["_"]+ident;assert(func,"Cannot call unknown function "+ident+"", make sure it is exported");return
func}function
ccall(ident,returnType,argTypes,args,opts){var toC={"string":function(str){var
ret=0;if(str!=null&&str!=undefined&&str!=0){var
len=(str.length<<2)+1;ret=stackAlloc(len);stringToUTF8(str,ret,len)}return ret},"array":function(arr){var
ret=stackAlloc(arr.length);writeArrayToMemory(arr,ret);return ret}};function
convertReturnValue(ret){if(returnType=="string")return UTF8ToString(ret);if(returnType=="boolean")return
Boolean(ret);return ret}var func=getCFunc(ident);var cArgs=[];var stack=0;if(args){for(var
i=0;i<args.length;i++){var
converter=toC[argTypes[i]];if(converter){if(stack==0)stack=stackSave();cArgs[i]=converter(args[i])}else{cArgs[i
]=args[i]}}var ret=func.apply(null,cArgs);ret=convertReturnValue(ret);if(stack!=0)stackRestore(stack);return
ret}function cwrap(ident,returnType,argTypes,opts){argTypes=argTypes||[];var
numericArgs=argTypes.every(function(type){return type=="number"});var
numericRet=returnType!="string";if(numericRet&&numericArgs&&!opts){return
getCFunc(ident)}return function(){return ccall(ident,returnType,argTypes,arguments,opts)}}var
UTF8Decoder=typeof TextDecoder!="undefined"?new TextDecoder("utf8"):undefined;function
UTF8ArrayToString(heap,idx,maxBytesToRead){var endIdx=idx+maxBytesToRead;var
endPtr=idx;while(heap[endPtr]&&!(endPtr>=endIdx))++endPtr;if(endPtr-
idx>16&&heap.subarray&&UTF8Decoder){return UTF8Decoder.decode(heap.subarray(idx,endPtr))}else{var
str="";while(idx<endPtr){var u0=heap[idx++];if(!(u0&128)){str+=String.fromCharCode(u0);continue}var
u1=heap[idx++]&63;if((u0&224)==192){str+=String.fromCharCode((u0&31)<<6|u1);continue}var
u2=heap[idx++]&63;if((u0&240)==224){u0=(u0&15)<<12|u1<<6|u2}else{u0=(u0&7)<<18|u1<<12|u2<<6|heap[id
x++]&63;if(u0<65536){str+=String.fromCharCode(u0)}else{var ch=u0-
65536;str+=String.fromCharCode(55296|ch>>10,56320|ch&1023)}}}return str}function
UTF8ToString(ptr,maxBytesToRead){return
ptr?UTF8ArrayToString(HEAPU8,ptr,maxBytesToRead):""}function
stringToUTF8Array(str,heap,outIdx,maxBytesToWrite){if(!(maxBytesToWrite>0))return
0;var startIdx=outIdx;var endIdx=outIdx+maxBytesToWrite-1;for(var i=0;i<str.length;++i){var
u=str.charCodeAt(i);if(u>=55296&&u<=57343){var
u1=str.charCodeAt(++i);u=65536+((u&1023)<<10|u1&1023)}if(u<=127){if(outIdx>=endIdx)break;heap[outIdx++]
=u}else if(u<=2047){if(outIdx+1>=endIdx)break;heap[outIdx++]=192|u>>6;heap[outIdx++]=128|u&63}else
if(u<=65535){if(outIdx+2>=endIdx)break;heap[outIdx++]=224|u>>12;heap[outIdx++]=128|u>>6&63;heap[outIdx
++]=128|u&63}else{if(outIdx+3>=endIdx)break;heap[outIdx++]=240|u>>18;heap[outIdx++]=128|u>>12&63;heap[

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outIdx++]=128|u>>6&63;heap[outIdx++]=128|u&63}}heap[outIdx]=0;return outIdx-startIdx}function
stringToUTF8(str,outPtr,maxBytesToWrite){return
stringToUTF8Array(str,HEAPU8,outPtr,maxBytesToWrite)}function
writeArrayToMemory(array,buffer){HEAP8.set(array,buffer)}function
alignUp(x,multiple){if(x%multiple>0){x+=multiple-x%multiple}return x}var
buffer,HEAP8,HEAPU8,HEAP16,HEAPU16,HEAP32,HEAPU32,HEAPF32,HEAPF64;function
updateGlobalBufferAndViews(buf){buffer=buf;Module["HEAP8"]=HEAP8=new
Int8Array(buf);Module["HEAP16"]=HEAP16=new Int16Array(buf);Module["HEAP32"]=HEAP32=new
Int32Array(buf);Module["HEAPU8"]=HEAPU8=new Uint8Array(buf);Module["HEAPU16"]=HEAPU16=new
Uint16Array(buf);Module["HEAPU32"]=HEAPU32=new
Uint32Array(buf);Module["HEAPF32"]=HEAPF32=new
Float32Array(buf);Module["HEAPF64"]=HEAPF64=new Float64Array(buf)}var
INITIAL_MEMORY=Module["INITIAL_MEMORY"]||16777216;var wasmTable;var __ATPRERUN__=[];var
__ATINIT__=[];var __ATMAIN__=[];var __ATPOSTRUN__=[];var
runtimeInitialized=false;__ATINIT__.push({func:function(){__wasm_call_ctors()}});function
preRun(){if(Module["preRun"]){if(typeof
Module["preRun"]=="function")Module["preRun"]=[Module["preRun"]];while(Module["preRun"].length){a
ddOnPreRun(Module["preRun"].shift())}callRuntimeCallbacks(__ATPRERUN__)}function
initRuntime(){runtimeInitialized=true;callRuntimeCallbacks(__ATINIT__)}function
preMain(){callRuntimeCallbacks(__ATMAIN__)}function
postRun(){if(Module["postRun"]){if(typeof
Module["postRun"]=="function")Module["postRun"]=[Module["postRun"]];while(Module["postRun"].lengt
h){addOnPostRun(Module["postRun"].shift())}callRuntimeCallbacks(__ATPOSTRUN__)}function
addOnPreRun(cb){__ATPRERUN__.unshift(cb)}function addOnPostRun(cb){__ATPOSTRUN__.unshift(cb)}var
runDependencies=0;var runDependencyWatcher=null;var dependenciesFulfilled=null;function
addRunDependency(id){runDependencies++;if(Module["monitorRunDependencies"]){Module["monitorRunDep
endencies"]((runDependencies))}function removeRunDependency(id){runDependencies--
;if(Module["monitorRunDependencies"]){Module["monitorRunDependencies"]((runDependencies))if(runDepend
encies==0){if(runDependencyWatcher!=null){clearInterval(runDependencyWatcher);runDependencyWatcher=null
}if(dependenciesFulfilled){var
callback=dependenciesFulfilled;dependenciesFulfilled=null;callback()}}Module["preloadedImages"]={}
;Module
["preloadedAudios"]={}
;function
abort(what){if(Module["onAbort"]){Module["onAbort"](what)}what+="\n";err(what);ABORT=true;EXITSTAT
US=1;what="abort(\n"+what+"\n). Build with -s ASSERTIONS=1 for more info.";var e=new
WebAssembly.RuntimeError(what);readyPromiseReject(e);throw e}function hasPrefix(str,prefix){return
String.prototype.startsWith?str.startsWith(prefix):str.indexOf(prefix)===0}var
dataURIPrefix="data:application/octet-stream;base64,";function isDataURI(filename){return
hasPrefix(filename,dataURIPrefix)}var fileURIPrefix="file://";function isFileURI(filename){return
hasPrefix(filename,fileURIPrefix)}var wasmBinaryFile="tfjs-backend-
wasm.wasm";if(!isDataURI(wasmBinaryFile)){wasmBinaryFile=locateFile(wasmBinaryFile)}function
getBinary(file){try{if(file===wasmBinaryFile&&wasmBinary){return new
Uint8Array(wasmBinary)}if(readBinary){return readBinary(file)}else{throw"both async and sync fetching of the
wasm failed"}}catch(err){abort(err)}}function
getBinaryPromise(){if(!wasmBinary&&(ENVIRONMENT_IS_WEB||ENVIRONMENT_IS_WORKER)){if(typeof
fetch==="function"&&!isFileURI(wasmBinaryFile)){return fetch(wasmBinaryFile,{credentials:"same-
origin"}).then(function(response){if(!response["ok"]){throw"failed to load wasm binary file at
"+wasmBinaryFile+"\""}return response["arrayBuffer"]()}).catch(function(){return
getBinary(wasmBinaryFile)})}else{if(readAsync){return new

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Promise(function(resolve,reject){readAsync(wasmBinaryFile,function(response){resolve(new
Uint8Array(response))},reject)}})}return Promise.resolve().then(function(){return
getBinary(wasmBinaryFile)}}function createWasm(){var info={"a":asmLibraryArg};function
receiveInstance(instance,module){var
exports=instance.exports;Module["asm"]=exports;wasmMemory=Module["asm"]()["j"];updateGlobalBufferAnd
Views(wasmMemory.buffer);wasmTable=Module["asm"]()["r"];removeRunDependency("wasm-
instantiate")}addRunDependency("wasm-instantiate");function
receiveInstantiatedSource(output){receiveInstance(output["instance"]);function
instantiateArrayBuffer(receiver){return getBinaryPromise().then(function(binary){return
WebAssembly.instantiate(binary,info))).then(receiver,function(reason){err("failed to asynchronously prepare
wasm: "+reason);abort(reason)})}function instantiateAsync(){if(!wasmBinary&&typeof
WebAssembly.instantiateStreaming===function"&&!isDataURI(wasmBinaryFile)&&!isFileURI(wasmBinaryFil
e)&&typeof fetch===function"){return fetch(wasmBinaryFile,{credentials:"same-
origin"}).then(function(response){var result=WebAssembly.instantiateStreaming(response,info);return
result.then(receiveInstantiatedSource,function(reason){err("wasm streaming compile failed: "+reason);err("falling
back to ArrayBuffer instantiation");return instantiateArrayBuffer(receiveInstantiatedSource)}))}else{return
instantiateArrayBuffer(receiveInstantiatedSource)}if(Module["instantiateWasm"]){try{var
exports=Module["instantiateWasm"](info,receiveInstance);return exports}catch(e){err("Module.instantiateWasm
callback failed with error: "+e);return false}}instantiateAsync().catch(Promise.reject);return{}}function
callRuntimeCallbacks(callbacks){while(callbacks.length>0){var callback=callbacks.shift();if(typeof
callback===function){callback(Module);continue}var func=callback.func;if(typeof
func===number){if(callback.arg===undefined){wasmTable.get(func)}else{wasmTable.get(func)(callback.arg)
}}else{func(callback.arg===undefined?null:callback.arg)}}function _abort(){abort()}function
_emscripten_memcpy_big(dest,src,num){HEAPU8.copyWithin(dest,src,src+num)}function
_emscripten_get_heap_size(){return HEAPU8.length}function
emscripten_realloc_buffer(size){try{wasmMemory.grow(size-
buffer.byteLength+65535>>>16);updateGlobalBufferAndViews(wasmMemory.buffer);return
1}catch(e){}}function _emscripten_resize_heap(requestedSize){var oldSize=_emscripten_get_heap_size();var
maxHeapSize=2147483648;if(requestedSize>maxHeapSize){return false}for(var
cutDown=1;cutDown<=4;cutDown*=2){var
overGrownHeapSize=oldSize*(1+.2/cutDown);overGrownHeapSize=Math.min(overGrownHeapSize,requestedSize
+100663296);var
newSize=Math.min(maxHeapSize,alignUp(Math.max(requestedSize,overGrownHeapSize),65536));var
replacement=emscripten_realloc_buffer(newSize);if(replacement){return true}}return false}var
SYSCALLS={mappings:{},buffers:[null,[],[]],printChar:function(stream,curr){var
buffer=SYSCALLS.buffers[stream];if(curr===0||curr===10){(stream===1?out:err)(UTF8ArrayToString(buffer,0));
buffer.length=0}else{buffer.push(curr)}},varargs:undefined,get:function(){SYSCALLS.varargs+=4;var
ret=HEAP32[SYSCALLS.varargs-4>>2];return ret},getStr:function(ptr){var ret=UTF8ToString(ptr);return
ret},get64:function(low,high){return low}};function _fd_close(fd){return 0}function
_fd_seek(fd,offset_low,offset_high,whence,newOffset){}function _fd_write(fd,iov,iovcnt,pnum){var num=0;for(var
i=0;i<iovcnt;i++){var ptr=HEAP32[iov+i*8>>2];var len=HEAP32[iov+(i*8+4)>>2];for(var
j=0;j<len;j++){SYSCALLS.printChar(fd,HEAPU8[ptr+j])}num+=len}HEAP32[pnum>>2]=num;return
0}function _pthread_create(){return 6}function _pthread_join(){return 28}function
setErrNo(value){HEAP32[___errno_location()>>2]=value;return value}function
_sysconf(name){switch(name){case 30:return 16384;case 85:var maxHeapSize=2147483648;return
maxHeapSize/16384;case 132:case 133:case 12:case 137:case 138:case 15:case 235:case 16:case 17:case 18:case
19:case 20:case 149:case 13:case 10:case 236:case 153:case 9:case 21:case 22:case 159:case 154:case 14:case
77:case 78:case 139:case 82:case 68:case 67:case 164:case 11:case 29:case 47:case 48:case 95:case 52:case 51:case

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46:return 200809;case 27:case 246:case 127:case 128:case 23:case 24:case 160:case 161:case 181:case 182:case
242:case 183:case 184:case 243:case 244:case 245:case 165:case 178:case 179:case 49:case 50:case 168:case
169:case 175:case 170:case 171:case 172:case 97:case 76:case 32:case 173:case 35:case 80:case 81:case 79:return-
1;case 176:case 177:case
7:case 155:case 8:case 157:case 125:case 126:case 92:case 93:case 129:case 130:case 131:case 94:case 91:return
1;case 74:case 60:case 69:case 70:case 4:return 1024;case 31:case 42:case 72:return 32;case 87:case 26:case
33:return 2147483647;case 34:case 1:return 47839;case 38:case 36:return 99;case 43:case 37:return 2048;case
0:return 2097152;case 3:return 65536;case 28:return 32768;case 44:return 32767;case 75:return 16384;case
39:return 1e3;case 89:return 700;case 71:return 256;case 40:return 255;case 2:return 100;case 180:return 64;case
25:return 20;case 5:return 16;case 6:return 6;case 73:return 4;case 84:{if(typeof navigator===\"object\")return
navigator[\"hardwareConcurrency\"]||1;return 1}}setErrNo(28);return-1}var
asmLibraryArg={\"a\":_abort,\"d\":_emscripten_memcpy_big,\"e\":_emscripten_resize_heap,\"f\":_fd_close,\"c\":_f
d_seek,\"b\":_fd_write,\"h\":_pthread_create,\"g\":_pthread_join,\"i\":_sysconf};var asm=createWasm();var
__wasm_call_ctors=Module[\"__wasm_call_ctors\"]=function(){return(__wasm_call_ctors=Module[\"__wasm
_call_ctors\"]=Module[\"asm\"][\"k\"]).apply(null,arguments)};var
_init=Module[\"_init\"]=function(){return(_init=Module[\"_init\"]=Module[\"asm\"][\"l\"]).apply(null,arguments)};
var
_init_with_threads_count=Module[\"_init_with_threads_count\"]=function(){return(_init_with_threads_count=Mod
ule[\"_init_with_threads_count\"]=Module[\"asm\"][\"m\"]).apply(null,arguments)};var
_get_threads_count=Module[\"_get_threads_count\"]=function(){return(_get_threads_count=Module[\"_get_threads
_count\"]=Module[\"asm\"][\"n\"]).apply(null,arguments)};var
_register_tensor=Module[\"_register_tensor\"]=function(){return(_register_tensor=Module[\"_register_tensor\"]=M
odule[\"asm\"][\"o\"]).apply(null,arguments)};var
_dispose_data=Module[\"_dispose_data\"]=function(){return(_dispose_data=Module[\"_dispose_data\"]=Module[\"
asm\"][\"p\"]).apply(null,arguments)};var
_dispose=Module[\"_dispose\"]=function(){return(_dispose=Module[\"_dispose\"]=Module[\"asm\"][\"q\"]).apply(n
ull,arguments)};var
_Abs=Module[\"_Abs\"]=function(){return(_Abs=Module[\"_Abs\"]=Module[\"asm\"][\"s\"]).apply(null,arguments
)};var
_Add=Module[\"_Add\"]=function(){return(_Add=Module[\"_Add\"]=Module[\"asm\"][\"t\"]).apply(null,argument
s)};var
_AddN=Module[\"_AddN\"]=function(){return(_AddN=Module[\"_AddN\"]=Module[\"asm\"][\"u\"]).apply(null,ar
guments)};var
_All=Module[\"_All\"]=function(){return(_All=Module[\"_All\"]=Module[\"asm\"][\"v\"]).apply(null,arguments)};
var
_Any=Module[\"_Any\"]=function(){return(_Any=Module[\"_Any\"]=Module[\"asm\"][\"w\"]).apply(null,argumen
ts)};var
_ArgMax=Module[\"_ArgMax\"]=function(){return(_ArgMax=Module[\"_ArgMax\"]=Module[\"asm\"][\"x\"]).app
ly(null,arguments)};var
_AvgPool=Module[\"_AvgPool\"]=function(){return(_AvgPool=Module[\"_AvgPool\"]=Module[\"asm\"][\"y\"]).a
pply(null,arguments)};var
_BatchMatMul=Module[\"_BatchMatMul\"]=function(){return(_BatchMatMul=Module[\"_BatchMatMul\"]=Modu
le[\"asm\"][\"z\"]).apply(null,arguments)};var
_Ceil=Module[\"_Ceil\"]=function(){return(_Ceil=Module[\"_Ceil\"]=Module[\"asm\"][\"A\"]).apply(null,argument
s)};var
_ClipByValue=Module[\"_ClipByValue\"]=function(){return(_ClipByValue=Module[\"_ClipByValue\"]=Module[\"
asm\"][\"B\"]).apply(null,arguments)};var
_Conv2D=Module[\"_Conv2D\"]=function(){return(_Conv2D=Module[\"_Conv2D\"]=Module[\"asm\"][\"C\"]).ap

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ply(null,arguments));var
_Conv2DBackpropInput=Module["_Conv2DBackpropInput"]=function(){return(_Conv2DBackpropInput=Module["_Conv2DBackpropInput"]=Module["asm"][_"D"].apply(null,arguments));var
_Cos=Module["_Cos"]=function(){return(_Cos=Module["_Cos"]=Module["asm"][_"E"].apply(null,arguments));var
_Cosh=Module["_Cosh"]=function(){return(_Cosh=Module["_Cosh"]=Module["asm"][_"F"].apply(null,arguments));var
_CropAndResize=Module["_CropAndResize"]=function(){return(_CropAndResize=Module["_CropAndResize"]=Module["asm"][_"G"].apply(null,arguments));var
_Cumsum=Module["_Cumsum"]=function(){return(_Cumsum=Module["_Cumsum"]=Module["asm"][_"H"].apply(null,arguments));var
_DepthToSpace=Module["_DepthToSpace"]=function(){return(_DepthToSpace=Module["_DepthToSpace"]=Module["asm"][_"I"].apply(null,arguments));var
_DepthwiseConv2dNative=Module["_DepthwiseConv2dNative"]=function(){return(_DepthwiseConv2dNative=Module["_DepthwiseConv2dNative"]=Module["asm"][_"J"].apply(null,arguments));var
_Elu=Module["_Elu"]=function(){return(_Elu=Module["_Elu"]=Module["asm"][_"K"].apply(null,arguments));var
_Equal=Module["_Equal"]=function(){return(_Equal=Module["_Equal"]=Module["asm"][_"L"].apply(null,arguments));var
_Exp=Module["_Exp"]=function(){return(_Exp=Module["_Exp"]=Module["asm"][_"M"].apply(null,arguments));var
_FlipLeftRight=Module["_FlipLeftRight"]=function(){return(_FlipLeftRight=Module["_FlipLeftRight"]=Module["asm"][_"N"].apply(null,arguments));var
_Floor=Module["_Floor"]=function(){return(_Floor=Module["_Floor"]=Module["asm"][_"O"].apply(null,arguments));var
_FloorDiv=Module["_FloorDiv"]=function(){return(_FloorDiv=Module["_FloorDiv"]=Module["asm"][_"P"].apply(null,arguments));var
_FusedBatchNorm=Module["_FusedBatchNorm"]=function(){return(_FusedBatchNorm=Module["_FusedBatchNorm"]=Module["asm"][_"Q"].apply(null,arguments));var
_FusedConv2D=Module["_FusedConv2D"]=function(){return(_FusedConv2D=Module["_FusedConv2D"]=Module["asm"][_"R"].apply(null,arguments));var
_FusedDepthwiseConv2D=Module["_FusedDepthwiseConv2D"]=function(){return(_FusedDepthwiseConv2D=Module["_FusedDepthwiseConv2D"]=Module["asm"][_"S"].apply(null,arguments));var
_Gather=Module["_Gather"]=function(){return(_Gather=Module["_Gather"]=Module["asm"][_"T"].apply(null,arguments));var
_GatherNd=Module["_GatherNd"]=function(){return(_GatherNd=Module["_GatherNd"]=Module["asm"][_"U"].apply(null,arguments));var
_Greater=Module["_Greater"]=function(){return(_Greater=Module["_Greater"]=Module["asm"][_"V"].apply(null,arguments));var
_GreaterEqual=Module["_GreaterEqual"]=function(){return(_GreaterEqual=Module["_GreaterEqual"]=Module["asm"][_"W"].apply(null,arguments));var
_LeakyRelu=Module["_LeakyRelu"]=function(){return(_LeakyRelu=Module["_LeakyRelu"]=Module["asm"][_"X"].apply(null,arguments));var
_Less=Module["_Less"]=function(){return(_Less=Module["_Less"]=Module["asm"][_"Y"].apply(null,arguments));var
_LessEqual=Module["_LessEqual"]=function(){return(_LessEqual=Module["_LessEqual"]=Module["asm"][_"Z"].apply(null,arguments));var
_Log=Module["_Log"]=function(){return(_Log=Module["_Log"]=Module["asm"][_"_"].apply(null,arguments

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});var
_LogicalAnd=Module["_LogicalAnd"]=function(){return(_LogicalAnd=Module["_LogicalAnd"]=Module["asm\
"]["$").apply(null,arguments));var
_Max=Module["_Max"]=function(){return(_Max=Module["_Max"]=Module["asm\"][\$aa").apply(null,argume
nts));var
_MaxPool=Module["_MaxPool"]=function(){return(_MaxPool=Module["_MaxPool"]=Module["asm\"][\$ba").
apply(null,arguments));var
_Maximum=Module["_Maximum"]=function(){return(_Maximum=Module["_Maximum"]=Module["asm\"][\$ca").
apply(null,arguments));var
_Mean=Module["_Mean"]=function(){return(_Mean=Module["_Mean"]=Module["asm\"][\$da").apply(null,ar
guments));var
_Min=Module["_Min"]=function(){return(_Min=Module["_Min"]=Module["asm\"][\$ea").apply(null,argumen
ts));var
_Minimum=Module["_Minimum"]=function(){return(_Minimum=Module["_Minimum"]=Module["asm\"][\$fa\
").apply(null,arguments));var
_MirrorPad=Module["_MirrorPad"]=function(){return(_MirrorPad=Module["_MirrorPad"]=Module["asm\"][\$g
a").apply(null,arguments));var
_Multiply=Module["_Multiply"]=function(){return(_Multiply=Module["_Multiply"]=Module["asm\"][\$ha").
apply(null,arguments));var
_Neg=Module["_Neg"]=function(){return(_Neg=Module["_Neg"]=Module["asm\"][\$ia").apply(null,argument
s));var
_NonMaxSuppressionV3=Module["_NonMaxSuppressionV3"]=function(){return(_NonMaxSuppressionV3=Mod
ule["_NonMaxSuppressionV3"]=Module["asm\"][\$ja").apply(null,arguments));var
_NonMaxSuppressionV4=Module["_NonMaxSuppressionV4"]=function(){return(_NonMaxSuppressionV4=Mod
ule["_NonMaxSuppressionV4"]=Module["asm\"][\$ka").apply(null,arguments));var
_NonMaxSuppressionV5=Module["_NonMaxSuppressionV5"]=function(){return(_NonMaxSuppressionV5=Mod
ule["_NonMaxSuppressionV5"]=Module["asm\"][\$la").apply(null,arguments));var
_NotEqual=Module["_NotEqual"]=function(){return(_NotEqual=Module["_NotEqual"]=Module["asm\"][\$ma\
").apply(null,arguments));var
_OneHot=Module["_OneHot"]=function(){return(_OneHot=Module["_OneHot"]=Module["asm\"][\$na").appl
y(null,arguments));var
_PadV2=Module["_PadV2"]=function(){return(_PadV2=Module["_PadV2"]=Module["asm\"][\$oa").apply(nul
l,arguments));var
_Pow=Module["_Pow"]=function(){return(_Pow=Module["_Pow"]=Module["asm\"][\$pa").apply(null,argume
nts));var
_Prelu=Module["_Prelu"]=function(){return(_Prelu=Module["_Prelu"]=Module["asm\"][\$qa").apply(null,argu
ments));var
_Prod=Module["_Prod"]=function(){return(_Prod=Module["_Prod"]=Module["asm\"][\$ra").apply(null,argum
ents));var
_RealDiv=Module["_RealDiv"]=function(){return(_RealDiv=Module["_RealDiv"]=Module["asm\"][\$sa").app
ly(null,arguments));var
_Relu=Module["_Relu"]=function(){return(_Relu=Module["_Relu"]=Module["asm\"][\$ta").apply(null,argume
nts));var
_Relu6=Module["_Relu6"]=function(){return(_Relu6=Module["_Relu6"]=Module["asm\"][\$ua").apply(null,ar
guments));var
_ResizeBilinear=Module["_ResizeBilinear"]=function(){return(_ResizeBilinear=Module["_ResizeBilinear"]=Mo
dule["asm\"][\$va").apply(null,arguments));var
_Reverse=Module["_Reverse"]=function(){return(_Reverse=Module["_Reverse"]=Module["asm\"][\$wa").app

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ly(null,arguments));var
_RotateWithOffset=Module["_RotateWithOffset"]=function(){return(_RotateWithOffset=Module["_RotateWithOffset"]=Module["asm\"][\"xa\"]).apply(null,arguments));var
_Round=Module["_Round"]=function(){return(_Round=Module["_Round"]=Module["asm\"][\"ya\"]).apply(null,arguments));var
_Rsqrt=Module["_Rsqrt"]=function(){return(_Rsqrt=Module["_Rsqrt"]=Module["asm\"][\"za\"]).apply(null,arguments));var
_ScatterNd=Module["_ScatterNd"]=function(){return(_ScatterNd=Module["_ScatterNd"]=Module["asm\"][\"Aa\"]).apply(null,arguments));var
_SelectV2=Module["_SelectV2"]=function(){return(_SelectV2=Module["_SelectV2"]=Module["asm\"][\"Ba\"]).apply(null,arguments));var
_Sigmoid=Module["_Sigmoid"]=function(){return(_Sigmoid=Module["_Sigmoid"]=Module["asm\"][\"Ca\"]).apply(null,arguments));var
_Sin=Module["_Sin"]=function(){return(_Sin=Module["_Sin"]=Module["asm\"][\"Da\"]).apply(null,arguments));var
_Softmax=Module["_Softmax"]=function(){return(_Softmax=Module["_Softmax"]=Module["asm\"][\"Ea\"]).apply(null,arguments));var
_Sqrt=Module["_Sqrt"]=function(){return(_Sqrt=Module["_Sqrt"]=Module["asm\"][\"Fa\"]).apply(null,arguments));var
_Square=Module["_Square"]=function(){return(_Square=Module["_Square"]=Module["asm\"][\"Ga\"]).apply(null,arguments));var
_SquaredDifference=Module["_SquaredDifference"]=function(){return(_SquaredDifference=Module["_SquaredDifference"]=Module["asm\"][\"Ha\"]).apply(null,arguments));var
_Step=Module["_Step"]=function(){return(_Step=Module["_Step"]=Module["asm\"][\"Ia\"]).apply(null,arguments));var
_StridedSlice=Module["_StridedSlice"]=function(){return(_StridedSlice=Module["_StridedSlice"]=Module["asm\"][\"Ja\"]).apply(null,arguments));var
_Sub=Module["_Sub"]=function(){return(_Sub=Module["_Sub"]=Module["asm\"][\"Ka\"]).apply(null,arguments));var
_Sum=Module["_Sum"]=function(){return(_Sum=Module["_Sum"]=Module["asm\"][\"La\"]).apply(null,arguments));var
_Tan=Module["_Tan"]=function(){return(_Tan=Module["_Tan"]=Module["asm\"][\"Ma\"]).apply(null,arguments));var
_Tanh=Module["_Tanh"]=function(){return(_Tanh=Module["_Tanh"]=Module["asm\"][\"Na\"]).apply(null,arguments));var
_Tile=Module["_Tile"]=function(){return(_Tile=Module["_Tile"]=Module["asm\"][\"Oa\"]).apply(null,arguments));var
_TopK=Module["_TopK"]=function(){return(_TopK=Module["_TopK"]=Module["asm\"][\"Pa\"]).apply(null,arguments));var
_Transform=Module["_Transform"]=function(){return(_Transform=Module["_Transform"]=Module["asm\"][\"Qa\"]).apply(null,arguments));var
_Transpose=Module["_Transpose"]=function(){return(_Transpose=Module["_Transpose"]=Module["asm\"][\"Ra\"]).apply(null,arguments));var
__FusedMatMul=Module["__FusedMatMul"]=function(){return(__FusedMatMul=Module["__FusedMatMul"]=Module["asm\"][\"Sa\"]).apply(null,arguments));var
_malloc=Module["_malloc"]=function(){return(_malloc=Module["_malloc"]=Module["asm\"][\"Ta\"]).apply(null,arguments));var
_free=Module["_free"]=function(){return(_free=Module["_free"]=Module["asm\"][\"Ua\"]).apply(null,arguments));var

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return {kernelIds};\n }\n\n move(\n  dataId: DataId, values: backend_util.BackendValues, shape: number[],\n  dtype: DataType, refCount: number): void {\n  const id = this.dataIdNextNumber++;\n  if (dtype === 'string') {\n    const stringBytes = values as Uint8Array[];\n    this.dataIdMap.set(\n      dataId,\n      {id, stringBytes,\n      shape, dtype, memoryOffset: null, refCount});\n    return;\n  }\n\n  const size = util.sizeFromShape(shape);\n  const numBytes = size * util.bytesPerElement(dtype);\n  const memoryOffset = this.wasm._malloc(numBytes);\n  this.dataIdMap.set(dataId, {id, memoryOffset, shape, dtype, refCount});\n  this.wasm.tfjs.registerTensor(id,\n  size, memoryOffset);\n  if (values != null) {\n    this.wasm.HEAPU8.set(\n      new Uint8Array(\n      (values as backend_util.TypedArray).buffer,\n      (values as backend_util.TypedArray).byteOffset,\n      numBytes),\n      memoryOffset);\n  }\n}\n\n async read(dataId: DataId):\nPromise<backend_util.BackendValues> {\n  return this.readSync(dataId);\n }\n\n readSync(dataId: DataId):\nbackend_util.BackendValues {\n  const {memoryOffset, dtype, shape, stringBytes} =\n  this.dataIdMap.get(dataId);\n  if (dtype === 'string') {\n    return stringBytes;\n  }\n  const bytes =\n  this.wasm.HEAPU8.slice(\n    memoryOffset,\n    memoryOffset + util.sizeFromShape(shape) *\n    util.bytesPerElement(dtype));\n  return typedArrayFromBuffer(bytes.buffer, dtype);\n }\n\n /**\n  * Dispose the\n  memory if the dataId\n  has 0 refCount. Return true if the memory\n  * is released, false otherwise.\n  * @param dataId\n  * @oaram force\n  Optional, remove the data regardless of refCount\n  */\n  disposeData(dataId: DataId, force = false): boolean {\n    if\n    (this.dataIdMap.has(dataId)) {\n      const data = this.dataIdMap.get(dataId);\n      data.refCount--;\n      if (!force\n      && data.refCount > 0) {\n        return false;\n      }\n      this.wasm._free(data.memoryOffset);\n      this.wasm.tfjs.disposeData(data.id);\n      this.dataIdMap.delete(dataId);\n    }\n    return true;\n  }\n\n  /** Return\n  refCount of a `TensorData`.\n  */\n  refCount(dataId: DataId): number {\n    if (this.dataIdMap.has(dataId)) {\n      const tensorData = this.dataIdMap.get(dataId);\n      return tensorData.refCount;\n    }\n    return 0;\n  }\n\n  incRef(dataId: DataId) {\n    const data = this.dataIdMap.get(dataId);\n    if (data != null) {\n      data.refCount++;\n    }\n  }\n\n  floatPrecision(): 32 {\n    return 32;\n  }\n\n  // Returns the memory offset of a tensor. Useful for debugging and unit\n  // testing.\n  getMemoryOffset(dataId: DataId): number {\n    return this.dataIdMap.get(dataId).memoryOffset;\n  }\n\n  dispose() {\n    this.wasm.tfjs.dispose();\n    if ('PThread' in this.wasm) {\n      this.wasm.PThread.terminateAllThreads();\n    }\n    this.wasm = null;\n  }\n\n  memory() {\n    return {unreliable:\n    false};\n  }\n\n  /**\n  * Make a tensor info for the output of an op. If `memoryOffset` is not\n  * present, this\n  method allocates memory on the WASM heap. If `memoryOffset`\n  * is present, the memory was allocated\n  elsewhere (in c++) and we just record\n  * the pointer where that memory lives.\n  */\n  makeOutput(shape:\n  number[], dtype: DataType, memoryOffset?: number):\n  TensorInfo {\n    let dataId: {};\n    if (memoryOffset\n    == null) {\n      dataId = this.write(null /* values */, shape, dtype);\n    } else {\n      const id =\n      this.dataIdNextNumber++;\n      dataId = {id};\n      this.dataIdMap.set(dataId, {id, memoryOffset, shape, dtype, refCount: 1});\n      const size =\n      util.sizeFromShape(shape);\n      this.wasm.tfjs.registerTensor(id, size, memoryOffset);\n    }\n    return {dataId,\n    shape, dtype};\n  }\n\n  typedArrayFromHeap({shape, dtype, dataId}: TensorInfo):\n  backend_util.TypedArray\n  {\n    const buffer = this.wasm.HEAPU8.buffer;\n    const {memoryOffset} = this.dataIdMap.get(dataId);\n    const\n    size = util.sizeFromShape(shape);\n    switch (dtype) {\n      case 'float32':\n        return new Float32Array(buffer,\n        memoryOffset, size);\n      case 'int32':\n        return new Int32Array(buffer, memoryOffset, size);\n      case 'bool':\n        return new Uint8Array(buffer, memoryOffset, size);\n      default:\n        throw new Error(`Unknown dtype\n        ${dtype}`);\n    }\n  }\n}\n\nfunction createInstantiateWasmFunc(path: string) {\n  // this will be replace by rollout\n  plugin patchWechatWebAssembly in\n  // minprogram's output.\n  // tslint:disable-next-line:no-any\n  return (imports: any, callback: any) => {\n    util.fetch(path, {credentials: 'same-origin'}).then((response) => {\n      if (!response['ok']) {\n        imports.env.a(`failed to load wasm binary file at '${path}'`);\n      }\n      response.arrayBuffer().then(binary => {\n        WebAssembly.instantiate(binary, imports).then(output => {\n          callback(output.instance, output.module);\n        });\n      });\n    });\n    return {};\n  };\n}\n\n/**\n  * Returns the\n  path of the WASM binary.\n  * @param simdSupported whether SIMD is supported\n  * @param threadsSupported

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whether multithreading is supported\n * @param wasmModuleFolder the directory containing the WASM
binaries.\n */\nfunction getPathToWasmBinary(\n  simdSupported: boolean, threadsSupported: boolean,\n  wasmModuleFolder: string) {\n  if (wasmPath != null) {\n    // If wasmPath is defined, the user has supplied a full
path to\n    // the vanilla .wasm binary.\n    return wasmPath;\n  }\n\n  let path:
WasmBinaryName = 'tfjs-backend-wasm.wasm';\n  if (simdSupported && threadsSupported) {\n    path = 'tfjs-
backend-wasm-threaded-simd.wasm';\n  } else if (simdSupported) {\n    path = 'tfjs-backend-wasm-simd.wasm';\n
}\n\n  if (wasmFileMap != null) {\n    if (wasmFileMap[path] != null) {\n      return wasmFileMap[path];\n    }\n
}\n\n  return wasmModuleFolder + path;\n}\n\n/**\n * Initializes the wasm module and creates the js <--> wasm
bridge.\n */\n * NOTE: We wrap the wasm module in a object with property 'wasm' instead of\n * returning
Promise<BackendWasmModule> to avoid freezing Chrome (last tested\n * in Chrome 76).\n */\nexport async
function init(): Promise<{wasm: BackendWasmModule}> {\n  const [simdSupported, threadsSupported] = await
Promise.all([\n    env().getAsync('WASM_HAS_SIMD_SUPPORT'),\n
env().getAsync('WASM_HAS_MULTITHREAD_SUPPORT')\n  ]);\n\n  return new Promise((resolve, reject) =>
{\n    const factoryConfig: WasmFactoryConfig = {};\n\n    /**\n     * This function
overrides the Emscripten module locateFile utility.\n     * @param path The relative path to the file that needs to be
loaded.\n     * @param prefix The path to the main JavaScript file's directory.\n     */\n    factoryConfig.locateFile =
(path, prefix) => {\n      if (path.endsWith('.worker.js')) {\n        const response = wasmWorkerContents;\n        const
blob = new Blob([response], {type: 'application/javascript'});\n        return URL.createObjectURL(blob);\n      }\n\n
      if (path.endsWith('.wasm')) {\n        return getPathToWasmBinary(\n          simdSupported as boolean,\n
threadsSupported as boolean,\n          wasmPathPrefix != null ? wasmPathPrefix : prefix);\n      }\n      return prefix
+ path;\n    };\n\n    // Use the instantiateWasm override when system fetch is not available.\n    // Reference:\n    //
https://github.com/emscripten-
core/emscripten/blob/2bca083cbbd5a4133db61fbd74d04f7feecfa907/tests/manual\_wasm\_instantiate.html#L170\n
if (customFetch) {\n
      factoryConfig.instantiateWasm =\n        createInstantiateWasmFunc(getPathToWasmBinary(\n
simdSupported as boolean, threadsSupported as boolean,\n          wasmPathPrefix != null ? wasmPathPrefix :
''));\n    }\n\n    let initialized = false;\n    factoryConfig.onAbort = () => {\n      if (initialized) {\n        // Emscripten
already called console.warn so no need to double log.\n        return;\n      }\n      if (initAborted) {\n        //
Emscripten calls `onAbort` twice, resulting in double error\n        // messages.\n        return;\n      }\n      initAborted
= true;\n      const rejectMsg =\n        'Make sure the server can serve the `.wasm` file relative to the ' +\n
'bundled js file. For more details see https://github.com/tensorflow/tfjs/blob/master/tfjs-backend-
wasm/README.md#using-bundlers;\n      reject({message: rejectMsg});\n    };\n\n    let wasm:
Promise<BackendWasmModule>;\n    // If `wasmPath` has been defined we must initialize
the vanilla module.\n    if (threadsSupported && simdSupported && wasmPath == null) {\n
factoryConfig.mainScriptUrlOrBlob = new Blob(\n      [\n        var WasmBackendModuleThreadedSimd = ` +\n
wasmFactoryThreadedSimd.toString(),\n        {type: 'text/javascript'};\n      ],\n      wasm =
wasmFactoryThreadedSimd(factoryConfig);\n    } else {\n      // The wasmFactory works for both vanilla and SIMD
binaries.\n      wasm = wasmFactory(factoryConfig);\n    }\n\n    // The WASM module has been successfully
created by the factory.\n    // Any error will be caught by the onAbort callback defined above.\n
wasm.then((module) => {\n      initialized = true;\n      initAborted = false;\n\n      const voidReturnType: string =
null;\n      // Using the tfjs namespace to avoid conflict with emscripten's API.\n      module.tfjs = {\n        init:
module.cwrap('init', null, []),\n        initWithThreadsCount:\n          module.cwrap('init_with_threads_count', null,
['number']),\n        getThreadsCount: module.cwrap('get_threads_count', 'number', []),\n        registerTensor: module.cwrap(\n
'register_tensor', null,\n          [\n            'number', // id\n            'number', // size\n            'number', //
memoryOffset\n          ]),\n        disposeData: module.cwrap('dispose_data', voidReturnType, ['number']),\n
dispose: module.cwrap('dispose', voidReturnType, []),\n      };\n\n      resolve({wasm: module});\n    });\n
}\n\nfunction typedArrayFromBuffer(\n  buffer: ArrayBuffer, dtype: DataType): backend_util.TypedArray {\n

```

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switch (dtype) {\n  case 'float32':\n    return new Float32Array(buffer);\n  case 'int32':\n    return new Int32Array(buffer);\n  case 'bool':\n    return new Uint8Array(buffer);\n  default:\n    throw new Error(`Unknown dtype ${dtype}`);\n }\n}\n\nconst wasmBinaryNames = [\n  'tfjs-backend-wasm.wasm', 'tfjs-backend-wasm-simd.wasm',\n  'tfjs-backend-wasm-threaded-simd.wasm'\n] as const;\n\ntype WasmBinaryName = typeof wasmBinaryNames[number];\n\nlet wasmPath: string = null;\nlet wasmPathPrefix: string = null;\nlet wasmFileMap: {[key in WasmBinaryName]?: string} = {};\nlet initAborted = false;\nlet customFetch = false;\n\n/**\n * @deprecated Use `setWasmPaths` instead.\n * Sets the path to the `.wasm` file which will be fetched when the wasm backend is initialized. See\n * https://github.com/tensorflow/tfjs/blob/master/tfjs-backend-wasm/README.md#using-bundlers\n * for more details.\n * @param path wasm file path or url\n * @param usePlatformFetch optional boolean to use platform fetch to download\n * the wasm file, default to false.\n */\n\n/**\n * @doc {heading: 'Environment', namespace: 'wasm'}\n */\n\nexport function setWasmPath(path: string, usePlatformFetch = false): void {\n  deprecationWarn(\n    'setWasmPath has been deprecated in favor of setWasmPaths and '\n    ' will be removed in a future release.);\n  if (initAborted) {\n    throw new Error(\n      'The WASM backend was already initialized. Make sure you call '\n      'setWasmPath()' before you call\n      `tf.setBackend()` or `tf.ready()`');\n  }\n  wasmPath = path;\n  customFetch = usePlatformFetch;\n}\n\n/**\n * Configures the locations of the WASM binaries.\n */\n\nexport function setWasmPaths({\n  renamed: 'renamed.wasm',\n  'tfjs-backend-wasm-simd': 'renamed-simd.wasm',\n  'tfjs-backend-wasm-threaded-simd': 'renamed-threaded-simd.wasm'\n} as const, {\n  prefixOrFileMap\n}: {\n  prefixOrFileMap: string | {\n    [key in WasmBinaryName]?: string\n  }\n}, usePlatformFetch = false): void {\n  if (initAborted) {\n    throw new Error(\n      'The WASM backend was already initialized. Make sure you call '\n      'setWasmPaths()' before you call `tf.setBackend()` or '\n      `tf.ready()`');\n  }\n  if (typeof prefixOrFileMap === 'string') {\n    wasmPathPrefix = prefixOrFileMap;\n  } else {\n    wasmFileMap = prefixOrFileMap;\n    const missingPaths = wasmBinaryNames.filter(name => wasmFileMap[name] == null);\n    if (missingPaths.length > 0) {\n      throw new Error(\n        `There were no entries found for the following binaries: ` +\n        `${missingPaths.join(',')}. Please either call setWasmPaths with a ` +\n        `map providing a path for each binary, or with a string indicating ` +\n        `the directory where all the binaries can be found.`);\n    }\n  }\n  customFetch = usePlatformFetch;\n}\n\n/**\n * Used in unit tests.\n */\n\nexport function resetWasmPath(): void {\n  wasmPath = null;\n  wasmPathPrefix = null;\n  wasmFileMap = {};\n  customFetch = false;\n  initAborted = false;\n}\n\nlet threadsCount = -1;\nlet actualThreadsCount = -1;\n\n/**\n * Sets the number of threads that will be used by XNNPACK to create\n * threadpool (default to the number of logical CPU cores).\n */\n\nexport function setThreadsCount(numThreads: number) {\n  threadsCount = numThreads;\n}\n\n/**\n * Gets the actual threads count that is used by XNNPACK.\n */\n\nexport function getThreadsCount(): number {\n  if (actualThreadsCount === -1) {\n    throw new Error(\n      'WASM backend not initialized.);\n  }\n  return actualThreadsCount;\n}\n\nexport const wasmWorkerContents = `var Module={};function threadPrintErr(){var text=Array.prototype.slice.call(arguments).join("\\n");console.error(text)}function threadAlert(){var text=Array.prototype.slice.call(arguments).join("\\n");postMessage({cmd:"alert",text:text,threadId:Module["_pthread_self"]()})}var err=threadPrintErr;this.alert=threadAlert;Module["instantiateWasm"]=function(info,receiveInstance){var

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instance=new
WebAssembly.Instance(Module["wasmModule"],info);Module["wasmModule"]=null;receiveInstance(instance);r
return instance.exports};function
moduleLoaded(){this.onmessage=function(e){try{if(e.data.cmd===\"load\"){Module["wasmModule"]=e.data.wa
smModule;Module["wasmMemory"]=e.data.wasmMemory;Module["buffer"]=Module["wasmMemory"].buffer;
Module["ENVIRONMENT_IS_PTHREAD"]=true;if(typeof
e.data.urlOrBlob===\"string\"){importScripts(e.data.urlOrBlob)}else{var
objectUrl=URL.createObjectURL(e.data.urlOrBlob);importScripts(objectUrl);URL.revokeObjectURL(objectUrl)}
WasmBackendModuleThreadedSimd(Module).then(function(instance){Module=instance;moduleLoaded()})}else
if(e.data.cmd===\"objectTransfer\"){Module["PThread"].receiveObjectTransfer(e.data)}else
if(e.data.cmd===\"run\"){Module["__performance_now_clock_drift"]=performance.now()-
e.data.time;Module["__emscripten_thread_init"](e.data.threadInfoStruct,0,0);var max=e.data.stackBase;var
top=e.data.stackBase+e.data.stackSize;Module["establishStackSpace"](top,max);Module["__emscripten_tls_init"](
);Module["PThread"].receiveObjectTransfer(e.data);Module["PThread"].setThreadStatus(Module["_pthread_self
"](),1);try{var
result=Module["invokeEntryPoint"](e.data.start_routine,e.data.arg);if(!Module["getNoExitRuntime"]())Module[\"
PThread\"].threadExit(result)}catch(ex){if(ex===\"Canceled!\"){Module["PThread"].threadCancel()}else
if(ex!==\"unwind\")if(ex instanceof
Module["ExitStatus"]){if(Module["getNoExitRuntime"]()){Module["PThread"].threadExit(ex.status)}}el
se{Module["PThread"].threadExit(-2);throw
ex}}}}else
if(e.data.cmd===\"cancel\")if(Module["_pthread_self"]()){Module["PThread"].threadCancel()}else
if(e.data.target===\"setimmediate\"){}else
if(e.data.cmd===\"processThreadQueue\")if(Module["_pthread_self"]()){Module["_emscripten_current_thread_
process_queued_calls"]()}else{err(\"worker.js received unknown command
\"+e.data.cmd);err(e.data)}}catch(ex){err(\"worker.js onmessage() captured an uncaught exception:
\"+ex);if(ex&&ex.stack)err(ex.stack);throw ex}};if(typeof process===\"object\"&&typeof
process.versions===\"object\"&&typeof process.versions.node===\"string\"){self={location:{href:__filename}}};var
onmessage=this.onmessage;var
nodeWorkerThreads=require(\"worker_threads\");global.Worker=nodeWorkerThreads.Worker;var
parentPort=nodeWorkerThreads.parentPort;parentPort.on(\"message\",function(data){onmessage({data:data})});var
nodeFS=require(\"fs\");var nodeRead=function(filename){return
nodeFS.readFileSync(filename,\"utf8\")};function
globalEval(x){global.require=require;global.Module=Module;eval.call(null,x)}importScripts=function(f){globalEva
l(nodeRead(f));postMessage=function(msg){parentPort.postMessage(msg)};if(typeof
performance===\"undefined\"){performance={now:function(){return Date.now()}}};\"/**\n * @license\n *
Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
\"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====\\n
*/\\n\\nimport './flags_wasm';\\n\\nimport {registerBackend} from '@tensorflow/tfjs-core';\\n\\nimport {BackendWasm,
init} from './backend_wasm';\\n\\nexport {BackendWasm, getThreadsCount, setThreadsCount, setWasmPath,
setWasmPaths} from './backend_wasm';\\n\\nexport {version as version_wasm} from './version';\\n\\nconst
WASM_PRIORITY = 2;\\nregisterBackend('wasm', async () => {\\n  const {wasm} = await init();\\n  return new
BackendWasm(wasm);\\n}, WASM_PRIORITY);\\n\", \"/** @license See the LICENSE file. */\\n\\n// This code is

```

auto-generated, do not modify this file!\nconst version = '3.11.0';\nexport

```
{ version }; \n", "names": [ "CppType", "FusableActivation", "wasmFusedMatMul", "fusedMatMulConfig", "kernelName", "_FusedMatMul", "backendName", "setupFunc", "backend", "wasm", "cwrap", "kernelFunc", "args", "inputs", "attrs", "a", "b", "bias", "preluActivationWeights", "dtype", "Error", "transposeA", "transposeB", "activation", "leakyreluAlpha", "aId", "dataIdMap", "get", "dataId", "id", "bId", "biasId", "biasData", "shape", "length", "preluActivationWeightsId", "fusedActivation", "leftDim", "rightDim", "batchDim", "out", "makeOutput", "outId", "aShapeBytes", "Uint8Array", "Int32Array", "buffer", "bShapeBytes", "createUnaryKernelConfig", "outType", "wasmFunc", "x", "xId", "util", "sizeFromShape", "absConfig", "Abs", "createBinaryKernelConfig", "supportsFullBroadcast", "outputType", "newShape", "backend_util", "assertAndGetBroadcastShape", "aBroadcastDims", "getBroadcastDims", "bBroadcastDims", "loopsOverAllOfA", "every", "v", "i", "loopsOverAllOfB", "addConfig", "Add", "addNConfig", "AddN", "inputIds", "map", "inputIdsBytes", "identity", "inVals", "typedArrayFromHeap", "set", "identityConfig", "Identity", "wasmTranspose", "transpose", "reducedShape", "perm", "newPerm", "push", "minValIdx", "j", "removeOneSizeDims", "permIsNoOp", "outShape", "inShape", "Array", "computeOutShape", "cloned", "permBytes", "xShapeBytes", "transposeConfig", "Transpose", "permuteAxesAndTranspose", "axis", "xShape", "xRank", "originalAxes", "parseAxisParam", "axes", "permutedAxes", "getAxesPermutation", "xTransposed", "inputWasTransposed", "getInnerMostAxes", "transposed", "wasmAll", "allConfig", "All", "keepDims", "inputId", "input", "inputRank", "assertAxesAreInnerMostDims", "reduceShape", "computeOutAndReduceShapes", "reduceSize", "disposeData", "expandShapeToKeepDim", "wasmAny", "anyConfig", "Any", "argMaxConfig", "ArgMax", "transposedId", "slice", "outerSize", "innerSize", "wasmAvgPool", "avgPoolConfig", "AvgPool", "filterSize", "strides", "pad", "dimRoundingMode", "convInfo", "computePool2DInfo", "filterHeight", "filterWidth", "padTop", "padInfo", "top", "padRight", "right", "padBottom", "bottom", "padLeft", "left", "strideHeight", "strideWidth", "channels", "inChannels", "dataFormat", "dilationWidth", "dilationHeight", "reshape", "xSize", "$shape", "inferFromImplicitShape", "assert", "incRef", "reshapeConfig", "Reshape", "wasmBatchMatMul", "batchMatMulConfig", "BatchMatMul", "aRank", "bRank", "innerShapeA", "innerShapeB", "outerShapeA", "outerShapeB", "outerDimsA", "outerDimsB", "batchDimA", "batchDimB", "batchDimsCompatible", "concat", "b3dShape", "a3d", "b3d", "a3dId", "b3dId", "Math", "max", "sliceImpl", "vals", "begin", "size", "isContinous", "slice_util", "isSliceContinous", "xStrides", "computeStrides", "flatOffset", "computeFlatOffset", "subarray", "decodedData", "fromUint8ToStringArray", "inBuf", "outBuf", "outLoc", "indexToLoc", "inLoc", "idx", "fromStringArrayToUint8", "values", "begin_", "size_", "parseSliceParams", "xVals", "readSync", "outData", "stringBytes", "res", "sliceImplCPU", "outVals", "rank", "xStride", "outOffset", "beginI", "beginJ", "endI", "xOffset", "slice2d", "xStride1", "xStride2", "beginK", "endJ", "slice3d", "xStride3", "endK", "beginL", "k", "slice4d", "sliceConfig", "Slice", "batchToSpaceNDConfig", "BatchToSpaceND", "blockShape", "crops", "prod", "reduce", "reshaped", "getReshaped", "permuted", "getPermuted", "reshapedPermuted", "getReshapedPermuted", "sliceBeginCoords", "getSliceBeginCoords", "sliceSize", "getSliceSize", "xReshaped", "result", "cast", "castConfig", "Cast", "ceilConfig", "Ceil", "wasmClip", "clipByValueConfig", "ClipByValue", "clipValueMin", "clipValueMax", "t", "$inputs", "filter", "shapes", "assertParamsConsistent", "inputs2D", "inputsValShapes", "simplyConcat", "getArrayFromDType", "offset", "forEach", "colOffset", "tIdx", "row", "resIdx", "col", "concatImplCPU", "finalOutShape", "sumInnerDims", "innerDims", "innerDim", "inOffset", "concatConfig", "Concat", "wasmConv2d", "conv2DConfig", "Conv2D", "filterId", "dilations", "$dataFormat", "convertConv2DDataFormat", "computeConv2DInfo", "inputChannels", "outputChannels", "outChannels", "isSamePad", "type", "wasmConv2DBackpropInput", "conv2DBackpropInputConfig", "Conv2DBackpropInput", "dy", "inputShape", "batchSize", "inHeight", "inWidth", "outHeight", "outWidth", "topPad", "leftPad", "isChannelsLast", "dxStrides", "dyStrides", "fltS0", "fltS1", "fltS2", "xBatchStride", "xRowStride", "xColStride", "xChannelStride", "yBatchStride", "yRowStride", "yColStride", "yChannelStride", "dyId", "cosConfig", "Cos", "coshConfig", "Cosh", "InterpolationMethod", "wasmCropAndResize", "cropAndResizeConfig", "CropAndResize", "method", "extrapolationValue", "cropSize", "image", "boxes", "boxInd", "numBoxes", "cropHeight", "cropWidth", "castedData", "imagesData", "imagesId", "boxesId", "boxIndId", "imagesShapeBytes", "wasmCumsum", "cumsumConfig", "Cumsum", "exclusive", "reverse", "permutation", "permutedX", "permutedAxis", "permutedOut", "finalDim", "permutedXId", "permutedOutId", "getUndoAxesPermutation", "wasmDepthToSpace", "depthToSpaceConfig", "DepthToSpace", "blockSize", "outputHeight", "outputWidth", "outputDepth", "outputShape", "xStridesBytes", "outputShapeBytes", "outStridesBytes", "wasmDepthwiseConv2d", "depthwiseConv2dNativeConfig", "DepthwiseConv2dNative", "$dilations", "eluConfig", "Elu", "equalConfig", "Equal", "expConfig", "Exp", "expandDims", "dim", "$dim", "s
```

plice", "expandDimsConfig", "ExpandDims", "fill", "value", "fillConfig", "Fill", "wasmFlipLeftRight", "flipLeftRightConfig", "FlipLeftRight", "imageId", "batch", "imageHeight", "imageWidth", "numChannels", "floorConfig", "Floor", "floorDivConfig", "FloorDiv", "wasmBatchNorm", "fusedBatchNormConfig", "FusedBatchNorm", "varianceEpsilon", "mean", "variance", "scale", "meanId", "varianceId", "offsetId", "scaleId", "wasmFusedConv2d", "fusedConv2DConfig", "FusedConv2D", "wasmFusedDepthwiseConv2d", "fusedDepthwiseConv2DConfig", "FusedDepthwiseConv2D", "wasmGatherNd", "gatherNdConfig", "GatherNd", "params", "indices", "resultShape", "numSlices", "gather_util", "prepareAndValidate", "indicesShape", "sliceRank", "indicesId", "stridesBytes", "wasmGather", "gatherV2Config", "GatherV2", "batchDims", "parsedAxis", "indicesVals", "axisDim", "index", "shapeInfo", "segment_util", "collectGatherOpShapeInfo", "flattenX", "dimSize", "indicesSize", "flattenIndex", "flattenOutputShape", "stridesSize", "greaterConfig", "Greater", "greaterEqualConfig", "GreaterEqual", "leakyReluConfig", "LeakyRelu", "alpha", "lessConfig", "Less", "lessEqualConfig", "LessEqual", "logConfig", "Log", "logicalAndConfig", "LogicalAnd", "wasmMax", "maxConfig", "Max", "reductionIndices", "maximumConfig", "Maximum", "wasmMaxPool", "maxPoolConfig", "MaxPool", "wasmMean", "meanConfig", "Mean", "reductionAxes", "castedInput", "wasmMin", "minConfig", "Min", "minimumConfig", "Minimum", "MirrorPaddingMode", "wasmMirrorPad", "mirrorPadConfig", "MirrorPad", "paddings", "mode", "p", "prePaddingsFlat", "padTuple", "postPaddingsFlat", "prePaddingsBytes", "postPaddingsBytes", "multiplyConfig", "Multiply", "negConfig", "Neg", "parseResultStruct", "resOffset", "HEAPU8", "pSelectedIndices", "selectedSize", "pSelectedScores", "pValidOutputs", "_free", "nonMaxSuppressionV3Config", "NonMaxSuppressionV3", "iouThreshold", "maxOutputSize", "scoreThreshold", "scores", "scoresId", "nonMaxSuppressionV4Config", "NonMaxSuppressionV4", "padToMaxOutputSize", "nonMaxSuppressionV5Config", "NonMaxSuppressionV5", "softNmsSigma", "notEqualConfig", "NotEqual", "wasmOneHot", "oneHotConfig", "OneHot", "depth", "onValue", "offValue", "onesLikeConfig", "OnesLike", "packConfig", "Pack", "assertShapesMatch", "intermediateTensorInfos", "expandedT", "wasmPadV2", "padV2Config", "PadV2", "constantValue", "powConfig", "Pow", "wasmPrelu", "preluConfig", "Prelu", "weightsId", "wasmProd", "prodConfig", "Prod", "rangeConfig", "Range", "start", "stop", "step", "makeZerosTypedArray", "numElements", "abs", "ceil", "rangeImplCPU", "realDivConfig", "RealDiv", "reluConfig", "Relu", "relu6Config", "Relu6", "wasmResizeBilinear", "resizeBilinearConfig", "ResizeBilinear", "images", "alignCorners", "halfPixelCenters", "newHeight", "newWidth", "oldHeight", "oldWidth", "xData", "wasmReverse", "reverseConfig", "Reverse", "dims", "axesBytes", "outShapeBytes", "wasmRotate", "rotateWithOffsetConfig", "RotateWithOffset", "radians", "fillValue", "center", "centerX", "centerY", "getImageCenter", "fillValues", "fillBytes", "roundConfig", "Round", "rsqrtConfig", "Rsqrt", "wasmScatterNd", "scatterNdConfig", "ScatterNd", "updates", "numUpdates", "outputSize", "scatter_util", "calculateShapes", "updatesId", "wasmSelect", "selectConfig", "Select", "condition", "e", "conditionId", "tId", "eId", "cRank", "tRank", "sigmoidConfig", "Sigmoid", "sinConfig", "Sin", "softmaxConfig", "Softmax", "logits", "spaceToBatchNDConfig", "SpaceToBatchND", "completePaddings", "paddedX", "reshapedPaddedShape", "permutedReshapedPaddedPermutation", "flattenShape", "paddedXReshaped", "paddedXT", "splitVConfig", "SplitV", "numOrSizeSplits", "\$axis", "splitSizes", "prepareSplitSize", "s", "xSliceSize", "xSlice", "sqrtConfig", "Sqrt", "squareConfig", "Square", "squaredDifferenceConfig", "SquaredDifference", "wasmStep", "stepConfig", "Step", "wasmStridedSlice", "stridedSliceConfig", "StridedSlice", "end", "beginMask", "endMask", "ellipsisMask", "newAxisMask", "shrinkAxisMask", "finalShapeSparse", "finalShape", "isIdentity", "sliceDim0", "isSimpleSlice", "\$begin", "\$end", "\$strides", "sliceInfo", "sliced", "beginBytes", "endBytes", "subConfig", "Sub", "wasmSum", "sumConfig", "Sum", "tanConfig", "Tan", "tanhConfig", "Tanh", "wasmTile", "tileConfig", "Tile", "reps", "newShapeBytes", "wasmTopK", "topKConfig", "TopK", "sorted", "outValues", "outValuesId", "outIndices", "outIndicesId", "wasmTransform", "transformConfig", "Transform", "transforms", "interpolation", "fillMode", "transformsId", "interpolationModeId", "fillModeId", "unpackConfig", "Unpack", "numOutputs", "outIndex", "outs", "zerosLikeConfig", "ZerosLike", "kernelConfigs", "kernelConfig", "registerKernel", "ENV", "env", "registerFlag", "async", "WebAssembly", "validate", "MessageChannel", "port1", "postMessage", "SharedArrayBuffer", "_scriptDir", "WasmBackendModuleThreadedSimd", "document", "currentScript", "src", "undefined", "__filename", "GROWABLE_HEAP_I8", "wasmMemory", "updateGlobalBufferAndViews", "HEAP8", "GROWABLE_HEAP_U8", "GROWABLE_HEAP_I32", "HEAP32", "GROWABLE_HEAP_U32", "HEAPU32", "GROWABLE_HEAP_F64", "HEAPF64", "readyPromiseResolve", "readyPromiseReject", "Module", "Promise", "resolve", "reject", "key", "moduleOverrides", "hasOwnProperty", "quit_", "status", "toThrow", "ENVIRONMENT_IS_WEB", "ENVIRONMENT_IS_WORKER", "ENVIRONMENT_IS_NODE", "ENVIRONMENT_IS_SHELL", "window", "importScripts", "process", "

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pten_stack_set_limits","getNoExitRuntime","invokeEntryPoint","__assert_fail","line","__call_main","argc","argv","_main","setErrNo","__errno_location","_atexit","_emscripten_proxy_to_main_thread_js","_emscripten_notify_thread_queue","targetThreadId","mainThreadId","_abort","_emscripten_asm_const_int","code","sigPtr","argbuf","readAsmConstArgs","_emscripten_conditional_set_current_thread_status","expectedStatus","newStatus","_emscripten_futex_wait","val","timeout","tNow","tEnd","exchange","wait","_emscripten_memcpy_big","dest","num","copyWithin","_emscripten_num_logical_cores","require\$\$4","cpus","navigator","sync","numCallArgs","serializedNumCallArgs","_emscripten_run_in_main_runtime_thread_js","dateNow","_emscripten_receive_on_main_thread_js_callbackArgs","readAsmConstArgsArray","double","_emscripten_receive_on_main_thread_js","proxiedFunctionTable","_emscripten_get_heap_size","emscripten_realloc_buffer","grow","_emscripten_resize_heap","requestedSize","oldSize","maxHeapSize","cutDown","overGrownHeapSize","min","JSEvents","inEventHandler","removeAllEventListeners","eventHandlers","_removeHandler","deferredCalls","registerRemoveEventListeners","removeEventListenersRegistered","deferCall","targetFunction","precedence","argsList","arraysHaveEqualContent","arrA","arrB","call","sort","y","removeDeferredCalls","canPerformEventHandlerRequests","currentEventHandler","allowsDeferredCalls","runDeferredCalls","removeAllHandlersOnTarget","eventTypeString","h","removeEventListener","eventListenerFunc","useCapture","registerOrRemoveHandler","eventHandler","jsEventHandler","event","handlerFunc","callbackfunc","addEventListener","queueEventHandlerOnThread_iiii","eventHandlerFunc","eventTypeId","eventData","userData","varargs","__emscripten_call_on_thread","getTargetThreadForEventCallback","getNodeNameForTarget","screen","nodeName","fullscreenEnabled","webkitFullscreenEnabled","stringToNewUTF8","jsString","cString","_emscripten_set_offscreencanvas_size_on_target_thread_js","targetCanvas","width","height","targetCanvasPtr","_emscripten_set_offscreencanvas_size_on_target_thread","maybeCStringToJsString","specialHTMLTargets","findEventTarget","querySelector","findCanvasEventTarget","_emscripten_set_canvas_element_size_calling_thread","canvas","canvasSharedPtr","offscreenCanvas","controlTransferredOffscreen","autoResizeViewport","GLctxObject","GLctx","prevViewport","getParameter","viewport","_emscripten_set_canvas_element_size_main_thread","_emscripten_set_canvas_element_size","_emscripten_set_current_thread_status","_emscripten_set_thread_name","threadId","name","__webgl_enable_ANGLE_instanced_arrays","ctx","ext","getExtension","divisor","first","primcount","__webgl_enable_OES_vertex_array_object","vao","__webgl_enable_WEBGL_draw_buffers","n","bufs","__webgl_enable_WEBGL_multi_draw","multiDrawWebgl","GL","counter","buffers","programs","framebuffers","renderbuffers","textures","uniforms","shaders","vaos","contexts","offscreenCanvases","timerQueriesEXT","programInfos","stringCache","unpackAlignment","recordError","errorCode","lastError","getNewId","table","getSource","shader","source","createContext","webGLContextAttributes","getContext","registerContext","handle","context","attributes","version","majorVersion","enableExtensionsByDefault","initExtensions","makeContextCurrent","contextHandle","currentContext","deleteContext","initExtensionsDone","disjointTimerQueryExt","getSupportedExtensions","populateUniformTable","program","ptable","maxUniformLength","maxAttributeLength","maxUniformBlockNameLength","utable","numUniforms","getProgramParameter","getActiveUniform","loc","getUniformLocation","_emscripten_webgl_power_preferences","_emscripten_webgl_do_create_context","powerPreference","contextAttributes","stencil","antialias","premultipliedAlpha","preserveDrawingBuffer","failIfMajorPerformanceCaveat","minorVersion","explicitSwapControl","proxyContextToMainThread","renderViaOffscreenBackBuffer","_emscripten_webgl_create_context","a0","a1","SYSCALLS","mappings","printChar","stream","curr","getStr","get64","low","high","_fd_close","fd","_fd_seek","offset_low","offset_high","whence","newOffset","_fd_write","iov","iocnt","pnum","_pthread_cleanup_pop","execute","routine","_pthread_cleanup_push","threadParams","stackHigh","stackSize","tis","detached","global_locale","_emscripten_get_global_libc","msg","start_routine","startRoutine","time","transferList","_pthread_create","attr","_emscripten_sync_run_in_main_thread_4","_memalign","_pthread_testcancel_js","_emscripten_check_blocking_allowed","_emscripten_do_pthread_join","block","_emscripten_main_browser_thread_id","threadStatus","threadExitCode","_pthread_join","_sysconf","calledRun","r","c","A","q","l","g","o","z","m","this","run","doRun","implicit","returnCode","runCaller","ready","WasmBackendModule","UTF8Decoder","TextDecoder","endPtr","decode","BackendWasm","KernelBackend","[object Object]","super","tfjs","initWithThreadsCount","threadsCount","actualThreadsCount","getThreadsCount","DataStorage","engine","dataIdNextNumber","move","numDataIds","kernelMs","refCount","memoryOffset","numBytes","by

tesPerElement","registerTensor","byteOffset","typedArrayFromBuffer","force","has","delete","dispose","unreliable","write","getPathToWasmBinary","simdSupported","threadsSupported","wasmModuleFolder","wasmPath","wasmFileMap","init","all","getAsync","factoryConfig","endsWith","blob","Blob","URL","createObjectURL","wasmPathPrefix","customFetch","instantiateWasm","imports","arrayBuffer","createInstantiateWasmFunc","initialized","onAbort","initAborted","mainScriptUrlOrBlob","wasmFactoryThreadedSimd","toString","wasmFactory","wasmBinaryNames","numThreads","usePlatformFetch","deprecationWarn","prefixOrFileMap","missingPaths","join"],"mappings":":,,,,,,,,,,,,,,,,oeAkBA,IAAYA,EASAC,ECJZ,IAAIC,iVDLJ,SAAYF,GACVA,yBACAA,qBACAA,mBACAA,uBACAA,6BALF,CAAYA,IAAAA,OASZ,SAAYC,GACVA,uBACAA,mBACAA,qBACAA,qBACAA,6BACAA,yBACAA,iBAPF,CAAYA,IAAAA,OC6EL,MAAME,EAAkC,CAC7CC,WAAYC,eACZC,YAAa,OACbC,UA7EF,SA AeC,GACbN,EAAkBM,EAAQC,KAAKC,MAAML,eAAc,KAAiB,CACIE,SACA,QACA,SACA,SACA,QACA,SACA,SACA,SACA,SACA,SACA,SACA,YAgEFM,WA5DF,SAA0BC,GAKxB,MAAMC,OAACA,EAAML,QAAEA,EAAOM,MAAEA,GAASF,GAC3BG,EAACA,EAACC,EAAEA,EAACC,KAAEA,EAAIC,uBAAEA,GAA0BL,EAE7C,GAAgB,YAAZE,EAAEI,OAAmC,YAAZH,EAAEG,MAC7B,MAAM,IAAIC,MACN,+DAGN,MAAMC,WAACA,EAAUC,WAAEA,EAAUC,WAAEA,EAAUC,eAAEA,GAakBV,EACvDW,EAAMjB,EAAQkB,UAAUC,IAAIZ,EAAEa,QAAQC,GACtCC,EAAMtB,EAAQkB,UAAUC,IAAIX,EAAEY,QAAQC,GAe5C,IAAIE,EAAS,EACb,GAAY,MAARd,EAAc,CACbB,MAAMe,EAAXxB,EAAQkB,UAAUC,IAAIV,EAARKW,QAC5C,GAA8B,IAA1BI,EAASC,MAAMC,OACjB,MAAM,IAAId,MAEN,uDAAQY,EAASC,MAAMC,WAE7BH,EAASC,EAASH,GAEPb,MAAMM,EAAqD,MAA1BjB,EAC7B,EACAV,EAAQkB,UAAUC,IAAIT,EAAuBU,QAAQC,GACnDO,EACFnC,EAAkBsB,GACtB,GAAuB,MAAnBa,EACF,MAAM,IAAIhB,MACN,GAAGG,uEAIT,MAAMc,EAAUhB,EAAaN,EAAEkB,MAAM,GAAKIB,EAAEkB,MAAM,GAC5CK,EAAXhB,EAAaN,EAAEiB,MAAM,GAAKjB,EAAEiB,MAAM,GAC7CM,EAAXxB,EAAEkB,MAAM,GAEnBO,EAAMhC,EAAQiC,WAAW,CACF,EAAUF,EAASC,GAAXvB,EAAEI,OAC1DuB,EAAQIC,EAAQkB,UAAUC,IAAIa,EAAIZ,QAAQC,GAe1Cc,EAAc,IAAIC,WAAW,IAAIC,WAAW9B,EAAEkB,OAAOa,QACrDC,EAAc,IAAIH,WAAW,IAAIC,WAAW7B,EAAEiB,OAAOa,QAO3D,OALA5C,EACIuB,EAAKkB,EAAa5B,EAAEkB,MAAMC,OAAQJ,EAAKiB,EAAa/B,EAAEiB,MAAMC,OAC5Db,EAAYC,EAAYc,EAAiBL,EAAQI,EACjDX,GAakB,EAAGkB,GAElBF,aC9EOQ,EACZ5C,EAAoB6C,GACtB,IAAIC,EA0BJ,MAAO,CAAC9C,WAAAA,EAAYE,YAAa,OAAQC,UAXBzC,SAAmBC,GACjB0C,EAAX1C,EAAQC,KAAKC,MAAMN,EAAY,KAAiB,CACzD,SACA,SACA,YAoBgDO,WAhBpD,SAAoBC,GAElB,MAAMJ,QAACA,EAASK,QAAQsC,EAACA,IAAMvC,EACzBwC,EAAM5C,EAAQkB,UAAUC,IAAIwB,EAAEvB,QAAQC,GACtCW,EAAMhC,EAAQiC,WAAWU,EAAElB,MAAOgB,GAAXWE,EAAEHc,OAC/CuB,EAAQIC,EAAQkB,UAAUC,IAAIa,EAAIZ,QAAQC,GAGhD,OAAsC,IAAICwB,OAAKC,cAAcd,EAAIP,QAI3BiB,EAASE,EAAKpD,EAA5mD,EAAEHc,OAAQuB,GAHxBf,ICxBN,MAAMe,EAA0BP,EAAXwBQ,gBCG/CC,EACZrD,EAAoBsD,EACpBvC,GACF,IAAI+B,EA6DJ,MAAO,CAAC9C,WAAAA,EAAYE,YAAa,OAAQC,UAXDzC,SAAmBC,GACjB0C,EAAX1C,EAAQC,KAAKC,MAAMN,EAAY,KAAiB,CACzD,SACA,QACA,SACA,SACA,QACA,SACA,SACA,YA+CgDO,WA3CpD,SAAoBC,GAElB,MAAMJ,QAACA,EAAOK,OAAEA,GAAUD,GACpBG,EAACA,EAACC,EAAEA,GAAXH,EACTY,EAAMjB,EAAQkB,UAAUC,IAAIZ,EAAEa,QAAQC,GACtCC,EAAMtB,EAAQkB,UAAUC,IAAIX,EAAEY,QAAQC,GAeIC8B,EAA5B,MAATxC,EAAGBA,EAAQJ,EAAEI,MACvCyC,EAAXC,eAAaC,2BAA2B/C,EAAEkB,MAAOjB,EAAEiB,OAC9DO,EAAMhC,EAAQiC,WAAWmB,EAAUD,GAGzC,GAAqC,IAAJCN,OAAKC,cAAcM,GACrB,OAAOpB,EAGT,MAAMG,EAAc,IAAIC,WAAW,IAAIC,WAAW9B,EAAEkB,OAAOa,QACrDC,EAAc,IAAIH,WAAW,IAAIC,WAAW7B,EAAEiB,OAAOa,QACrDJ,EAAQIC,EAAQkB,UAAUC,IAAIa,EAAIZ,QAAQC,GAC1CIB,EAAa,IAAMuC,EACrBzB,EAAKkB,EAAa5B,EAAEkB,MAAMC,OAAQJ,EAAKiB,EAAa/B,EAAEiB,MAAMC,OAC5DIC,EAASe,EAAEI,OAAQuB,GAGvB,GAAGiB,GAAGqC,YAAZ3C,EAAEI,MAE7B,OADAR,IACO6B,EAGT,MAAMuB,EAAiBF,eAAaG,iBAAiBjD,EAAEkB,MAAO2B,GACxDK,EAAiBJ,eAAaG,iBAAiBhD,EAAEiB,MAAO2B,GACxDM,EAAkBH,EAAeI,OAAAM,CAACC,EAAGC,IAAMD,IAAMC,IACvDC,EAAkBL,EAAeE,OAAAM,CAACC,EAAGC,IAAMD,IAAMC,IAC7D,GAAIH,GAAMBI,EAERb,OADA3D,IACO6B,EAEP,MAAM,IAAIpB,MAEN,0DAAiBL,EAAEI,SAASf,QC9DtC,MAEEamE,EACTd,EAAYBe,OAHC,GCE9B,IAAIItB,EA8BG,MAAMuB,EAA2B,CACiCrE,WAAYS,E,OACZpE,YAAa,OACbC,UA7BF,SAAmBC,GACjB0C,EAAX1C,EAAQC,KAAKC,MAAMgE,OAAAM,KAAiB,CACnD,QACA,SACA,SACA,YAYBF/D,WArBF,SAAcC,GACZ,MAAMC,OAACA,EAAML,QAAEA,GA

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D,GAAWE,EAAInzB,QAAoC,OAA5BozB,EAAmBD,EAAI7D,GAAYA,IAAsJiD,EAAKF,EAASC,GAAWe,EAAM,GAAOC,EAAM,EA AE,GAAG50B,EAAM,IAAI,IAAIyD,EAAE,EAAEA,EAAEzD,EA AKsB,OAAOmC,IAAI,CAAC,IAAIoxB,EAAUX,EAAIF,EAASvwB,IAAOoxB,GAAsB,IAARD,IAAU,A,EAAME,MAAYH,EAAMlxB,GAAGoxB,EAAU70B,EA AKyD,KAASkx B,EAAMlx B,GAAGzD,EA AKyD,GA AK,IAAImtB,EAAIiD,EA AKkB,MAAM,KA AKJ,GAAoE,OAA7D/D,EAARy,SAA4BA,GA AK,MAAgB,WAAbmD,EAA6BiB,EAAapE,GAAqB,YAAbmD,EAA8BkB,QAAQR E,GAAYA,EA AiQsE,CAAmBiE,GAAGB,IAARgE,GAAUO,GAAaP,GA AchE,EA AI,SAAS9wB,EAAM8zB,EAAMG,EA AWC,EAASC,GAA4B,IAAIImB,GAA1BpB,EAASA,GAAU,IAA4BzwB,OAAM,SAASoP,GAAM,MAAc,WAAPA,KAAuD,MAAT,WAAbohB,GAAqCqB,IAAcnB,EAAaN,EAASC,GAAC,WAAW,OAAOE,EAAMF,EAAMG,EA AWC,EAASqB,YAAiB,IAAGzDnzB,EAAO6rB,EAAMtO,EAAsByO,EAA/O DmsB,EAAiC,oBAAdC,YAA0B,IAAIA,YAAY,aAAQ5sB,EAAU,SAAS4H,EA AKBC,EA AK7oB,EAAI8oB,GAA6D,IAA7C,IAAIC,EAAO/oB,EAAI8oB,EAAMb+kB,EAAO7tC,EAAU6oB,EA AKglB,MAAWA,GAAQ9kB,MAAU8kB,EAAO,GAAGA,EAAO7tC,EA AI,IAAI6oB,EA AKrpB,UAAUmuC,EAAa,OAAOA,EAAYG,OAAOjlB,EA AKrpB,SAASQ,EA AI6tC,IAAyB,IAAX,IAAIInmB,EA AI,GAAS1nB,EAAI6tC,GAAO,CAAC,IAAI7kB,EAAGH,EA AK7oB,KAAO,GAAQ,IAAHgpB,EAAL,CAAoD,IAAIC,EAAe,GA AZJ,EA AK7oB,KAAU,GAAa,MAAN,IAAHgpB,GA AJ,CAAmE,IAAIE,EAAe,GA AZL,EA AK7oB,KAAmG,IAAvEgpB,EAAL,MAAN,IAAHA,IAAqB,GA AHA,IAAQ,GAAGC,GA AI,EAAEC,GAAe,EA AHF,IAAO,GAAGC,GA AI,GAAGC,GA AI,EAAc,GA AZL,EA AK7oB,MAAgB,MAAO0nB,GA AKyB,OAAOC,aAAaJ,OAAQ,CAAC,IAAIK,EAAGL,EAAG,MAAMtB,GA AKyB,OAAOC,aAAa,MAAMC,GA AI,GAAG,MAAS,KAAHA,SAA3Q3B,GA AKyB,OAAOC,cAAiB,GA AHJ,IAAQ,EAAEC,QAAIHvB,GA AKyB,OAAOC,aAAaJ,GAA2U,OAAOtB,EA AI,SAASY,EAAAgB,EA AIR,GAAGB,OAAOQ,EA AIV,EA AKB7V,EAAOuW,EA AIR,GAAGB,GAAG,SAASS,EA AKB7B,EA AIImB,EA AKW,EAAOC,GAAiB,KAAKA,EAAgB,GAAG,OAAO,EAA0D,IAAx D,IAAIC,EAASF,EA AWT,EAAOS,EAAOC,EAAgB,EAAU1yB,EAAE,EAAEA,EAAE2wB,EAAI9yB,SAASmC,EAAE,CAAC,IAAI4yB,EAAEjC,EA AIkC,WAAW7yB,GAAoF,GAA9E4yB,GAAG,OAAOA,GAAG,QAAkCA,EAAE,QAAU,KAAFA,IAAS,IAAO,KAA9CjC,EA AIkC,aAAa7yB,IAAqC4yB,GAAG,IAAI,CAAC,GAAGH,GAAQT,EAAO,MAAMF,EA AKW,KAAUG,OAAO,GAAGA,GAAG,KAAK,CAAC,GAAGH,EAAO,GAAGT,EAAO,MAAMF,EA AKW,KAAU,IAAIG,GAAG,EAAEd,EA AKW,KAAU,IAAM,GA AFG,OAAU,GAAGA,GAAG,MAAM,CAAC,GAAGH,EAAO,GAAGT,EAAO,MAAMF,EA AKW,KAAU,IAAIG,GAAG,GAAGd,EA AKW,KAAU,IAAIG,GAAG,EAAE,GAAGd,EA AKW,KAAU,IAAM,GA AFG,GAAqB,OAAfd,EA AKW,GAAQ,EAASA,EAAOE,EAAS,SAAS9B,EAAaF,EA AIImC,EAAOJ,GAAiB,OAAOF,EA AKB7B,EAAI3U,EAAO8W,EAAOJ,GAAiB,SAASzB,EAAmBF,EAAMTyB,GAAQ6rB,EAAM1pB,IAAIImwB,EAAMTyB,GAAQ,SAASu0B,EAAQl0B,EAAEm0B,GA AKD,OAArCn0B,EAAEm0B,EAAS,IAAGn0B,GAAGm0B,EAASn0B,EAAEm0B,GAAGBn0B,EAAwE,SAASurB,EAA2B6I,GA AKz0B,EAAOy0B,EAAIII,EAAc,MAAEV,EAAM,IAAI6I,UAAUD,GA AKII,EAAe,OAAS,IAAIoI,WAAWF,GA AKII,EAAe,OAAEP,EAAO,IAAIjsB,WAAW00B,GA AKII,EAAe,OAAEhP,EAAO,IAAIzd,WAAW20B,GA AKII,EAAGB,QAAU,IAAIqI,YAAYH,GA AKII,EAAGB,QAAU,IAAIIsI,YAAYJ,GA AKII,EAAGB,QAAU,IAAIuI,aAAaL,GA AKII,EAAGB,QAAU,IAAIwI,aAAaN,GAAwBII,EAAuB,eAA1C,IAA0DyI,EAAcO,EAAa,GAAOC,EA AW,GAAOC,EA AW,GAAOC,EAAc,GAAyF,SAASC,IAAS,GAAGpJ,EAAe,OAA8E,IAA/C,mBAAlBA,EAAe,SAACa,EAAe,OAAE,CAACA,EAAe,SAA SA,EAAe,OAAEntB,QAAQw2B,EAAYrJ,EAAe,OAAEsJ,SAAUC,GAAqBP,GAAC,SAASQ,IAAsCD,GAAqBN,GAAY,SAASQ,IAAUUF,GAAqBL,GAAY,SAASQ,IAAU,GAAG1J,EAAGB,QAAiF,IAAjD,mBAAnBA,EAAGB,UAAcA,EAAGB,QAAE,CAACA,EAAGB,UAASA,EAAGB,QAAEntB,QAAQ82B,EAAa3J,EAAGB,QAAEsJ,SAAUC,GAAqBJ,GAAe,SAASE,EAAYO,GA AIZ,EAAaa,QAAQD,GA AI,SAASD,EAAaC,GA AIT,EAAcU,QAAQD,GA A9tBX,EA AW7yB,KAAK,CAACgvB,KAAK,WAAW0E,QAAisB,IAAIC,EAAGB,EAAoCC,EAAsB,KAAK,SAASC,GAAiBz3B,GAAIu3B,IAAqB/J,EAA+B,wBAAGA,EAA+B,uBAAE+J,GA AKB,SAASG,GAAoB13B,GAA6G,GAAzGu3B,IAAqB/J,EAA+B,wBAAGA,EAA+B,uBAAE+J,GAAqC,GAAjBA,GAAqHC,EAAsB,CAAC,IAAIG,EAASH,EAAsBA,EAAsB,KAAKG,KAAuE,SAAS5H,GAAM6H,GAASpK,EAAGB,SAAGA,EAAGB,QAAEoK,GAAezF,EAATyF,GAAM,IAAanF,GAAM,EA AKBmF,EA AK,SAASA,EA AK,+CAA+C,IAAIxs,EAAE,IAAI0G,YAAY+L,aAAaD,GAA4B,MAAtBrK,EAAmBnI,GAASA,EAAE,SAAS0S,GAAU3E,EAAI4E,GAAQ,OAAOnD,

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AKM,YAAwB5G,EAAGB,QAAE,WAAW,OAAeA,EAAGB,QAAEA,EAAY,IAAK,GAAGsG,MAAM,KAAKM,Y
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padRight: number,\n  padBottom: number, padLeft: number, strideHeight: number,\n  strideWidth: number,
channels: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n  wasmAvgPool =
backend.wasm.cwrap(AvgPool, null /* void */, [\n    'number', // xId\n    'number', // batchSize\n    'number', //
inputHeight\n    'number', // inputWidth\n    'number', // filterHeight\n    'number', // filterWidth\n    'number', //
padTop\n    'number', // padRight\n    'number', // padBottom\n    'number', // padLeft\n    'number', //
strideHeight\n    'number', // strideWidth\n    'number', // channels\n    'number', // outId\n  ]);\n}\n\nfunction
avgPool(\n
  args: {inputs: AvgPoolInputs, backend: BackendWasm, attrs: AvgPoolAttrs}) {\n  const {inputs, attrs, backend} =
args;\n  const x = inputs.x as Tensor4D;\n  const xId = backend.dataIdMap.get(x.dataId).id;\n  const {filterSize,
strides, pad, dimRoundingMode} = attrs;\n  const convInfo = backend_util.computePool2DInfo(\n    x.shape,
filterSize, strides, 1 /* dilations */, pad, dimRoundingMode);\n  const filterHeight = convInfo.filterHeight;\n  const
filterWidth = convInfo.filterWidth;\n  const padTop = convInfo.padInfo.top;\n  const padRight =
convInfo.padInfo.right;\n  const padBottom = convInfo.padInfo.bottom;\n  const padLeft = convInfo.padInfo.left;\n
const strideHeight = convInfo.strideHeight;\n  const strideWidth = convInfo.strideWidth;\n  const channels =
convInfo.inChannels;\n  if (convInfo.dataFormat !== 'channelsLast') {\n    throw new Error(\n      `wasm backend
does not support dataFormat: ` +\n      `${convInfo.dataFormat}`. Please use 'channelsLast'.`);\n  }\n  if (convInfo.dilationWidth !== 1 || convInfo.dilationHeight !== 1) {\n    throw new Error(\n      `was backend only
supports average pooling with dilation = [1, 1], ` +\n      `got [${convInfo.dilationHeight},
${convInfo.dilationWidth}].`);\n  }\n  const out = backend.makeOutput(convInfo.outShape, 'float32');\n  const
outId = backend.dataIdMap.get(out.dataId).id;\n  wasmAvgPool(\n    xId, x.shape[0], x.shape[1], x.shape[2],
filterHeight, filterWidth,\n    padTop, padRight, padBottom, padLeft, strideHeight, strideWidth, channels,\n
    outId);\n  return out;\n}\n\nexport const avgPoolConfig: KernelConfig = {\n  kernelName: AvgPool,\n
backendName: 'wasm',\n  setupFunc: setup,\n  kernelFunc: avgPool as { } as KernelFunc\n};\n"]

```

Found in path(s):

* /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/AvgPool.js.map

No license file was found, but licenses were detected in source scan.

```

{"version":3,"file":"RotateWithOffset.js","sourceRoot":"","sources":["../../src/kernels/RotateWithOffset.ts"],"names
":[],"mappings":"AAAA;;;;;;;;;;GAeG;AAEH,OAAO,EAA2B,gBAAGB,EAA4D,MAAM,uBAAuB,CAAC;AAC
5L,OAAO,EAAC,YAAY,EAAC,MAAM,uBAAuB,CAAC;AAInD,IAAI,UAGiE,CAAC;AAEtE,SAAS,KAAK,CA
AC,OAAoB;IACjC,UAAU,GAAG,OAAO,CAAC,IAAI,CAAC,KAAK,CAAC,gBAAGB,EAAE,IAAI,CAAC,UAA
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UAAU,CAAC,IAAI,UAAU,CAAC,UAAU,CAAC,CAAC,MAAM,CAAC,CAAC;IAEpE,UAAU,CACN,OAAO,E

```

```
AAE,KAAK,EAAE,WAaw,EAAE,UAAU,EAAE,WAaw,EAAE,OAAO,EAAE,OAAO,EACtE,OAAO,EAAE,S
AAS,EAAE,UAAU,CAAC,MAAM,EAAE,KAAK,CAAC,CAAC;IACID,OAAO,GAAG,CAAC;AACb,CAAC;AA
ED,MAAM,CAAC,MAAM,sBAAsB,GAAiB;IACID,UAAU,EAAE,gBAAGB;IAC5B,WAaw,EAAE,MAAM;IAC
nB,UAAU,EAAE,gBAAoC;IACbD,SAAS,EAAE,KAAK;CACjB,CAAC","sourcesContent":["/**\n
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport { KernelConfig, KernelFunc, RotateWithOffset, RotateWithOffsetAttrs, RotateWithOffsetInputs,
TensorInfo } from '@tensorflow/tfjs-core';\nimport { backend_util } from '@tensorflow/tfjs-core';\n\nimport
{ BackendWasm } from '../backend_wasm';\n\nlet wasmRotate: (\n  xId: number, batch: number, imageHeight:
number, imageWidth: number,\n  numChannels: number, radians: number, centerX:
number, centerY: number,\n  fillBytes: Uint8Array, fillLength: number, outId: number) => void;\n\nfunction
setup(backend: BackendWasm) {\n  wasmRotate = backend.wasm.cwrap(RotateWithOffset, null /* void */, [\n
'number', // xId\n 'number', // batch\n 'number', // imageHeight\n 'number', // imageWidth\n 'number', //
numChannels\n 'number', // radians\n 'number', // centerX\n 'number', // centerY\n 'array', // fillBytes\n
'number', // fillLength\n 'number', // outId\n ]);\n\n  \n\nexport function rotateWithOffset(args: {\n  inputs:
RotateWithOffsetInputs,\n  backend: BackendWasm,\n  attrs: RotateWithOffsetAttrs\n}): TensorInfo {\n  const
{ inputs, backend, attrs } = args;\n  const { image } = inputs;\n  const { radians, fillValue, center } = attrs;\n\n  const out
= backend.makeOutput(image.shape, image.dtype);\n  const imageId = backend.dataIdMap.get(image.dataId).id;\n
const outId = backend.dataIdMap.get(out.dataId).id;\n\n  const [batch, imageHeight,
imageWidth, numChannels] = image.shape;\n\n  const [centerX, centerY] =\n
backend_util.getImageCenter(center, imageHeight, imageWidth);\n\n  const fillIsBlack = fillValue === 0;\n  const
fullOpacityValue = 255;\n  const fillValues = typeof fillValue === 'number' ?\n    [fillValue, fillValue, fillValue,
fillIsBlack ? 0 : fullOpacityValue] :\n    [...fillValue, fullOpacityValue];\n  const fillBytes = new Uint8Array(new
Int32Array(fillValues).buffer);\n\n  wasmRotate(\n    imageId, batch, imageHeight, imageWidth, numChannels,
radians, centerX,\n    centerY, fillBytes, fillValues.length, outId);\n  return out;\n\n  \n\nexport const
rotateWithOffsetConfig: KernelConfig = {\n  kernelName: RotateWithOffset,\n  backendName: 'wasm',\n
kernelFunc: rotateWithOffset as {} as KernelFunc,\n  setupFunc: setup\n};\n"}]
```

Found in path(s):

* /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/RotateWithOffset.js.map

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```
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```

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- * limitations under the License.
- * =====
- */
- /**
- * @deprecated Use `setWasmPaths` instead.
- * Sets the path to the `wasm` file which will be fetched when the wasm
- * backend is initialized. See
- * <https://github.com/tensorflow/tfjs/blob/master/tfjs-backend-wasm/README.md#using-bundlers>
- * for more details.
- * @param path wasm file path or url
- * @param usePlatformFetch optional boolean to use platform fetch to download
- * the wasm file, default to false.
- *
- * @doc {heading: 'Environment', namespace: 'wasm'}
- */

Found in path(s):

- * /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/tf-backend-wasm.fesm.js

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```
{ "version": 3, "file": "tf-backend-wasm.fesm.js", "sources": [ "../src/kernels/types.ts", "../src/kernels/_FusedMatMul.ts", "../src/kernels/unary_kernel.ts", "../src/kernels/Abs.ts", "../src/kernels/binary_kernel.ts", "../src/kernels/Add.ts", "../src/kernels/AddN.ts", "../src/kernels/Identity.ts", "../src/kernels/Transpose.ts", "../src/kernels/kernel_utils.ts", "../src/kernels/All.ts", "../src/kernels/Any.ts", "../src/kernels/ArgMax.ts", "../src/kernels/AvgPool.ts", "../src/kernels/Reshape.ts", "../src/kernels/BatchMatMul.ts", "../node_modules/@tensorflow/tfjs-backend-cpu/dist/kernels/Concat_impl.js", "../node_modules/@tensorflow/tfjs-backend-cpu/dist/kernels/Range_impl.js", "../node_modules/@tensorflow/tfjs-backend-cpu/dist/kernels/Slice.js", "../src/kernels/Slice.ts", "../src/kernels/BatchToSpaceND.ts", "../src/kernels/Cast.ts", "../src/kernels/Ceil.ts", "../src/kernels/ClipByValue.ts", "../src/kernels/Concat.ts", "../src/kernels/Conv2D.ts", "../src/kernels/Conv2DBackpropInput.ts", "../src/kernels/Cos.ts", "../src/kernels/Cosh.ts", "../src/kernels/CropAndResize.ts", "../src/kernels/Cumsum.ts", "../src/kernels/DepthToSpace.ts", "../src/kernels/DepthwiseConv2dNative.ts", "../src/kernels/Elu.ts", "../src/kernels/Equal.ts", "../src/kernels/Exp.ts", "../src/kernels/ExpandDims.ts", "../src/kernels/Fill.ts", "../src/kernels/FlipLeftRight.ts", "../src/kernels/Floor.ts", "../src/kernels/FloorDiv.ts", "../src/kernels/FusedBatchNorm.ts", "../src/kernels/FusedConv2D.ts", "../src/kernels/FusedDepthwiseConv2D.ts", "../src/kernels/GatherNd.ts", "../src/kernels/GatherV2.ts", "../src/kernels/Greater.ts", "../src/kernels/GreaterEqual.ts", "../src/kernels/LeakyRelu.ts", "../src/kernels/Less.ts", "../src/kernels/LessEqual.ts", "../src/kernels/Log.ts", "../src/kernels/LogicalAnd.ts", "../src/kernels/Max.ts", "../src/kernels/Maximum.ts", "../src/kernels/MaxPool.ts", "../src/kernels/Mean.ts", "../src/kernels/Min.ts", "../src/kernels/Minimum.ts", "../src/kernels/MirrorPad.ts", "../src/kernels/Multiply.ts", "../src/kernels/Neg.ts", "../src/kernels/NonMaxSuppression_util.ts", "../src/kernels/NonMaxSuppressionV3.ts", "../src/kernels/NonMaxSuppressionV4.ts", "../src/kernels/NonMaxSuppressionV5.ts", "../src/kernels/NotEqual.ts", "../src/kernels/OneHot.ts", "../src/kernels/OnesLike.ts", "../src/kernels/Pack.ts", "../src/kernels/PadV2.ts", "../src/kernels/Pow.ts", "../src/kernels/Prelu.ts", "../src/kernels/Prod.ts", "../src/kernels/Range.ts", "../src/kernels/RealDiv.ts", "../src/kernels/Relu.ts", "../src/kernels/Relu6.ts", "../src/kernels/ResizeBilinear.ts", "../src/kernels/Reverse.ts", "../src/kernels/RotateWithOffset.ts", "../src/kernels/Round.ts", "../src/kernels/Rsqrt.ts", "../src/kernels/ScatterNd.ts", "../src/kernels/Select.ts", "../src/kernels/Sigmoid.ts", "../src/kernels/Sin.ts", "../src/kernels/Softmax.ts" ] }
```

```

tmax.ts", "../src/kernels/SpaceToBatchND.ts", "../src/kernels/SplitV.ts", "../src/kernels/Sqrt.ts", "../src/kernels/Square.ts",
"../src/kernels/SquaredDifference.ts", "../src/kernels/Step.ts", "../src/kernels/StridedSlice.ts", "../src/kernels/Sub.ts",
"../src/kernels/Sum.ts", "../src/kernels/Tan.ts", "../src/kernels/Tanh.ts", "../src/kernels/Tile.ts", "../src/kernels/TopK.ts",
"../src/kernels/Transform.ts", "../src/kernels/Unpack.ts", "../src/kernels/ZerosLike.ts", "../src/register_all_kernels.ts",
"../src/c/flags_wasm.ts", "../wasm-out/tfjs-backend-wasm-threaded-simd.js", "../wasm-out/tfjs-backend-wasm-threaded-simd.worker.js",
"../wasm-out/tfjs-backend-wasm.js", "../src/backend_wasm.ts", "../src/version.ts", "../src/base.ts"], "sourcesContent": ["/*\n
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 * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n
 * limitations under the License.\n */\n
=====
\n
*\n\n// This enum must align with the enum defined in cc/backend.h.\nexport enum CppDType {\n  float32 = 0,\n  int32 = 1,\n  bool = 2,\n  string = 3,\n  complex64 = 4\n}\n\n// Must match enum in cc/fusable_activations.h.\nexport enum FusableActivation {\n  linear = 0,\n  relu = 1,\n  relu6 = 2,\n  prelu = 3,\n  leakyrelu = 4,\n  sigmoid = 5,\n  elu = 6\n}\n\n\"/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n
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 * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n
 * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n
 * limitations under the License.\n */\n
=====
\n
*\n\nimport { _FusedMatMul, _FusedMatMulAttrs, _FusedMatMulInputs, KernelConfig, KernelFunc } from '@tensorflow/tfjs-core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nimport { FusableActivation } from './types';\n\nlet wasmFusedMatMul: (\n  aId: number, aShape: Uint8Array, aShapeSize: number, bId: number, bShape: Uint8Array, bShapeSize: number, transposeA: boolean, transposeB: boolean, activation: number, biasId: number, preluActivationWeightsId: number, leakyreluAlpha: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n  wasmFusedMatMul = backend.wasm.cwrap(_FusedMatMul, null /* void */, [\n    'number',\n    // a_id\n    'array', // a_shape\n    'number', // a_shape.length\n    'number', // b_id\n    'array', // b_shape\n    'number', // b_shape.length\n    'number', // transpose_a\n    'number', // transpose_b\n    'number', // activation\n    'number', // biasId\n    'number', // preluActivationWeightsId\n    'number', // leakyreluAlpha\n    'number' // out_id\n  ]);\n\n  function fusedBatchMatMul(args: {\n    inputs: _FusedMatMulInputs,\n    backend: BackendWasm,\n    attrs: _FusedMatMulAttrs\n  }) {\n    const { inputs, backend, attrs } = args;\n    const { a, b, bias, preluActivationWeights } = inputs;\n\n    if (a.dtype !== 'float32' || b.dtype !== 'float32') {\n      throw new Error(`_FusedMatMul for non non-float32 tensors not yet supported.`);\n    }\n\n    const { transposeA, transposeB, activation, leakyreluAlpha } = attrs;\n    const aId = backend.dataIdMap.get(a.dataId).id;\n    const bId = backend.dataIdMap.get(b.dataId).id;\n\n    let biasId = 0;\n    if (bias != null) {\n      const biasData = backend.dataIdMap.get(bias.dataId);\n      if (biasData.shape.length !== 1) {\n        throw new Error(`_FusedMatMul only supports rank-1 bias but got ` +\n          `rank ${biasData.shape.length}.`);\n      }\n      biasId = biasData.id;\n    }\n\n    const preluActivationWeightsId = preluActivationWeights == null ? 0 : backend.dataIdMap.get(preluActivationWeights.dataId).id;\n    const fusedActivation = FusableActivation[activation as { } as keyof typeof FusableActivation];\n    if (fusedActivation == null) {\n      throw new Error(`_${activation}_ activation not yet supported for FusedConv2D ` +\n        `in the wasm backend.`);\n    }\n  }\n}

```

```

}\n\n const leftDim = transposeA ? a.shape[2] : a.shape[1];\n const rightDim = transposeB ? b.shape[1] :
b.shape[2];\n const batchDim = a.shape[0];\n\n const out = backend.makeOutput([batchDim, leftDim, rightDim],
a.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n const aShapeBytes = new Uint8Array(new
Int32Array(a.shape).buffer);\n const bShapeBytes = new Uint8Array(new Int32Array(b.shape).buffer);\n\n
wasmFusedMatMul(\n    aId, aShapeBytes, a.shape.length, bId, bShapeBytes, b.shape.length,\n    transposeA, transposeB, fusedActivation, biasId, preluActivationWeightsId,\n    leakyreluAlpha || 0, outId);\n\n return out;\n}\n\n\nexport const fusedMatMulConfig: KernelConfig = {\n kernelName: _FusedMatMul,\n backendName:
'wasm',\n setupFunc: setup,\n kernelFunc: fusedBatchMatMul as { } as KernelFunc\n};\n\n", "/*\n * @license\n *
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WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport {DataType, KernelConfig, TensorInfo, UnaryInputs, util} from '@tensorflow/tfjs-core';\n\nimport
{BackendWasm} from '../backend_wasm';\n\nimport {CppType} from './types';\n\n\nexport function
createUnaryKernelConfig(\n    kernelName: string, outType?: DataType): KernelConfig {\n    let wasmFunc: (xId:
number, dtype: number, outId: number) => void;\n\n    function setupFunc(backend: BackendWasm): void {\n
wasmFunc = backend.wasm.cwrap(kernelName, null /* void */, [\n    'number', // x_id\n    'number', // dtype\n
'number', // out_id\n    ]);\n    }\n\n    function kernelFunc(args: {backend: BackendWasm, inputs: UnaryInputs}): \n
TensorInfo {\n    const {backend, inputs: {x}} = args;\n    const xId = backend.dataIdMap.get(x.dataId).id;\n
    const out = backend.makeOutput(x.shape, outType || x.dtype);\n    const outId =
backend.dataIdMap.get(out.dataId).id;\n\n    // Short-circuit zero-sized tensors.\n    if (util.sizeFromShape(out.shape)
=== 0) {\n    return out;\n    }\n\n    wasmFunc(xId, CppDType[x.dtype], outId);\n    return out;\n    }\n\n    return
{kernelName, backendName: 'wasm', setupFunc, kernelFunc};\n}\n\n", "/*\n * @license\n * Copyright 2019 Google
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
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and\n * limitations under the License.\n *
=====\n
*/\n\nimport {Abs, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from
'../unary_kernel';\n\n\nexport const absConfig: KernelConfig = createUnaryKernelConfig(Abs);\n\n", "/*\n * @license\n *
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the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport {backend_util, BinaryInputs, DataType, KernelConfig, TensorInfo, util} from '@tensorflow/tfjs-
core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport {CppType} from './types';\n\n\nexport
function createBinaryKernelConfig(\n    kernelName: string, supportsFullBroadcast: boolean,\n    dtype?:
DataType): KernelConfig {\n    let wasmFunc:\n    (aId: number, aShape: Uint8Array, aShapeLen: number, bId:

```



```
inputIds.length, CppDType[out.dtype], outId);\n\n return out;\n}\n\nexport const addNConfig: KernelConfig = {\n  kernelName: AddN,\n  backendName: 'wasm',\n  setupFunc,\n  kernelFunc: addn as {} as KernelFunc,\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version\n 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a\n copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable\n law or agreed
```

```
to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT\n WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific\n language governing permissions and\n * limitations under the License.\n *
```

```
=====\n\n*\n\nimport {Identity, IdentityInputs, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';\nimport\n {TensorInfo} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\n\nexport function\n identity(args: {inputs: IdentityInputs, backend: BackendWasm}): \n  TensorInfo {\n    const {inputs: {x}, backend} =\n args;\n    const out = backend.makeOutput(x.shape, x.dtype);\n    const inVals = backendtypedArrayFromHeap(x);\n    const outVals = backendtypedArrayFromHeap(out);\n    outVals.set(inVals);\n    return out;\n}\n\nexport const\n identityConfig: KernelConfig = {\n  kernelName: Identity,\n  backendName: 'wasm',\n  \n  kernelFunc: identity as {} as KernelFunc,\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights\n Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file\n except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES\n OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n governing permissions and\n * limitations under the License.\n *
```

```
=====\n\n*\n\nimport {KernelConfig, KernelFunc, TensorInfo, Transpose, TransposeAttrs, TransposeInputs} from\n '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nimport {identity} from\n './Identity';\nimport {CppType}\n from './types';\n\nlet wasmTranspose: (\n  xId: number, xShape: Uint8Array, xShapeLength: number, dtype:\n CppDType,\n  outId: number, perm: Uint8Array, permLength: number) => void;\n\nfunction setup(backend:\n BackendWasm) {\n  wasmTranspose = backend.wasm.cwrap(Transpose, null /* void */, [\n    'number', // xId\n    'array', // x.shape\n    'number', // x.shape.length\n    'number', // dtype\n    'number', // outId\n    'array', // perm\n    'number', // perm.length\n  ]);\n\n  export function transpose(\n    args: {\n      inputs: TransposeInputs, backend:\n BackendWasm, attrs: TransposeAttrs\n    }): \n    TensorInfo {\n      const {inputs, backend, attrs} = args;\n      // Reduce any\n dimensions with size one. Lower-rank transpose kernel performs\n // better due to simpler memory access pattern.\n      const [reducedShape, perm] = removeOneSizeDims(inputs.x.shape, attrs.perm);\n      let permIsNoOp = true;\n      for\n (let i = 0; i < perm.length; i++) {\n        if (perm[i] !== i) {\n          permIsNoOp\n = false;\n        }\n      }\n      const outShape = computeOutShape(inputs.x.shape, attrs.perm);\n      const x = {\n        dataId:\n inputs.x.dataId,\n        shape: reducedShape,\n        dtype: inputs.x.dtype\n      };\n      if (permIsNoOp) {\n        const cloned =\n identity({inputs, backend});\n        cloned.shape = outShape;\n        return cloned;\n      }\n      const out =\n backend.makeOutput(outShape, x.dtype);\n      const xId = backend.dataIdMap.get(x.dataId).id;\n      const outId =\n backend.dataIdMap.get(out.dataId).id;\n      const permBytes = new Uint8Array(new Int32Array(perm).buffer);\n      const xShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);\n      wasmTranspose(\n        xId,\n        xShapeBytes, x.shape.length, CppDType[x.dtype], outId, permBytes,\n        perm.length);\n      return\n out;\n\n      function computeOutShape(inShape: number[], perm: number[]): number[] {\n        const outShape = new\n Array(inShape.length);\n        for (let i = 0; i < outShape.length; i++) {\n          outShape[i] = inShape[perm[i]];\n        }\n        return outShape;\n      }\n\n      function\n removeOneSizeDims(\n        shape: number[], perm: number[]): [number[], number[]] {\n        const newShape: number[\n ] = [];\n        const newPerm: number[\n ] = [];\n        for (let i = 0; i < shape.length; ++i) {\n          if (shape[i] !== 1) {\n
```



```

const reduceSize = util.sizeFromShape(reduceShape);\n\n const out = backend.makeOutput(outShape, x.dtype);\n
if (util.sizeFromShape(input.shape) !== 0) {\n  const outId = backend.dataIdMap.get(out.dataId).id;\n
wasmAll(inputId, reduceSize, outId);\n } \n\n if (inputWasTransposed) {\n  // dispose of the transposed tensor.\n
backend.disposeData(transposed.dataId);\n } \n\n if (keepDims) {\n  // reshape\n  const newShape =
backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n  out.shape = newShape;\n } \n\n return
out;\n} \n\n\nexport const allConfig: KernelConfig = {\n  kernelName: All,\n  backendName: 'wasm',\n  setupFunc:
setup,\n  kernelFunc: all as { } as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2021 Google LLC. All Rights
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except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n
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distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n *
===== \n
*/\n\nimport { Any, AnyAttrs, AnyInputs, backend_util, KernelConfig, KernelFunc, TensorInfo, util } from
'@tensorflow/tfjs-core';\n\nimport { BackendWasm } from './backend_wasm';\n\nimport
{ permuteAxesAndTranspose } from './kernel_utils';\n\nlet wasmAny: (xId: number, reduceSize: number, outId:
number) => void;\n\nfunction setup(backend: BackendWasm): void {\n  wasmAny = backend.wasm.cwrap(Any,
null /*void*/, ['number, number, number']);\n}\n\nfunction any(args: { backend: BackendWasm, inputs: AnyInputs,
attrs: AnyAttrs }):\n  TensorInfo {\n  const { backend, inputs,
attrs } = args;\n  const { axis, keepDims } = attrs;\n  const { x } = inputs;\n  const xId =
backend.dataIdMap.get(x.dataId).id;\n  let inputId = xId;\n  let input = x;\n\n  const { transposed, axes, originalAxes,
inputWasTransposed } =\n    permuteAxesAndTranspose(x, axis, backend);\n\n  if (inputWasTransposed) {\n
const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n  input = transposed;\n  inputId =
transposedId;\n } \n\n  const inputRank = input.shape.length;\n  backend_util.assertAxesAreInnerMostDims('any',
axes, inputRank);\n  const [outShape, reduceShape] =\n
backend_util.computeOutAndReduceShapes(input.shape, axes);\n  const reduceSize =
util.sizeFromShape(reduceShape);\n\n  const out = backend.makeOutput(outShape, x.dtype);\n  if
(util.sizeFromShape(input.shape) !== 0) {\n  const outId = backend.dataIdMap.get(out.dataId).id;\n
wasmAny(inputId, reduceSize, outId);\n } \n\n if (inputWasTransposed) {\n  // dispose of the transposed tensor.\n
backend.disposeData(transposed.dataId);\n
}\n\n if (keepDims) {\n  // reshape\n  const newShape = backend_util.expandShapeToKeepDim(out.shape,
originalAxes);\n  out.shape = newShape;\n } \n\n return out;\n} \n\n\nexport const anyConfig: KernelConfig = {\n
kernelName: Any,\n  backendName: 'wasm',\n  setupFunc: setup,\n  kernelFunc: any as { } as
KernelFunc\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
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Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n
* ===== \n
*/\n\nimport { ArgMax, ArgMaxAttrs, ArgMaxInputs, KernelConfig, KernelFunc, util } from '@tensorflow/tfjs-
core';\n\nimport { BackendWasm } from './backend_wasm';\n\nimport { permuteAxesAndTranspose } from
'./kernel_utils';\n\nimport { CppDType } from './types';\n\nlet wasmFunc: (\n  xId: number, dtype: number, outerSize:
number, innerSize: number,\n  outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n
wasmFunc = backend.wasm.cwrap(ArgMax, null /* void */, [\n  'number', // x_id\n  'number', // dtype\n

```


[illegible]

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on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
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License.\n *

```
=====\n
*\n\nimport { KernelConfig, KernelFunc, Reshape, ReshapeAttrs, ReshapeInputs, util } from '@tensorflow/tfjs-
core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nexport function reshape(\n  args: { inputs:
ReshapeInputs, attrs: ReshapeAttrs, backend: BackendWasm }) {\n  const { inputs, attrs } = args;\n  const { x } =
inputs;\n  const { shape } = attrs;\n\n  const xSize = util.sizeFromShape(x.shape);\n  const $shape =
util.inferFromImplicitShape(shape, xSize);\n\n  util.assert(\n    xSize === util.sizeFromShape($shape),\n    () =>
`new shape: ${$shape}, old shape: ${x.shape}. New shape and old ` +\n    `shape must have the same number of
elements.`);\n\n  // Backend needs to track refCount
  for the dataId for reshape op\n  args.backend.incref(x.dataId);\n  return { dataId: x.dataId, shape: $shape, dtype:
x.dtype};\n}\n\nexport const reshapeConfig: KernelConfig = {\n  kernelName: Reshape,\n  backendName: 'wasm',\n  kernelFunc: reshape as { } as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
```

```
=====\n
*\n\nimport
{ BatchMatMul, BatchMatMulAttrs, BatchMatMulInputs, KernelConfig, KernelFunc, util } from '@tensorflow/tfjs-
core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nimport { reshape } from './Reshape';\n\nlet
wasmBatchMatMul: (\n  aId: number, aShape: Uint8Array, aShapeSize: number, bId: number,\n  bShape:
Uint8Array, bShapeSize: number, transposeA: boolean,\n  transposeB: boolean, outId: number) =>
void;\n\nfunction setup(backend: BackendWasm) {\n  wasmBatchMatMul = backend.wasm.cwrap(BatchMatMul,
null /* void */, [\n    'number', // a_id\n    'array', // a_shape\n    'number', // a_shape.length\n    'number', // b_id\n    'array', // b_shape\n    'number', // b_shape.length\n    'number', // transpose_a\n    'number', // transpose_b\n    'number' // out_id\n  ]);\n\n  function batchMatMul(args: {\n    inputs: BatchMatMulInputs,\n    backend:
BackendWasm,\n    attrs: BatchMatMulAttrs\n  }) {\n    const { inputs, backend, attrs } = args;\n    const { a, b } = inputs;\n    const
{ transposeA, transposeB } = attrs;\n\n    if (a.dtype !== 'float32' || b.dtype !== 'float32') {\n      throw new Error(\n
`BatchMatMul for non non-float32 tensors not yet supported.`);\n    }\n\n    const aRank = a.shape.length;\n    const
bRank = b.shape.length;\n\n    const innerShapeA = transposeA ? a.shape[aRank - 2] : a.shape[aRank - 1];\n    const
innerShapeB = transposeB ? b.shape[bRank - 1] : b.shape[bRank - 2];\n\n    const outerShapeA = transposeA ?
a.shape[aRank - 1] : a.shape[aRank - 2];\n    const outerShapeB = transposeB ? b.shape[bRank - 2] : b.shape[bRank -
1];\n\n    const outerDimsA = a.shape.slice(0, -2);\n    const outerDimsB = b.shape.slice(0, -2);\n\n    const batchDimA =
util.sizeFromShape(outerDimsA);\n    const batchDimB = util.sizeFromShape(outerDimsB);\n\n    const
batchDimsCompatible =\n      batchDimA === batchDimB || batchDimA === 1 || batchDimB === 1;\n\n    util.assert(\n      aRank >= 2 && bRank >= 2 && batchDimsCompatible,\n      () => `Error in matMul: the input
batch dimensions
must either be the ` +\n      `same or at least one input batch dimension must be 1. Got input ` +\n      `batch
dimensions of (${outerDimsA}) and (${outerDimsB}).`);\n\n    const outShapeOuterDims =\n      batchDimA >
```

[illegible]

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```
*\nimport { util } from '@tensorflow/tfjs-core';\nextort function rangeImpl(start, stop, step, dtype) {\n    const\nsameStartStop = start === stop;\n    const increasingRangeNegativeStep = start < stop && step < 0;\n    const decreasingRangePositiveStep = stop < start && step > 1;\n    if (sameStartStop || increasingRangeNegativeStep ||\ndecreasingRangePositiveStep) {\n        return util.makeZerosTypedArray(0, dtype);\n    }\n    const numElements\n= Math.abs(Math.ceil((stop - start) / step));\n    const values = util.makeZerosTypedArray(numElements, dtype);\nif (stop < start && step === 1) {\n        // Auto adjust\nthe step's sign if it hasn't been set\n        // (or was set to 1)\n        step = -1;\n    }\n    values[0] = start;\n    for (let i\n= 1; i < values.length; i++) {\n        values[i] = values[i - 1] + step;\n    }\n    return values;\n}\n/>\n#sourceMappingURL=data:application/json;base64,eYJ2ZXJzaW9uIjozLCJmaXxlIjoiUmFuZ2VfaW1wbC5qcyIsInNvdXJjZVJvb3QiOiIlLCJzb3VyY2VlIjpbiLi4uLy4uLy4uLy4uLy4uL3RmanMtYmFja2VuZC1jcHUvc3JlL2tlicm5lbHMvUmfuZ2VfaW1wbC50cyJdLCJuYW1lcyl6W10slmlhcHBpbmdzIjoiQUFBRQTs7Ozs7Ozs7Ozs7OzdBUc7QUFFSCxPQUFPLEVBQWMsSUFBSsxFUFDLE1BQU0sdUBQBXCLENBQUM7QUFFEeEQsTUFBTsxVQUFVLFBNBQMVsQ0FDcklsS0FBYSxFQUFFLEIBQVKsRUFRBsXJQUFZFLEVBBQ3pDLEtBQXdCO0lBQzFCLE1BQU0sYUFBYSXHQUFHLEtBQUssS0FBSyxJUUFJLENBQUM7SUFDckMsTUFTSwyKkFBMksROFBRyxLQUFLLEDBQUcsSUFBSsxJQUFJLEIBQUksR0FBRyxDUQDFDENBQUM7SUFDNOqsTUFTSWyKkfBMksROFBRyxJUUFJLEdBQUcsS0FBSyxJUUFJLEIBQUksR0FBRyxDUQDFDENBQUM7SUFFFFNQsSUFBSsxHQUFHLEIBQUksMKJBQTJC01FBQzVDLDJCQUEYQixFQUFFOF1FBQy9CLE9BQU8sSUFBSsxDUQDFDLG1CQUftQixDUQDFDENBQUMsRUFRBsXLQUFLLENBQUMsQ0FBQtLtLUQMzQtZtJQUVELE1BQU0sVOFBVyxBQUFHLEIBQUksQ0FBQyxHQUFHLLENBQUMsSUFBSsxDUQDFDELBQUksQ0FBQyxDUQDFLEIBQUksR0FBRyxLQUFLLENBQUMsR0FBRyxJUUFJLENBQUMsQ0FBQyxDUQDO01BQy9ELE1BQU0sTUFTBSxHQUFHLEIBQUksQ0FBQyxTKKFbbUISQ0FBQyxXQUFXLEVBQUUsS0FBSyxDUQDFDENBQUM7SUFFFNUQSUSUFBSsxJQUFJLEdBQUcsS0FBYSxJUUFJLEIBQUksS0FBSyxDUQDFDEVBQUU7UUFDODUIsb0RBQW9EO1FBQ3BELG9CQUFvQjtRQUNwQixJQUFJLEdBQUcsQ0FBQyxDUQDFDENBQUM7S0FDWDtJQUVELE1BQU0sQ0FBQyxDUQDFDENBQUMsR0FBRyxLQUFLLENBQUM7SUFDbeEIS0FBSyxJUUFJLENBQUMsR0FBRyxDUQDFDEVBQUUsQ0FBQyxHQUFHLE1BQU0sQ0FBQyxNQUFNLLENBQUUsQ0FBQyxQUFFFEVBQUU7UUFDdeEMsTUFTBSxDQUFDLENBQUMsQ0FBQyxHQUFHLE1BQU0sQ0FBQyxDUQDFLEdBQUcsQ0FBQyxDUQDFLEdBQUcsSUFBSsxDUQDFDO0tBQ2xDO0lBQQ0St0FBTyxnQUFNLENBQUM7QUFDAELsQ0FBQyIslnNvdXJjZXNDdb250ZW50IjpbbiIscGlxcuICogQGxpY2Vuc2VcbiAqIEhvcllyWdotCAyMDIWIEdvb2dsZSBMTEmUlEFfbCBsaWdobHMgUmVzXXJJ2ZWQuXG4gKiBMaWNlbnNiZCBibmRldCIBoAGUGXBhY2hlExpY2Vuc2UsIFZlcnNpb24gMi4wIChoaGUgXCJMawNNlbnNiXCIPo1xuICogeW91IG1heSBub3QgdXNIHRoaXMgZmlsZSBleGNlcHQgaW4gY29tcGxpYW5jZSB3aXRORRoZSBMaWNlbnNiLnluICogeWW91IG1heSBvYnRhaw4gYSBJb3B5IG9mIHRRoZSBMaWNlbnBiGF0XG4gKIxcuICogaHRocDovL3d3dy5hcGFJaGUUb3JnlL2XPY2Vuc2VzlOUjQOVouUtMI4wXG4gKIxcuICogVV5sZXNZIHJIcXVPcmVkIGJ5IGFWcgxpY2FibGUGbgGF3IG9yIGFnemViZCB0byBPbiB3cmllOW5nLCBzb2Z0d2FYZVxuICogeZGlzdHIjPyYnV0ZWQgdW5kZZXIgdGhlIExpY2Vuc2UgaXMgZGlzdHIjPyYnV0ZWQgb24gYW4gXCJBUEYBU1wiElEU0ITLFXuICogeV0IUSe9VVCBXQXVSJSQU5USUVTIe9SIE NPTKRJEIPTIMGT0YGQU5ZIEtJKTsIGVpdGHlcBlEHByZXNZlg9yIGlteGXpZWQuXG4gKiBTZWUgdGhlIE xpY2Vuc2UgZm9yIHRRoZSBzcGVjawZpYYbsYW5ndWFnb3Zlcn5pbmcgcGVybWlzczlvbnMGyYW5kXG4 gKiBsaWlpdGF0aW9ucyBIbmRldCIBoAGUTgljZW5zSS5cbiAQID09PT09PT09PT09PT09PT09PT09PT09 PT09PT09PT09PT09PT09PT09PT09PT09PT09PT09PT09PT09PT09PT09PT09PT09PT09PT09PT09 XG4gKi9cblxaW1wb3JlOIhtEYXRhVHlwZU1hcCwgZXRpbH0gZnJvbSAanQRHlbnNvemZsb3cvdGZqcyljb3JlIzticlxuZXhw b3JOIGZlbnM
```

NoaW9uIHJhbmdlSW1wbChcbiAgICBzdGFydDogbnVtYmVyLCBzdG9wOiBudW1iZXIhIHN0ZXAAIG51bWJlci
xcbiAgICBkdHlwZTogJ2Zsb2F0MzInfCdpcbnQzMicpOiBEYXRhVHlwZU1hcFsnZmxvYXQzMicgfCAAnaW50Mz
InXSb7XG4gIGNvbnN0IHhnbWVtdGFydFN0b3AgPSBzdGFydCA9PT0gc3RvcDtcbiAgY29uc3QgaW5jcmVhc
2luZl1JhbmdlTmVnYXRpdmdVTdGVwID0gc3RhcncQgPCBzdG9wICYmIHN0ZXAgPCAwOl1xulCBjb25zdCBkZ
WNyZWZfaW5nUmFuZ2VQb3NpdGl2ZVN0ZXAgPSBzdG9wIDwgc3RhcncQgJiYgc3RlcCA+IDE7XG5cbiAga
WYgKHhnbWVtdGFydFN0b3AgfHwgaW5jcmVhc2luZl1JhbmdlTmVnYXRpdmdVTdGVwIHx8XG4gICAgICBk
ZWNyZWZfaW5nUmFuZ2VQb3NpdGl2ZVN0ZXApIHtcbiAgICByZXRx1cm4gdXRpbC5tYWtlWmVyb3NUeXB
lZEFycmF5KDAsIGR0eXBikTtcbiAgfVxuXG4gIGNvbnN0IG51bUVsZW1lbRnZID0gTWF0aC5hYnMoTWF0aC
5jZWlsKChzdG9wIC0gc3RhcncQpIC8gc3RlcCkpOl1xulCBjb25zdCB2YWx1ZXMMgPSB1dGlslm1ha2VaZXJvc1R
5cGVkQXJyYXkobnVtRWxlbWVudHMslIGR0eXBikTtcblxulCBpZiAoc3RvcCA8IHN0YXJ0ICYmIHN0ZXAgP
T09IDEpIHtcbiAgICAvLyBBdXRvIGFkanVzdCB0aGUgc3RlcCdZIHNPZ24gaWYgaXQgaGFzbid0IGJlZW4gc2V
0XG4gICAgLy8gKG9yIHdhcyBzZXQgdG8gMSlcbiAgICBzdGVwID0gLTE7XG4gIH1cblxulCB2YWx1ZXNBm
F0gPSBzdGFydDtcbiAgZm9yIChsZXQgaSA9IDE7IGkgPCB2YWx1ZXMMubGVuZ3RoOyBpKyspIHtcbiAgICB2
YWx1ZXNBaV0gPSB2YWx1ZXNBaSAtdFdfICsgc3RlcDtcbiAgfVxulCBY/ZXR1cm4gdmFsdWVzOl1xufVxull19"

ZW5kQ1BfVFSBmcm9tICCuL2iYWNrZW5kX2NwdSc7XG5pbXBvcnQge2Fzc2VydE5vdENvbXBBSXh9IGZyb2
0gJy4uL2NwdV91dGlsJztcblxuZXhwb3J0IGZ1bmN0aW9uIHNsaWNISW1wbChcbiAgICB2YWxzOiBCYWNRZ
W5kVmFsdWVzLCBiZWdpbjogbnVtYmVyW10sIHNpemU6IG51bWJlcldLCBzaGFwZTogbnVtYmVyW10sXG
4gICAgZHR5cGU6IERhdGFUeXBikTogQmFja2VuZGFzaGVlc3B7XG4gIGNvbnN0IGlzQ29udGlub3VzID0gc2
xpY2VfdXRpbC5pc1NsaWNlQ29udGlub3VzKHNoYXBILCBiZWdpbiwgc2l6ZSk7XG4gIGNvbnN0IGxlbmd0aC
A9IHV0aWwuc2l6ZUZyb21TaGFwZShzaXplKTtcbiAgY29uc3QgeFN0cmllkZXMGPSB1dGlsLmNvbXB1dGVTd
HJpZGVzKHNoYXBikTtcbiAgICBpZiAoXNDb250aW5vdXMPiHtcbiAgICBjb25zdCBmbGF0T2Zmc2V0ID0gc
2xpY2VfdXRpbC5jb21wdXRIRmxhdE9mZnNldChiZWdpbiwgc2Fzc2VydE5vdENvbXBBSXh9IGZyb2
BlID09PSAnc3RyaW5nJykgelxuICAgICAgcmV0dXJuICh2YWxzIGFzIFVpbmQ4QXJyYXl1bXSkuc2xpY2UoZmx
hdE9mZnNldCwgZmxhdE9mZnNldCARIgxlbnmd0aCk7XG4gICAgfVxuXG4gICAgcmV0dXJuICh2YWxzIGFzIF
R5cGVkQXJyYXkplNn1YmFycmF5KGZsYXRPMzZzZXQsIGZsYXRPMzZzZXQgKyBsZW5ndGppO1xuICB9
XG5cbiAgY29uc3QgZGVjb2RlZERhdGEgPSBkdHlwZSA9PT0gJ3N0cmllkZycgP1xuICAgICAgYmFja2VuZGF91d
GlsLmZyb21VaW50OFRvU3RyaW5nQXJyYXkodmFscyBhcyBVaW50OEFycmF5W10pIDpobiAgICAgIHZhbH
MgYXMGVHlwZWRBcnJheTtcbiAgICBjb25zdCBpbk1JiA9IGJ1ZmZlcihzaGFwZSwgZHR5cGU5IGRIY29kZW
REYXRhKTtcbiAgY29uc3Qgb3V0QnVmID0gYnVmZmVyKHNPemUsIGR0eXBikTtcbiAgZm9yIChsZXQgaSA
9IDA7IGkgPCBvdXRCDWYuc2l6ZTsgKypKSB7XG4gICAgY29uc3Qgb3V0TG9jID0gb3V0QnVmLmluZGV4V
G9Mb2MoaSk7XG4gICAgY29uc3QgaW5Mb2MgPSBvdXRMB2MubWFwKChpZHG6IG51bWJlcwgaikPT4ga
WR4ICsgYmVnaW5bal0pO1xuICAgICAgIG91dEJ1Zi5zZXQoaW5CdWYuZ2V0KC4uLmluTG9jKSgwLi4ub3V0TG9j
KTtcbiAgfVxuXG4gIGlmIChkdHlwZSA9PT0gJ3N0cmllkZycgP1xuICAgICAgICBjZXR1cm4gYmFja2VuZGF91dGlsLm
Zyb21TdHJpbnmdBcnJheVRvVWludDgob3V0QnVmLnZhbHVlc3B7XG4gIH1cbiAgcmV0d
XJuIG91dEJ1Zi52YWxlZXMGYXMGVHlwZWRBcnJheTtcbiAgICBjb25zdCBpbk1JiA9IGJ1ZmZlcihzaGFwZSwgZHR5cGU5IGRIY29kZW
ICAgIGFyZ3M6IHtpbnB1dHM6IFNsaWNISW5wdXRzLCBiYWNrZW5kOiBNYXR0QmFja2VuZENQVSgwYX
R0cnM6IFNsaWNlQXR0cnN9KTpbiAgICBUZw5zb3JJbmZvIHtcbiAgY29uc3Qge2lucHV0cywYmFja2VuZC
wgYXR0cnN9ID0gYXJncztcbiAgY29uc3Qge3h9ID0gaW5wdXRzO1xuICBjb25zdCB7YmVnaW4sIHNpemV9ID
0gYXR0cnM7XG5cbiAgYXNzZXJ0Tm90Q29tcGxleCh4LCAnc2xpY2UnKTtcbiAgICBjb25zdCBbJGJlZ2luLCAk
c2l6ZV0gPSBzbGljZV91dGlsLnBhcnNIU2xpY2VQYXJhbXMoeCwgYmVnaW4sIHNpemUpO1xuICBzbGljZV9
1dGlsLmFzc2VydFBhcmFtc1ZhbGlkKHgsICRiZWdpbiwgJHNpemUpO1xuXG4gIGNvbnN0IHZhbHMgPSBiYW
NrZW5kLmRhdGEuZ2V0KHguZGF0YUlkKS52YWxlZXMG7XG4gIGNvbnN0IG91dFZhbHMgPSBzbGljZUltcG
wodmFscywgJGJlZ2luLCAk2l6ZSwgeC5zaGFwZSwgeC5kdHlwZSk7XG4gIHJldHVybiBiYWNrZW5kLm1ha2
VUZw5zb3JJbmZvKCRzaXplLCB4LmR0eXBILCBvdXRWYXxzKTtcbiAgICBjb25zdCBbJGJlZ2luLCAk
lQ29uZmlnOiBLZXJuZWxDb25maWcgPSB7XG4gIGtclm5lbE5hbWU6IFNsaWNlFxuICBiYWNrZW5kTmFtZ
TogJ2NwdScsXG4gIGtclm5lbEZ1bmM6IHNSaWNlIGFzIHt9IGFzIEtclm5lbEZ1bmNcbn07XG4iXX0=","/*\n

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for the specific language governing permissions and\n * limitations under the License.\n *

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*  

from 'tensorflow/tfjs-core';  

import {BackendWasm} from '../backend_wasm';  

import {sliceImplCPU} from '../kernel_utils/shared';  

export function slice(  
  args: {inputs: SliceInputs, attrs: SliceAttrs, backend: BackendWasm})  
  {  
    const {inputs: {x}, attrs: {begin, size}, backend} = args;  
    const [begin_, size_] = slice_util.parseSliceParams(x, begin, size);  
    const isContinuous = slice_util.isSliceContinuous(x.shape, begin_, size_);  
    const xVals = backend.readSync(x.dataId);  
    const out = backend.makeOutput(size_, x.dtype);  
    const xStrides = util.computeStrides(x.shape);  
    const outData = backend.dataIdMap.get(out.dataId);  
    if (isContinuous) {  
      const flatOffset = slice_util.computeFlatOffset(begin_, xStrides);  
      if (x.dtype === 'string') {  
        outData.stringBytes =  
          (xVals as Uint8Array[]).slice(flatOffset, flatOffset +

```



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util.sizeFromShape(size_));\n } else {\n   const outVals = backend.toArrayFromHeap(out);\n   outVals.set(\n     (xVals as TypedArray)\n     .subarray(flatOffset, flatOffset +\n   util.sizeFromShape(size_));\n   }\n   return out;\n }\n\n if (x.dtype === 'string') {\n   const res =\n   sliceImplCPU(xVals, begin_, size_, x.shape, x.dtype);\n   outData.stringBytes = res as Uint8Array[];\n   return\n   out;\n }\n\n const outVals = backend.toArrayFromHeap(out);\n const rank = x.shape.length;\n if (rank === 2)\n {\n   slice2d(\n     xVals as TypedArray, xStrides[0], outVals, begin_ as [number, number],\n     size_ as [number, number]);\n } else if (rank === 3) {\n   slice3d(\n     xVals\n   as TypedArray, xStrides[0], xStrides[1], outVals,\n     begin_ as [number, number, number], size_ as [number,\n   number, number]);\n } else if (rank === 4) {\n   slice4d(\n     xVals as TypedArray, xStrides[0], xStrides[1],\n   xStrides[2], outVals,\n     begin_ as [number, number, number, number],\n     size_ as [number, number, number, number]);\n } else {\n   const res =\n   sliceImplCPU(xVals, begin_, size_, x.shape, x.dtype) as TypedArray;\n   outVals.set(res);\n }\n\n return out;\n }\n\nfunction slice2d(\n  xVals: backend_util.TypedArray, xStride:\n  number,\n  outVals: backend_util.TypedArray, begin: [number, number],\n  size: [number, number]): void {\n  let\n  outOffset = 0;\n  const beginI = begin[0];\n  const beginJ = begin[1];\n  const endI = beginI + size[0];\n  for (let i =\n  beginI; i < endI; i++) {\n    const xOffset = i * xStride + beginJ;\n    outVals.set(xVals.subarray(xOffset, xOffset +\n  size[1]), outOffset);\n    outOffset += size[1];\n  }\n}\n\nfunction\n  slice3d(\n    xVals: backend_util.TypedArray, xStride1: number, xStride2: number,\n    outVals:\n    backend_util.TypedArray, begin: [number, number, number],\n    size: [number, number, number]): void {\n    let\n    outOffset = 0;\n    const beginI = begin[0];\n    const beginJ = begin[1];\n    const beginK = begin[2];\n    const endI =\n    beginI + size[0];\n    const endJ = beginJ + size[1];\n    for (let i = beginI; i < endI; i++) {\n      for (let j = beginJ; j <\n    endJ; j++) {\n        const xOffset = i * xStride1 + j * xStride2 + beginK;\n        outVals.set(xVals.subarray(xOffset,\n    xOffset + size[2]), outOffset);\n        outOffset += size[2];\n      }\n    }\n  }\n}\n\nfunction slice4d(\n  xVals:\n  backend_util.TypedArray, xStride1: number, xStride2: number,\n  xStride3: number, outVals:\n  backend_util.TypedArray,\n  begin: [number, number, number, number],\n  size: [number, number, number,\n  number]): void {\n    let outOffset = 0;\n    const beginI = begin[0];\n    const beginJ = begin[1];\n    const beginK =\n    begin[2];\n    const endI = beginI + size[0];\n    const endJ = beginJ + size[1];\n    const endK = beginK + size[2];\n    const beginL =\n    begin[3];\n    for (let i = beginI; i < endI; i++) {\n      for (let j = beginJ; j < endJ; j++) {\n        for (let k = beginK; k <\n    endK; k++) {\n          const xOffset = i * xStride1 + j * xStride2 + k * xStride3 + beginL;\n          outVals.set(xVals.subarray(xOffset, xOffset + size[3]), outOffset);\n          outOffset += size[3];\n        }\n      }\n    }\n  }\n}\n\nexport const sliceConfig: KernelConfig = {\n  kernelName: 'Slice',\n  backendName: 'wasm',\n  kernelFunc:\n  slice as {} as KernelFunc,\n};\n\n/**\n * @license\n * Copyright 2021 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in\n  compliance with the License.\n * You may obtain a copy of the License at\n * \n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n  software\n * distributed\n  under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF\n  ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n  limitations under the License.\n *\n  =====\n  *\n  \nimport {backend_util, BatchToSpaceND, BatchToSpaceNDAttrs, BatchToSpaceNDInputs, KernelConfig,\n  KernelFunc} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nimport\n  {reshape} from './Reshape';\nimport {slice} from './Slice';\nimport {transpose} from './Transpose';\n\nfunction\n  batchToSpaceND(args: {\n    inputs: BatchToSpaceNDInputs,\n    backend: BackendWasm,\n    attrs:\n    BatchToSpaceNDAttrs\n  }) {\n    const {inputs, backend, attrs} = args;\n    const {x} = inputs;\n    const {blockShape,\n  crops} = attrs;\n\n    const prod = blockShape.reduce((a, b) => a * b);\n    const reshaped =\n    backend_util.getReshaped(x.shape, blockShape, prod);\n    const

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    permuted = backend_util.getPermuted(reshaped.length, blockShape.length);\n  const reshapedPermuted =\n  backend_util.getReshapedPermuted(x.shape, blockShape, prod);\n  const sliceBeginCoords =\n  backend_util.getSliceBeginCoords(crops, blockShape.length);\n  const sliceSize =\n  backend_util.getSliceSize(reshapedPermuted, crops, blockShape.length);\n\n  const xReshaped = reshape({inputs:\n    {x}, backend, attrs: {shape: reshaped}});\n  const xTransposed =\n    transpose({inputs: {x: xReshaped}, backend,\n    attrs: {perm: permuted}});\n  const xTransposedReshaped = reshape(\n    {inputs: {x: xTransposed}, backend,\n    attrs: {shape: reshapedPermuted}});\n  const result = slice({\n    inputs: {x: xTransposedReshaped},\n    backend,\n    attrs: {begin: sliceBeginCoords, size: sliceSize}\n  });\n\n  backend.disposeData(xReshaped.dataId);\n  backend.disposeData(xTransposed.dataId);\n  backend.disposeData(xReshaped.dataId);\n\n  return\n  result;\n}\n\nexport const batchToSpaceNDConfig: KernelConfig\n  = {\n    kernelName: BatchToSpaceND,\n    backendName: 'wasm',\n    kernelFunc: batchToSpaceND as {} as\n    KernelFunc\n  };\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the\n * Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the\n * License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed\n * on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or\n * implied.\n * See the License for the specific language governing permissions and\n * limitations under the\n * License.\n */\n\n=====\n\n*/\n\nimport {Cast, CastAttrs, CastInputs, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';\nimport\n  {TensorInfo} from '@tensorflow/tfjs-core';\n\nimport\n  {BackendWasm} from '../backend_wasm';\n\nexport function cast(\n  args: {inputs: CastInputs, attrs: CastAttrs,\n  backend: BackendWasm});\n  TensorInfo {\n    const {inputs: {x}, attrs: {dtype}, backend} = args;\n    const out =\n    backend.makeOutput(x.shape, dtype);\n    const inVals = backend.typedArrayFromHeap(x);\n    const outVals =\n    backend.typedArrayFromHeap(out);\n    outVals.set(inVals);\n    return out;\n  }\n\nexport const castConfig:\n  KernelConfig = {\n    kernelName: Cast,\n    backendName: 'wasm',\n    kernelFunc: cast as {} as\n    KernelFunc\n  };\n\n"/**\n * @license\n * Copyright 2021 Google LLC. All Rights Reserved.\n * Licensed under the\n * Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the\n * License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed\n * on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License\n * for the specific language governing permissions and\n * limitations under the License.\n */\n\n=====\n\n*/\n\nimport {KernelConfig, Ceil} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from\n  './unary_kernel';\n\nexport const ceilConfig: KernelConfig = createUnaryKernelConfig(Ceil);\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version\n * 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a\n * copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable\n * law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n\n=====\n\n*/\n\nimport {ClipByValue, ClipByValueAttrs, ClipByValueInputs, KernelConfig, KernelFunc} from\n  '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nlet wasmClip: (xId: number, min:\n  number, max: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n  wasmClip =\n    backend.wasm.cwrap(ClipByValue, null /* void */, [\n      'number', // x_id\n      'number', // min\n      'number', //\n      max\n      'number' // out_id\n    ]);\n\n  function clip(args: {\n    inputs: ClipByValueInputs,\n    backend:\n
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BackendWasm,\n attrs: ClipByValueAttrs)\n)) {\n const {inputs, backend, attrs} = args;\n const {x} = inputs;\n const {clipValueMin, clipValueMax} = attrs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const out =\n backend.makeOutput(x.shape, x.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n wasmClip(xId, clipValueMin, clipValueMax, outId);\n return out;\n}\n\nexport const clipByValueConfig:\n KernelConfig = {\n kernelName: ClipByValue,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: clip\n as {} as KernelFunc\n};\n","/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed\n under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the\n License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed\n on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or\n implied.\n * See the License for the specific language governing permissions and\n * limitations under the\n License.\n *\n=====\n*/\n\nimport\n {backend_util, Concat, ConcatAttrs, ConcatInputs, KernelConfig, KernelFunc, util} from '@tensorflow/tfjs-\ncore';\nimport {BackendWasm} from '../backend_wasm';\nimport {concatImplCPU} from\n '../kernel_utils/shared';\nimport {identity} from './Identity';\nimport {reshape} from './Reshape';\n\nexport function\n concat(\n args: {inputs: ConcatInputs, backend: BackendWasm, attrs: ConcatAttrs}) {\n const {inputs, backend}\n = args;\n\n const axis = util.parseAxisParam(args.attrs.axis, inputs[0].shape)[0];\n\n let outShape =\n backend_util.computeOutShape(inputs.map(t => t.shape), axis);\n\n // Keep only non-empty tensors (ignore tensors\n with 0 in their shape).\n const $inputs = inputs.filter(t => util.sizeFromShape(t.shape) > 0);\n if ($inputs.length ===\n 1) {\n return identity({inputs: {x: $inputs[0]}, backend});\n }\n\n const out = backend.makeOutput(outShape,\n inputs[0].dtype);\n\n if (util.sizeFromShape(outShape) === 0) {\n return out;\n }\n\n const shapes =\n $inputs.map(t\n => t.shape);\n\n backend_util.assertParamsConsistent(shapes, axis);\n\n if ($inputs[0].dtype === 'string') {\n // Any concat of n-dimensional tensors across any axis can be reduced to\n // a concatenation of two-dimensional\n tensors across the axis 1 by first\n // partitioning the axes of the original tensors into those less than the\n // axis\n to be concatenated and the rest. Then reshape the tensors\n // into a two-dimensional tensor by collapsing these\n two sets of axes and\n // concatenate the resulting matrices across the axis 1, finally reshaping\n // the result to\n have the proper shape.\n const inputs2D = $inputs.map(t => {\n const innerSize =\n util.sizeFromShape(t.shape.slice(axis));\n const shape = [-1, innerSize];\n return reshape({inputs: {x: t},\n backend, attrs: {shape}});\n });\n\n const inputsValShapes = inputs2D.map(t => {\n return {vals:\n backend.readSync(t.dataId), shape: t.shape};\n });\n\n // Concats 2d tensors\n along axis=1.\n outShape =\n backend_util.computeOutShape(inputs2D.map(t => t.shape), 1 /* axis */);\n\n const simplyConcat = inputs2D[0].shape[0] === 1;\n const outVals = concatImplCPU(\n inputsValShapes, outShape, inputs[0].dtype,\n simplyConcat) as string[];\n\n const finalOutShape\n =\n backend_util.computeOutShape($inputs.map(t => t.shape), axis);\n\n out.shape = finalOutShape;\n\n const outData = backend.dataIdMap.get(out.dataId);\n outData.stringBytes =\n backend_util.fromStringArrayToUint8(outVals);\n\n inputs2D.forEach(t => backend.disposeData(t.dataId));\n\n return out;\n }\n\n const batchDim = util.sizeFromShape($inputs[0].shape.slice(0, axis));\n let sumInnerDims =\n 0;\n const innerDims = $inputs.map(input => {\n const innerDim = util.sizeFromShape(input.shape.slice(axis));\n sumInnerDims += innerDim;\n return innerDim;\n });\n\n const inVals = $inputs.map(input =>\n backend.toArrayFromHeap(input));\n\n const outVals = backend.toArrayFromHeap(out);\n for (let b = 0; b < batchDim; b++) {\n let outOffset = b *\n sumInnerDims;\n for (let i = 0; i < inVals.length; i++) {\n const innerDim = innerDims[i];\n const inOffset =\n b * innerDim;\n const vals = inVals[i].subarray(inOffset, inOffset + innerDim);\n outVals.set(vals,\n outOffset);\n outOffset += innerDim;\n }\n }\n\n return out;\n }\n\nexport const concatConfig: KernelConfig =\n {\n kernelName: Concat,\n backendName: 'wasm',\n kernelFunc: concat as {} as KernelFunc,\n };
```

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*\n\nimport {backend_util, Conv2D, Conv2DAttrs, Conv2DInputs, KernelConfig, KernelFunc, Tensor4D} from
'@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nlet wasmConv2d: (\n  xId:
number, batchSize: number, inputHeight: number, inputWidth: number,\n  filterId: number, filterHeight: number,
filterWidth: number, padTop: number,\n  padRight: number, padBottom: number, padLeft: number, isSamePad:
number,\n  dilationHeight: number, dilationWidth: number, strideHeight: number,\n  strideWidth: number,
inputChannels: number, outputChannels: number,\n  outId: number) => void;\n\nfunction setup(backend:
BackendWasm) {\n  wasmConv2d = backend.wasm.cwrap(Conv2D,
    null /* void */, [\n    'number', // xId\n    'number', // batchSize\n    'number', // inputHeight\n    'number', // inputWidth\n    'number', // filterId\n    'number', // filterHeight\n    'number', // filterWidth\n    'number', // padTop\n    'number', // padRight\n    'number', // padBottom\n    'number', // padLeft\n    'number', // isSamePad\n    'number', // dilationHeight\n    'number', // dilationWidth\n    'number', // strideHeight\n    'number', // strideWidth\n    'number', // inputChannels\n    'number', // outputChannels\n    'number', // outId\n  ]);\n\n  function conv2d(\n    args: {inputs: Conv2DInputs, backend: BackendWasm, attrs: Conv2DAttrs}) {\n    const {inputs, attrs, backend} = args;\n    const {x, filter} = inputs;\n    const xId =
backend.dataIdMap.get(x.dataId).id;\n    const filterId = backend.dataIdMap.get(filter.dataId).id;\n    const {strides,
dilations, pad, dimRoundingMode, dataFormat} = attrs;\n    const $dataFormat =
backend_util.convertConv2DDataFormat(dataFormat);\n    const convInfo = backend_util.computeConv2DInfo(\n      (x as Tensor4D).shape, (filter as Tensor4D).shape,
strides, dilations,\n      pad, dimRoundingMode, false, $dataFormat);\n    const filterHeight =
convInfo.filterHeight;\n    const filterWidth = convInfo.filterWidth;\n    const padTop = convInfo.padInfo.top;\n    const
padRight = convInfo.padInfo.right;\n    const padBottom = convInfo.padInfo.bottom;\n    const padLeft =
convInfo.padInfo.left;\n    const dilationHeight = convInfo.dilationHeight;\n    const dilationWidth =
convInfo.dilationWidth;\n    const strideHeight = convInfo.strideHeight;\n    const strideWidth =
convInfo.strideWidth;\n    const inputChannels = convInfo.inChannels;\n    const outputChannels =
convInfo.outChannels;\n    const isSamePad = convInfo.padInfo.type === 'SAME' ? 1 : 0;\n    if
(convInfo.dataFormat !== 'channelsLast') {\n      throw new Error(\n        `wasm backend Conv2D does not support
dataFormat:~` +\n        `${convInfo.dataFormat}`. Please
        use 'channelsLast'.`);\n    }\n    const out = backend.makeOutput(convInfo.outShape, 'float32');\n    const outId =
backend.dataIdMap.get(out.dataId).id;\n    wasmConv2d(\n      xId, x.shape[0], x.shape[1], x.shape[2], filterId,
filterHeight,\n      filterWidth, padTop, padRight, padBottom, padLeft, isSamePad,\n      dilationHeight,
dilationWidth, strideHeight, strideWidth, inputChannels,\n      outputChannels, outId);\n    return out;\n  }\n\n  export
const conv2DConfig: KernelConfig = {\n    kernelName: Conv2D,\n    backendName: 'wasm',\n    setupFunc: setup,\n    kernelFunc: conv2d as { } as KernelFunc\n  };\n  /**\n   * @license\n   * Copyright 2020 Google LLC. All Rights
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software\n   * distributed under the License is distributed on an \"AS IS\" BASIS,\n   * WITHOUT WARRANTIES OR CONDITIONS OF ANY
KIND, either express or implied.\n   * See the License for the specific language governing permissions and\n   *
limitations under the License.\n   */
}
```

```

=====\\n
*\\n\\nimport { backend_util, Conv2DBackpropInput, Conv2DBackpropInputAttrs, Conv2DBackpropInputInputs,
KernelConfig, KernelFunc, TensorInfo, util } from '@tensorflow/tfjs-core';\\n\\nimport { BackendWasm } from
'./backend_wasm';\\n\\nlet wasmConv2DBackpropInput: (\\n  dyId: number, filterId: number, batchSize: number,
filterHeight: number,\\n  filterWidth: number, inHeight: number, inWidth: number, inChannels: number,\\n
outHeight: number, outWidth: number, outChannels: number,\\n  strideHeight: number, strideWidth: number,
topPad: number, leftPad: number,\\n  fltS0: number, fltS1: number, fltS2: number, xBatchStride: number,\\n
xRowStride: number, xColStride: number,
xChannelStride: number,\\n  yBatchStride: number, yRowStride: number, yColStride: number,\\n  yChannelStride:
number, outId: number) => void;\\n\\nfunction setup(backend: BackendWasm): void {\\n
wasmConv2DBackpropInput = backend.wasm.cwrap(Conv2DBackpropInput, null, [\\n  'number', // dyId\\n
'number', // filterId\\n  'number', // batchSize\\n  'number', // filterHeight\\n  'number', // filterWidth\\n
'number', // inHeight\\n  'number', // inWidth\\n  'number', // inChannels\\n  'number', // outHeight\\n
'number', // outWidth\\n  'number', // outChannels\\n  'number', // strideHeight\\n  'number', // strideWidth\\n
'number', // topPad\\n  'number', // leftPad\\n  'number', // fltS0\\n  'number', // fltS1\\n  'number', // fltS2\\n
'number', // xBatchStride\\n  'number', // xRowStride\\n  'number', // xColStride\\n  'number', // xChannelStride\\n
'number', // yBatchStride\\n  'number', // yRowStride\\n  'number', // yColStride\\n
'number', // yChannelStride\\n  'number', // outId\\n ]);\\n\\n\\nfunction conv2DBackpropInput(args: {\\n backend:
BackendWasm,\\n inputs: Conv2DBackpropInputInputs,\\n attrs: Conv2DBackpropInputAttrs\\n}): TensorInfo {\\n
const { backend, inputs, attrs } = args;\\n const { dy, filter } = inputs;\\n const { strides, pad, dataFormat,
dimRoundingMode, inputShape } = attrs;\\n\\n const dilations = 1;\\n\\n const $dataFormat =
backend_util.convertConv2DDataFormat(dataFormat);\\n const convInfo = backend_util.computeConv2DInfo(\\n
inputShape, filter.shape as [number, number, number, number], strides,\\n  dilations, pad, dimRoundingMode,
false /* depthwise */, $dataFormat);\\n const {\\n  batchSize,\\n  filterHeight,\\n  filterWidth,\\n  inChannels,\\n
inHeight,\\n  inWidth,\\n  outChannels,\\n  outHeight,\\n  outWidth,\\n  strideHeight,\\n  strideWidth\\n } =
convInfo;\\n\\n const topPad = filterHeight - 1 - convInfo.padInfo.top;\\n const leftPad = filterWidth - 1 -
convInfo.padInfo.left;\\n\\n
const isChannelsLast = convInfo.dataFormat === 'channelsLast';\\n const dxStrides =
util.computeStrides(convInfo.inShape);\\n const dyStrides = util.computeStrides(dy.shape);\\n const [fltS0, fltS1,
fltS2] = util.computeStrides(filter.shape);\\n const xBatchStride = dxStrides[0];\\n const xRowStride =
isChannelsLast ? dxStrides[1] : dxStrides[2];\\n const xColStride = isChannelsLast ? dxStrides[2] : 1;\\n const
xChannelStride = isChannelsLast ? 1 : dxStrides[1];\\n const yBatchStride = dyStrides[0];\\n const yRowStride =
isChannelsLast ? dyStrides[1] : dyStrides[2];\\n const yColStride = isChannelsLast ? dyStrides[2] : 1;\\n const
yChannelStride = isChannelsLast ? 1 : dyStrides[1];\\n\\n const out = backend.makeOutput(convInfo.inShape,
'float32');\\n const outId = backend.dataIdMap.get(out.dataId).id;\\n const dyId =
backend.dataIdMap.get(dy.dataId).id;\\n const filterId = backend.dataIdMap.get(filter.dataId).id;\\n\\n
wasmConv2DBackpropInput(\\n  dyId, filterId, batchSize,
filterHeight, filterWidth, inHeight, inWidth,\\n  inChannels, outHeight, outWidth, outChannels, strideHeight,
strideWidth,\\n  topPad, leftPad, fltS0, fltS1, fltS2, xBatchStride, xRowStride,\\n  xColStride, xChannelStride,
yBatchStride, yRowStride, yColStride,\\n  yChannelStride, outId);\\n return out;\\n}\\n\\n\\nexport const
conv2DBackpropInputConfig: KernelConfig = {\\n  kernelName: Conv2DBackpropInput,\\n  backendName:
'wasm',\\n  setupFunc: setup,\\n  kernelFunc: conv2DBackpropInput as { } as KernelFunc\\n};\\n\\n"/**\\n * @license\\n *
Copyright 2019 Google LLC. All Rights Reserved.\\n * Licensed under the Apache License, Version 2.0 (the
"License");\\n * you may not use this file except in compliance with the License.\\n * You may obtain a copy of the
License at\\n *\\n * http://www.apache.org/licenses/LICENSE-2.0\\n *\\n * Unless required by applicable law or
agreed to in writing, software\\n * distributed under the License is distributed on an "AS IS" BASIS,\\n *
WITHOUT WARRANTIES

```

OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *

```
=====\n\n*\n\nimport { Cos, KernelConfig } from '@tensorflow/tfjs-core';\n\nimport { createUnaryKernelConfig } from\n'./unary_kernel';\n\nexport const cosConfig: KernelConfig = createUnaryKernelConfig(Cos);\n\n"/**\n * @license\n * Copyright 2021 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\n * License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or\n * agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n * the\n * specific language governing permissions and\n * limitations under the License.\n */
```

```
=====\n\n*\n\nimport { Cosh, KernelConfig } from '@tensorflow/tfjs-core';\n\nimport { createUnaryKernelConfig } from\n'./unary_kernel';\n\nexport const coshConfig: KernelConfig = createUnaryKernelConfig(Cosh);\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version\n * 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a\n * copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable\n * law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n * the specific language governing permissions and\n * limitations under the License.\n */
```

```
=====\n\n*\n\nimport { CropAndResize, CropAndResizeAttrs, CropAndResizeInputs, KernelConfig, KernelFunc,\nTensorInfo } from '@tensorflow/tfjs-core';\n\nimport { BackendWasm } from './backend_wasm';\n\nimport { cast }\nfrom './Cast';\n\n// Must match enum in CropAndResize.cc\nenum InterpolationMethod {\n  bilinear = 0,\n  nearest = 1\n}\n\nlet wasmCropAndResize: (\n  imagesId: number, boxesId: number, boxIndId: number, numBoxes:\n  number,\n  imagesShape: Uint8Array, cropHeight: number, cropWidth: number,\n  method: number,\n  extrapolationValue: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n  wasmCropAndResize = backend.wasm.cwrap(CropAndResize, null /*void*/, [\n    'number', // imagesId\n    'number', // boxesId\n    'number', // boxIndId\n    'number', // numBoxes\n    'array', // images shape\n    'number', // cropHeight\n    'number', // cropWidth\n    'number', // method\n    'number', // extrapolation value\n    'number' // out id\n  ]);\n\n  function cropAndResize(args: {\n    backend: BackendWasm,\n    inputs: CropAndResizeInputs,\n    attrs: CropAndResizeAttrs\n  }): TensorInfo {\n    const { backend,\n    inputs, attrs } = args;\n    const { method, extrapolationValue, cropSize } = attrs;\n    const { image, boxes, boxInd } = inputs;\n    const numBoxes = boxes.shape[0];\n    const [cropHeight, cropWidth] = cropSize as [number,\n    number];\n    const outShape = [numBoxes, cropHeight, cropWidth, image.shape[3]];\n    let imagesData = backend.dataIdMap.get(image.dataId);\n    let castedData;\n    if (image.dtype !== 'float32') {\n      castedData = cast({ backend, inputs: { x: image }, attrs: { dtype: 'float32' }});\n      imagesData = backend.dataIdMap.get(castedData.dataId);\n    }\n    const imagesId = imagesData.id;\n    const boxesId = backend.dataIdMap.get(boxes.dataId).id;\n    const boxIndId = backend.dataIdMap.get(boxInd.dataId).id;\n    const out = backend.makeOutput(outShape, 'float32');\n\n    const outId = backend.dataIdMap.get(out.dataId).id;\n\n    const imagesShapeBytes = new Uint8Array(new\n    Int32Array(image.shape).buffer);\n\n    wasmCropAndResize(\n      imagesId, boxesId, boxIndId, numBoxes,\n      imagesShapeBytes, cropHeight,\n      cropWidth,\n      InterpolationMethod[method as {} as keyof typeof\n      InterpolationMethod],\n      extrapolationValue, outId);\n\n    if (castedData !== null) {\n      backend.disposeData(castedData.dataId);\n    }\n\n    return out;\n  }\n\n  export const cropAndResizeConfig:\n  KernelConfig = {\n    kernelName: CropAndResize,\n    backendName: 'wasm',\n    setupFunc: setup,\n    kernelFunc:\n    cropAndResize as {} as KernelFunc\n  };\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights
```

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```
=====
*\n\nimport { backend_util, KernelConfig, KernelFunc, Cumsum, CumsumAttrs, CumsumInputs, TensorInfo, util }
from '@tensorflow/tfjs-core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nimport { CppDType } from
'./types';\n\nimport { transpose } from './Transpose';\n\nlet wasmCumsum: (xId: number, exclusive: number, reverse:
number,\n      finalDim: number, outId: number, dtype: CppDType) => void;\n\nfunction setup(backend:
BackendWasm) {\n  wasmCumsum = backend.wasm.cwrap(Cumsum, null /* void */, [\n    'number', // x_id\n    'number', // exclusive\n    'number', // reverse\n    'number', // final_dim\n    'number', // out_id\n    'number' // dtype\n  ]);\n\n  nextexport function cumsum(\n    args: { inputs: CumsumInputs,
backend: BackendWasm, attrs: CumsumAttrs }):\n    TensorInfo {\n    const { inputs, backend, attrs } = args;\n    const { x }
= inputs;\n    const { axis, exclusive, reverse } = attrs;\n    const xRank = x.shape.length;\n    util.assert(x.dtype ===
'float32' || x.dtype === 'int32',\n      () => `cumsum does not support ${x.dtype} tensors in the WASM backend`);\n    //
permute required axis to inner most axis\n    const permutation = backend_util.getAxesPermutation([axis], xRank);\n    let
permutedX = x;\n    if (permutation !== null) {\n      permutedX = transpose({ inputs: { x }, attrs: { perm:
permutation }, backend });\n    }\n    const permutedAxis = backend_util.getInnerMostAxes(1, xRank)[0];\n    backend_util.assertAxesAreInnerMostDims('cumsum', [permutedAxis], xRank);\n    const permutedOut =
backend.makeOutput(permutedX.shape, permutedX.dtype);\n    const finalDim = permutedX.shape[permutedAxis];\n    const permutedXId
= backend.dataIdMap.get(permutedX.dataId).id;\n    const permutedOutId =
backend.dataIdMap.get(permutedOut.dataId).id;\n    wasmCumsum(permutedXId, exclusive ? 1 : 0, reverse ? 1 : 0,
finalDim,\n      permutedOutId, CppDType[x.dtype]);\n    // transpose data back if permuted\n    let out =
permutedOut;\n    if (permutation !== null) {\n      const undoPermutation =
backend_util.getUndoAxesPermutation(permutation);\n      out = transpose(\n        { inputs: { x: permutedOut }, attrs:
{ perm: undoPermutation }, backend });\n      backend.disposeData(permutedX.dataId);\n      backend.disposeData(permutedOut.dataId);\n    }\n    return out;\n  }\n\n  nextexport const cumsumConfig: KernelConfig =
{\n    kernelName: Cumsum,\n    backendName: 'wasm',\n    setupFunc: setup,\n    kernelFunc: cumsum as { } as
KernelFunc\n  };\n  \"**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
```

```
=====
*\n\nimport { DepthToSpace, DepthToSpaceAttrs, DepthToSpaceInputs, KernelConfig, KernelFunc, TensorInfo,
util } from '@tensorflow/tfjs-core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nlet wasmDepthToSpace:
(\n  xId: number, blockSize: number, channelsLast: number, xStrides: Uint8Array,\n  xStridesLength: number,
outputShape: Uint8Array, outputStrides: Uint8Array,\n  outSize: number, outId: number) => void;\n\nfunction
setup(backend: BackendWasm): void {\n  wasmDepthToSpace
= backend.wasm.cwrap(DepthToSpace, null /*void*/, [\n    'number', // xId\n    'number', // blockSize\n    'number', // channelsLast\n    'array', // xStrides\n    'number', // xStridesLength\n    'array', // outputShape\n    'array', // outputStrides\n    'number', // outSize\n    'number', // outId\n  ]);\n\n  nextexport function depthToSpace(args: {\n    backend: BackendWasm,\n    inputs: DepthToSpaceInputs,\n    attrs: DepthToSpaceAttrs\n  }): TensorInfo {\n    const
```



```

convInfo.inChannels;\n const outputChannels = convInfo.outChannels;\n const isSamePad = convInfo.padInfo.type
=== 'SAME' ? 1 : 0;\n\n if (convInfo.dataFormat !== 'channelsLast') {\n   throw new Error(\n     `wasm backend
DepthwiseConv2dNative does not support dataFormat:` +\n     `${convInfo.dataFormat}`. Please use
'channelsLast'.`);\n }\n\n const out = backend.makeOutput(convInfo.outShape, 'float32');\n const outId =
backend.dataIdMap.get(out.dataId).id;\n wasmDepthwiseConv2d(\n   xId, x.shape[0], x.shape[1], x.shape[2],
filterId, filterHeight,\n   filterWidth,
padTop, padRight, padBottom, padLeft, isSamePad,\n   dilationHeight, dilationWidth, strideHeight, strideWidth,
inputChannels,\n   outputChannels, outId);\n return out;\n}\n\nexport const depthwiseConv2dNativeConfig:
KernelConfig = {\n  kernelName: DepthwiseConv2dNative,\n  backendName: 'wasm',\n  setupFunc: setup,\n  kernelFunc: depthwiseConv2d as {} as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2021 Google LLC. All
Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations
under the License.\n *
=====
\n
*/\nimport {Elu, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from
'./unary_kernel';\n\nexport const eluConfig: KernelConfig = createUnaryKernelConfig(Elu);\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
\"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====
\n
*/\nimport {Equal, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from
'./binary_kernel';\n\nconst supportsFullBroadcast = false;\nexport const equalConfig: KernelConfig =\ncreateBinaryKernelConfig(Equal, supportsFullBroadcast, 'bool');\n", "/*\n * @license\n * Copyright 2019 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not
use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
\n
*/\nimport {Exp, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from
'./unary_kernel';\n\nexport const expConfig: KernelConfig = createUnaryKernelConfig(Exp, 'float32');\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version
2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====
\n
*/\nimport {ExpandDims, ExpandDimsAttrs, ExpandDimsInputs,

```

```
KernelConfig, KernelFunc, util) from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from
'./backend_wasm';\n\nimport {reshape} from './Reshape';\n\n\nexport function expandDims(args: {\n  inputs:
ExpandDimsInputs,\n  attrs: ExpandDimsAttrs,\n  backend: BackendWasm\n}) {\n  const {inputs, attrs, backend} =
args;\n  const {input} = inputs;\n  const {dim} = attrs;\n  const inputRank = input.shape.length;\n  const newShape
= input.shape.slice();\n  let $dim = dim;\n  if (dim < 0) {\n    // Negative value is counted from the tail of rank.\n    util.assert(\n      -(inputRank + 1) <= dim,\n      () => `Axis must be in the interval [${-(inputRank + 1)}, ${\n        inputRank\n      }])`;\n    $dim = inputRank + dim + 1;\n  }\n  newShape.splice($dim, 0, 1);\n  return reshape({inputs:
{x: input}, backend, attrs: {shape: newShape}});\n}\n\nexport const expandDimsConfig: KernelConfig = {\n
kernelName: ExpandDims,\n  backendName: 'wasm',\n  kernelFunc: expandDims as {} as KernelFunc,\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version
2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n */
```

```
=====\\n
*\\n\\nimport {FlipLeftRight, FlipLeftRightInputs, KernelConfig, KernelFunc, TensorInfo} from '@tensorflow/tfjs-
core';\\n\\nimport {BackendWasm} from '../backend_wasm';\\n\\nlet wasmFlipLeftRight: (\\n   xId: number, batch:
number, imageHeight: number, imageWidth: number,\\n   numChannels: number, outId: number) =>
void;\\n\\nfunction setup(backend: BackendWasm) {\\n   wasmFlipLeftRight = backend.wasm.cwrap(FlipLeftRight,
null /* void */, [\\n     'number', // xId\\n     'number', // batch\\n     'number', // imageHeight\\n     'number', //
imageWidth\\n     'number', // numChannels\\n     'number', // outId\\n   ]);\\n}\\n\\nexport function flipLeftRight(\\n
args: {inputs: FlipLeftRightInputs, backend: BackendWasm}): TensorInfo {\\n   const {inputs, backend} = args;\\n
const {image} = inputs;\\n\\n   const out = backend.makeOutput(image.shape, image.dtype);\\n   const imageId =
backend.dataIdMap.get(image.dataId).id;\\n   const outId = backend.dataIdMap.get(out.dataId).id;\\n\\n
   const [batch, imageHeight, imageWidth, numChannels] = image.shape;\\n\\n   wasmFlipLeftRight(\\n     imageId,
batch, imageHeight, imageWidth, numChannels, outId);\\n   return out;\\n}\\n\\nexport const flipLeftRightConfig:
KernelConfig = {\\n   kernelName: FlipLeftRight,\\n   backendName: 'wasm',\\n   kernelFunc: flipLeftRight as {} as
KernelFunc,\\n   setupFunc: setup\\n};\\n"/>**\\n * @license\\n * Copyright 2020 Google LLC. All Rights Reserved.\\n
* Licensed under the Apache License, Version 2.0 (the "License");\\n * you may not use this file except in
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http://www.apache.org/licenses/LICENSE-2.0\\n * \\n * Unless required by applicable law or agreed to in writing,
software\\n * distributed under the License is distributed on an "AS IS" BASIS,\\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\\n * See the License for the specific language
```

governing permissions and
* limitations under the

```

=====\\n
*\\nimport {Floor, KernelConfig} from '@tensorflow/tfjs-core';\\n\\nimport {createUnaryKernelConfig} from
'./unary_kernel';\\nexport const floorConfig: KernelConfig = createUnaryKernelConfig(Floor);\\n"/**\\n *
@license\\n * Copyright 2019 Google LLC. All Rights Reserved.\\n * Licensed under the Apache License, Version
2.0 (the "License");\\n * you may not use this file except in compliance with the License.\\n * You may obtain a
copy of the License at\\n * \\n * http://www.apache.org/licenses/LICENSE-2.0\\n * \\n * Unless required by applicable
law or agreed to in writing, software\\n * distributed under the License is distributed on an "AS IS" BASIS,\\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\\n * See the License for
the specific language governing permissions and\\n * limitations under the License.\\n *

```

```

=====
*\n\nimport {FusedBatchNorm, FusedBatchNormAttrs, FusedBatchNormInputs, KernelConfig, KernelFunc,
TensorInfo, util} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nlet
wasmBatchNorm: (\n  xId: number, meanId: number, varianceId: number, offsetId: number,\n  scaleId: number,
varianceEpsilon: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n
wasmBatchNorm = backend.wasm.cwrap(\n  FusedBatchNorm, null /* void */,\n  ['number', 'number',
'number', 'number', 'number', 'number', 'number']);\n}\n\nfunction fusedBatchNorm(args: {\n backend:
BackendWasm,\n inputs: FusedBatchNormInputs,\n attrs: FusedBatchNormAttrs\n}): TensorInfo {\n const
{backend, inputs, attrs} = args;\n const {varianceEpsilon} = attrs;\n const {x, mean, variance, offset, scale} =
inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const meanId =
backend.dataIdMap.get(mean.dataId).id;\n const varianceId = backend.dataIdMap.get(variance.dataId).id;\n
const offsetId = offset != null ? backend.dataIdMap.get(offset.dataId).id : 0;\n const scaleId = scale != null ?
backend.dataIdMap.get(scale.dataId).id : 0;\n\n const out = backend.makeOutput(x.shape, x.dtype);\n // Short-
circuit zero-sized tensors.\n if (util.sizeFromShape(x.shape) === 0) {\n return out;\n }\n\n const outId =
backend.dataIdMap.get(out.dataId).id;\n\n wasmBatchNorm(\n  xId, meanId, varianceId, offsetId, scaleId,
varianceEpsilon, outId);\n return out;\n}\n\nexport const fusedBatchNormConfig: KernelConfig = {\n kernelName:
FusedBatchNorm,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: fusedBatchNorm as {} as
KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
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*\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is
distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n */

```

```

{FusableActivation} from './types';\n\nlet wasmFusedConv2d:\n  (xId: number, batchSize: number, inputHeight:\n  number, inputWidth: number,\n  filterId: number, filterHeight: number, filterWidth: number,\n  biasId: number,\n  padTop: number, padRight: number, padBottom: number,\n  padLeft: number, isSamePad: number,\n  dilationHeight: number,\n  dilationWidth:\n  number, strideHeight: number, strideWidth: number,\n  inputChannels: number, outputChannels: number,\n  activation: number,\n  preluActivationWeightsId: number, leakyreluAlpha: number, outId: number) =>\n  void;\n\nfunction setup(backend: BackendWasm) {\n  wasmFusedConv2d = backend.wasm.cwrap(FusedConv2D,\n  null /* void */, [\n    'number', // xId\n    'number', // batchSize\n    'number', // inputHeight\n    'number', //\n    inputWidth\n    'number', // filterId\n    'number', // filterHeight\n    'number', // filterWidth\n    'number', // biasId\n    'number', // padTop\n    'number', // padRight\n    'number', // padBottom\n    'number', // padLeft\n    'number', //\n    isSamePad\n    'number', // dilationHeight\n    'number', // dilationWidth\n    'number', // strideHeight\n    'number',\n    // strideWidth\n    'number', // inputChannels\n    'number', // outputChannels\n    'number', // activation\n    'number', // preluActivationWeightsId\n    'number', // leakyreluAlpha\n    'number', // outId\n  ]);\n\n  function fusedConv2d(args: {\n    inputs: FusedConv2DInputs,\n    backend:\n    BackendWasm,\n    attrs: FusedConv2DAttrs\n  }) {\n    const {inputs, attrs, backend} = args;\n    const {x, filter, bias,\n    preluActivationWeights} = inputs;\n    const {\n      strides,\n      pad,\n      dilations,\n      dataFormat,\n      dimRoundingMode,\n      activation,\n      leakyreluAlpha\n    } = attrs;\n    const convInfo =\n    backend_util.computeConv2DInfo(\n      (x as Tensor4D).shape, (filter as Tensor4D).shape, strides, dilations,\n      pad, dimRoundingMode);\n    const fusedActivation =\n      FusableActivation[activation as {} as keyof typeof\n      FusableActivation];\n    if (fusedActivation == null) {\n      throw new Error(\n        `${activation} activation not yet\n        supported for FusedConv2D`\n      );\n    }\n    const xId =\n    backend.dataIdMap.get(x.dataId).id;\n    const filterId = backend.dataIdMap.get(filter.dataId).id;\n    const\n    outputChannels = convInfo.outChannels;\n\n    let biasId = 0;\n    if (bias != null) {\n      const biasData = backend.dataIdMap.get(bias.dataId);\n      if\n      (biasData.shape.length !== 1) {\n        throw new Error(\n          `FusedConv2D only supports rank-1 bias but got`\n        );\n      }\n      if (biasData.shape[0] !== outputChannels) {\n        throw new\n        Error(\n          `FusedConv2D bias shape (${biasData.shape}) does not`\n        );\n      }\n      biasId = biasData.id;\n    }\n    const filterHeight =\n    convInfo.filterHeight;\n    const filterWidth = convInfo.filterWidth;\n    const padTop = convInfo.padInfo.top;\n    const\n    padRight = convInfo.padInfo.right;\n    const padBottom = convInfo.padInfo.bottom;\n    const padLeft =\n    convInfo.padInfo.left;\n    const dilationHeight = convInfo.dilationHeight;\n    const dilationWidth =\n    convInfo.dilationWidth;\n    const strideHeight = convInfo.strideHeight;\n    const strideWidth =\n    convInfo.strideWidth;\n\n    const inputChannels = convInfo.inChannels;\n    const isSamePad = convInfo.padInfo.type === 'SAME' ? 1 : 0;\n    const batchSize = convInfo.batchSize;\n    const inHeight = convInfo.inHeight;\n    const inWidth =\n    convInfo.inWidth;\n    if (dataFormat !== 'NHWC') {\n      throw new Error(\n        `wasm backend FusedConv2D\n        does not support dataFormat:``\n      );\n    }\n    const out =\n    backend.makeOutput(convInfo.outShape, 'float32');\n    const outId = backend.dataIdMap.get(out.dataId).id;\n    const\n    preluActivationWeightsId = preluActivationWeights == null ?\n    0 :\n    backend.dataIdMap.get(preluActivationWeights.dataId).id;\n\n    wasmFusedConv2d(\n      xId, batchSize, inHeight,\n      inWidth, filterId, filterHeight, filterWidth,\n      biasId, padTop, padRight, padBottom, padLeft, isSamePad,\n      dilationHeight,\n      dilationWidth, strideHeight, strideWidth, inputChannels, outputChannels,\n      fusedActivation,\n      preluActivationWeightsId, leakyreluAlpha ||\n      0, outId);\n\n    return out;\n  }\n\n  export const fusedConv2DConfig: KernelConfig = {\n    kernelName:\n    FusedConv2D,\n    backendName: 'wasm',\n    setupFunc: setup,\n    kernelFunc: fusedConv2d as {} as\n    KernelFunc\n  };\n\n  /**\n   * @license\n   * Copyright 2019 Google LLC. All Rights Reserved.\n   * Licensed under the\n   * Apache License, Version 2.0 (the "License");\n   * you may not use this file except in compliance with the\n   * License.\n   * You may obtain a copy of the License at\n   * http://www.apache.org/licenses/LICENSE-2.0\n   */

```

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License.

```
=====
*/
import { backend_util, FusedDepthwiseConv2D, FusedDepthwiseConv2DAttrs,
FusedDepthwiseConv2DInputs, KernelConfig, KernelFunc, Tensor4D } from '@tensorflow/tfjs-core';
import { BackendWasm } from '../backend_wasm';
import { FusibleActivation } from '../types';

let wasmFusedDepthwiseConv2d = (xId: number, batchSize: number, inputHeight: number, inputWidth: number,
filterId: number, filterHeight: number, filterWidth: number, biasId: number, padTop: number, padRight:
number, padBottom: number, padLeft: number, isSamePad: number, dilationHeight: number,
dilationWidth: number, strideHeight: number, strideWidth: number, inputChannels: number, outputChannels:
number, activation: number, preluActivationWeightsId: number, leakyreluAlpha: number, outId: number) =>
void;

function setup(backend: BackendWasm) {
  wasmFusedDepthwiseConv2d =
    backend.wasm.cwrap(FusedDepthwiseConv2D, null /* void */, [
      'number', // xId
      'number', // batchSize
      'number', // inputHeight
      'number', // inputWidth
      'number', // filterId
      'number', // filterHeight
      'number', // filterWidth
      'number', // biasId
      'number', // padTop
      'number', // padRight
      'number', // padBottom
      'number', // padLeft
      'number', // isSamePad
      'number', // dilationHeight
      'number', // dilationWidth
      'number', // strideHeight
      'number', // strideWidth
      'number', // inputChannels
      'number', // outputChannels
      'number', // activation
      'number', // preluActivationWeightsId
      'number', // leakyreluAlpha
      'number', // outId
    ]);

  function fusedDepthwiseConv2d(args: {
    inputs: FusedDepthwiseConv2DInputs,
    backend: BackendWasm,
    attrs: FusedDepthwiseConv2DAttrs
  }) {
    const { inputs, attrs, backend } = args;
    const { x, filter, bias, preluActivationWeights } = inputs;
    const {
      strides,
      pad,
      dilations,
      dataFormat,
      dimRoundingMode,
      activation,
      leakyreluAlpha
    } = attrs;

    const convInfo = backend_util.computeConv2DInfo(
      (x as Tensor4D).shape, (filter as Tensor4D).shape, strides, dilations,
      pad, dimRoundingMode, true /* depthwise */
    );

    const fusedActivation = FusibleActivation[activation as keyof typeof FusibleActivation];
    if (fusedActivation == null) {
      throw new Error(`${activation} activation not yet supported for FusedDepthwiseConv2D` +
        `in the wasm backend.`);
    }

    const xId = backend.dataIdMap.get(x.dataId).id;
    const filterId = backend.dataIdMap.get(filter.dataId).id;
    const outputChannels = convInfo.outChannels;

    let biasId = 0;
    if (bias != null) {
      const biasData = backend.dataIdMap.get(bias.dataId);
      if (biasData.shape.length !== 1) {
        throw new Error(`FusedDepthwiseConv2D only supports rank-1 bias but got` +
          `rank ${biasData.shape.length}`);
      }
      if (biasData.shape[0] !== outputChannels) {
        throw new Error(`FusedDepthwiseConv2D bias shape (${biasData.shape}) does not` +
          `match the number of output channels (${outputChannels})`);
      }
      biasId = biasData.id;
    }

    const filterHeight = convInfo.filterHeight;
    const filterWidth = convInfo.filterWidth;
    const padTop = convInfo.padInfo.top;
    const padRight = convInfo.padInfo.right;
    const padBottom = convInfo.padInfo.bottom;
    const padLeft = convInfo.padInfo.left;
    const dilationHeight = convInfo.dilationHeight;
    const dilationWidth = convInfo.dilationWidth;
    const strideHeight = convInfo.strideHeight;
    const strideWidth = convInfo.strideWidth;
    const inputChannels = convInfo.inChannels;
    const isSamePad = convInfo.padInfo.type === 'SAME' ? 1 : 0;
    const batchSize = convInfo.batchSize;
    const inHeight = convInfo.inHeight;
    const inWidth = convInfo.inWidth;

    if (dataFormat !== 'NHWC') {
      throw new Error(`wasm backend FusedDepthwiseConv2D does not support dataFormat:` +
        `${dataFormat}` +
        `Please use 'NHWC'`);
    }

    const out = backend.makeOutput(convInfo.outShape, 'float32');
    const outId = backend.dataIdMap.get(out.dataId).id;
    const preluActivationWeightsId = preluActivationWeights == null ? 0 :
      backend.dataIdMap.get(preluActivationWeights.dataId).id;

    wasmFusedDepthwiseConv2d(xId,
```

```

batchSize, inHeight, inWidth, filterId, filterHeight, filterWidth,\n    biasId, padTop, padRight, padBottom, padLeft,
isSamePad, dilationHeight,\n    dilationWidth, strideHeight, strideWidth, inputChannels, outputChannels,\n    fusedActivation, preluActivationWeightsId, leakyreluAlpha || 0, outId);\n\nreturn out;\n}\n\nexport const
fusedDepthwiseConv2DConfig: KernelConfig = {\n  kernelName: FusedDepthwiseConv2D,\n  backendName:
'wasm',\n  setupFunc: setup,\n  kernelFunc: fusedDepthwiseConv2d as { } as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
'License');\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
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agreed to in writing, software\n * distributed under the License is distributed on an 'AS IS' BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n */

```

```

=====
*\n\nimport {gather_util, GatherNd, GatherNdInputs, KernelConfig, TensorInfo} from '@tensorflow/tfjs-
core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport {CppDType} from './types';\n\nlet
wasmGatherNd: (\n  xId: number, dtype: CppDType, indicesId: number, numSlices: number,\n  sliceRank: number, sliceSize: number, strides: Uint8Array, outId: number) =>\n  void;\n\nfunction
setup(backend: BackendWasm): void {\n  wasmGatherNd = backend.wasm.cwrap(GatherNd, null /*void*/, [\n
'number', // xId\n 'number', // dtype\n 'number', // indicesId\n 'number', // numSlices\n 'number', //
sliceRank\n 'number', // sliceSize\n 'array', // strides\n 'number' // outId\n ]);\n\nfunction gatherNd(args:
{backend: BackendWasm, inputs: GatherNdInputs}): \n  TensorInfo {\n    const {backend, inputs} = args;\n    const
{params, indices} = inputs;\n    const [resultShape, numSlices, sliceSize, strides] =\n
gather_util.prepareAndValidate(params, indices);\n    const out = backend.makeOutput(resultShape,
params.dtype);\n    if (numSlices === 0) {\n      return out;\n    }\n    const indicesShape = indices.shape;\n    const
sliceRank = indicesShape[indicesShape.length - 1];\n    const xData = backend.dataIdMap.get(params.dataId);\n
const xId = xData.id;\n
    const indicesData = backend.dataIdMap.get(indices.dataId);\n    const indicesId = indicesData.id;\n    const
stridesBytes = new Uint8Array(new Int32Array(strides).buffer);\n    const outId =
backend.dataIdMap.get(out.dataId).id;\n    wasmGatherNd(\n      xId, CppDType[params.dtype], indicesId,
numSlices, sliceRank, sliceSize,\n      stridesBytes, outId);\n    return out;\n  }\n\nexport const gatherNdConfig:
KernelConfig = {\n  kernelName: GatherNd,\n  backendName: 'wasm',\n  setupFunc: setup,\n  kernelFunc:
gatherNd\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the 'License');\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless
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on an 'AS IS' BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n */

```

```

=====
*\n\nimport {backend_util, GatherV2, GatherV2Attrs, GatherV2Inputs, KernelConfig, KernelFunc, Tensor,
TensorInfo, TypedArray, util} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from
'../backend_wasm';\n\nimport {reshape} from './Reshape';\n\nimport {CppDType} from './types';\n\nlet
wasmGather: (\n  xId: number, dtype: CppDType, xStrides: Uint8Array, stridesSize: number,\n  indicesId: number, batchSize:
number, outStrides: Uint8Array,\n  outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n
wasmGather = backend.wasm.cwrap('Gather', null /*void*/, [\n 'number', // xId\n 'number', // dtype\n 'array',
// xStrides\n 'number', // stridesSize\n 'number', // indicesId\n 'number', // batchSize\n
'array', // outStrides\n 'number' // outId\n ]);\n\nfunction gatherV2(\n  args: {backend: BackendWasm,
inputs: GatherV2Inputs, attrs: GatherV2Attrs}): \n  TensorInfo {\n    const {backend, inputs, attrs} = args;\n    const
{x, indices} = inputs;\n    const {axis, batchDims} = attrs;\n    // Throw error when any index is out of bound.\n

```

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const parsedAxis = util.parseAxisParam(axis, x.shape)[0];\n const indicesVals = backend.readSync(indices.dataId)
as TypedArray;\n const axisDim = x.shape[parsedAxis];\n for (let i = 0; i < indicesVals.length; ++i) {\n const
index = indicesVals[i];\n util.assert(\n index <= axisDim - 1 && index >= 0,\n () =>\n `GatherV2:
the index value ${index} is not in [0, ${axisDim - 1}]`);\n }\n\n const shapeInfo =
backend_util.segment_util.collectGatherOpShapeInfo(\n x as Tensor, indices as Tensor, parsedAxis,
batchDims);\n\n const flattenX = reshape({\n inputs: {x},\n attrs: {\n shape: [\n
shapeInfo.batchSize, shapeInfo.outerSize, shapeInfo.dimSize,\n shapeInfo.sliceSize\n ]\n },\n backend\n
});\n const indicesSize = util.sizeFromShape(indices.shape);\n const flattenIndex = reshape({\n inputs: {x:
indices},\n attrs: {shape: [shapeInfo.batchSize, indicesSize / shapeInfo.batchSize]},\n backend\n });\n const
flattenOutputShape = [\n shapeInfo.batchSize, shapeInfo.outerSize, indicesSize / shapeInfo.batchSize,\n
shapeInfo.sliceSize\n ];\n\n const out = backend.makeOutput(flattenOutputShape, x.dtype);\n if
(util.sizeFromShape(x.shape) === 0) {\n return out;\n }\n\n const stridesSize = flattenX.shape.length - 1;\n\n const
xData = backend.dataIdMap.get(flattenX.dataId);\n const xId = xData.id;\n\n const indicesData =
backend.dataIdMap.get(flattenIndex.dataId);\n const indicesId = indicesData.id;\n\n const outId =
backend.dataIdMap.get(out.dataId).id;\n\n const xStridesBytes = new Uint8Array(\n new
Int32Array(util.computeStrides(flattenX.shape)).buffer);\n
const outStridesBytes = new Uint8Array(\n new
Int32Array(util.computeStrides(flattenOutputShape)).buffer);\n\n wasmGather(\n xId, CppDType[x.dtype],
xStridesBytes, stridesSize, indicesId,\n shapeInfo.batchSize, outStridesBytes, outId);\n\n
backend.disposeData(flattenX.dataId);\n backend.disposeData(flattenIndex.dataId);\n\n // reshape\n out.shape =
shapeInfo.outputShape;\n return out;\n}\n\nexport const gatherV2Config: KernelConfig = {\n kernelName:
GatherV2,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: gatherV2 as { } as KernelFunc\n};\n\n", "/**\n
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copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable
law or agreed to in writing, software\n * distributed
under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF
ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n *
limitations under the License.\n *
=====
\n
*/\nimport {Greater, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from
'/binary_kernel';\n\nconst supportsFullBroadcast = false;\nexport const greaterConfig: KernelConfig =\ncreateBinaryKernelConfig(Greater, supportsFullBroadcast, 'bool');\n\n", "/**\n * @license\n * Copyright 2019 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not
use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
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* distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR
CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing
permissions and\n * limitations under the License.\n *
=====
\n
*/\nimport {GreaterEqual, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig}
from '/binary_kernel';\n\nconst supportsFullBroadcast = false;\nexport const greaterEqualConfig: KernelConfig =\ncreateBinaryKernelConfig(GreaterEqual, supportsFullBroadcast, 'bool');\n\n", "/**\n * @license\n * Copyright 2019
Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you
may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in

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=====
\n
*\n\nimport { KernelConfig, KernelFunc, LeakyRelu, LeakyReluAttrs, LeakyReluInputs, TensorInfo, util } from
'@tensorflow/tfjs-core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nimport { CppDType } from
'/types';\n\nlet wasmFunc: (\n  xId: number, dtype: number, leakyreluAlpha: number, outId: number) =>
void;\n\nfunction setupFunc(backend: BackendWasm): void {\n  wasmFunc = backend.wasm.cwrap(LeakyRelu,
null /* void */, [\n  'number', // x_id\n  'number', // dtype\n  'number', // leakyrelu_alpha\n  'number', //
out_id\n  ]);\n\n  next export function leakyRelu(\n    args: {\n      inputs: LeakyReluInputs, attrs: LeakyReluAttrs,
backend: BackendWasm\n    }):\n    TensorInfo {\n      const { inputs: { x }, attrs: { alpha }, backend } = args;\n      const xId =
backend.dataIdMap.get(x.dataId).id;\n      // According to TF API, LeakyRelu returns float32 when input is either
float32\n      // or int32.\n      const out = backend.makeOutput(x.shape, 'float32');\n      if (util.sizeFromShape(x.shape)
!== 0) {\n        const outId = backend.dataIdMap.get(out.dataId).id;\n        wasmFunc(xId, CppDType[x.dtype], alpha,
outId);\n      }\n      return out;\n    }\n\n  next export const leakyReluConfig: KernelConfig = {\n    kernelName: LeakyRelu,\n    backendName: 'wasm',\n    setupFunc,\n    kernelFunc: leakyRelu as {\n    } as KernelFunc,\n  };
\n  }, \"/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
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License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====
\n
*\n\nimport { KernelConfig, Less } from '@tensorflow/tfjs-core';\n\nimport { createBinaryKernelConfig } from
'/binary_kernel';\n\nconst supportsFullBroadcast = false;\n\nnext export const lessConfig: KernelConfig =\ncreateBinaryKernelConfig(Less, supportsFullBroadcast, 'bool');\n\n}, \"/*\n * @license\n * Copyright 2019 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not
use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law
or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====
\n
*\n\nimport { KernelConfig, LessEqual } from '@tensorflow/tfjs-core';\n\nimport { createBinaryKernelConfig } from
'/binary_kernel';\n\nconst supportsFullBroadcast = false;\n\nnext export const lessEqualConfig: KernelConfig =\ncreateBinaryKernelConfig(LessEqual, supportsFullBroadcast, 'bool');\n\n}, \"/*\n * @license\n * Copyright 2019
Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you
may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====
\n
*\n\nimport { KernelConfig, Log } from '@tensorflow/tfjs-core';\n\nimport { createUnaryKernelConfig } from
'/unary_kernel';\n\nnext export const logConfig: KernelConfig = createUnaryKernelConfig(Log);\n\n}, \"/*\n * @license\n *
Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
\"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
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```
=====
\n
*/\nimport {KernelConfig, LogicalAnd} from '@tensorflow/tfjs-core';\n\nimport {createBinaryKernelConfig} from
'./binary_kernel';\nconst supportsFullBroadcast = false;\n\nexport const logicalAndConfig: KernelConfig =\ncreateBinaryKernelConfig(LogicalAnd, supportsFullBroadcast, 'bool');\n\n", "/*\n * @license\n * Copyright 2019
Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you
may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
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```

is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *

```
=====
\n
*/\n\nimport {backend_util, KernelConfig, KernelFunc, Max, MaxAttrs, MaxInputs, TensorInfo, util} from
'@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport
{permuteAxesAndTranspose} from './kernel_utils';\nimport {CppType} from './types';\n\nlet wasmMax: (xId:
number, dtype: number, reduceSize: number, outId: number) =>\n void;\n\nfunction setup(backend:
BackendWasm): void {\n  wasmMax = backend.wasm.cwrap(Max, null /*void*/, [\n    'number', // x_id\n    'number', // dtype\n    'number', // reduce_size\n    'number', // out_id\n  ]);\n\n  function max(args: {backend:
BackendWasm, inputs: MaxInputs, attrs: MaxAttrs}): \n    TensorInfo {\n    const
{backend, inputs, attrs} = args;\n    const {reductionIndices: axis, keepDims} = attrs;\n    const {x} = inputs;\n    const
xId = backend.dataIdMap.get(x.dataId).id;\n    let inputId = xId;\n    let input = x;\n\n    const {transposed, axes,
originalAxes, inputWasTransposed} =\n      permuteAxesAndTranspose(x, axis, backend);\n\n    if
(inputWasTransposed) {\n      const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n      input =
transposed;\n      inputId = transposedId;\n    }\n\n    const inputRank = input.shape.length;\n    backend_util.assertAxesAreInnerMostDims('max', axes, inputRank);\n    const [outShape, reduceShape] =\n      backend_util.computeOutAndReduceShapes(input.shape, axes);\n    const reduceSize =
util.sizeFromShape(reduceShape);\n\n    const out = backend.makeOutput(outShape, x.dtype);\n    if
(util.sizeFromShape(input.shape) !== 0) {\n      const outId = backend.dataIdMap.get(out.dataId).id;\n      wasmMax(inputId, CCppType[x.dtype], reduceSize, outId);\n    }\n\n    if (inputWasTransposed)
{\n      // dispose of the transposed tensor.\n      backend.disposeData(transposed.dataId);\n    }\n\n    if (keepDims) {\n      // reshape\n      const newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n      out.shape =
newShape;\n    }\n\n    return out;\n  }\n\n  export const maxConfig: KernelConfig = {\n    kernelName: Max,\n    backendName: 'wasm',\n    setupFunc: setup,\n    kernelFunc: max as {} as KernelFunc\n  };\n\n", "/*\n * @license\n *
Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
\"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing
permissions and\n * limitations under the License.\n *
```

```
=====
\n
*/\nimport {KernelConfig, Maximum} from '@tensorflow/tfjs-core';\n\nimport {createBinaryKernelConfig} from
'./binary_kernel';\nconst supportsFullBroadcast = false;\n\nexport const maximumConfig: KernelConfig =\ncreateBinaryKernelConfig(Maximum, supportsFullBroadcast);\n\n", "/*\n * @license\n * Copyright 2019 Google
```

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```
=====
*\n\nimport {backend_util, KernelConfig, KernelFunc, MaxPool, MaxPoolAttrs, MaxPoolInputs, Tensor4D, util}
from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nlet wasmMaxPool: (\n  xId:
number, batchSize: number, inputHeight: number, inputWidth: number,\n  filterHeight: number, filterWidth:
number, padTop: number, padRight: number,\n  padBottom: number, padLeft: number, dilationHeight: number,\n  dilationWidth: number, strideHeight: number, strideWidth: number,\n  inputChannels: number, outputChannels:
number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n  wasmMaxPool =
backend.wasm.cwrap(MaxPool, null /* void */, [\n    'number', // xId\n    'number', // batchSize\n    'number', //
inputHeight\n    'number', // inputWidth\n    'number', // filterHeight\n    'number', // filterWidth\n
    'number', // padTop\n    'number', // padRight\n    'number', // padBottom\n    'number', // padLeft\n    'number', //
dilationHeight\n    'number', // dilationWidth\n    'number', // strideHeight\n    'number', // strideWidth\n
    'number', // inputChannels\n    'number', // outputChannels\n    'number', // outId\n  ]);\n\n  function maxPool(\n    args:
{inputs: MaxPoolInputs, backend: BackendWasm, attrs: MaxPoolAttrs}) {\n    const {inputs, attrs, backend} =
args;\n\n    const x = inputs.x as Tensor4D;\n    const xId = backend.dataIdMap.get(x.dataId).id;\n\n    // TF API
supports int32 input. CPU and WebGL backend also support int32\n    // input. WASM backend doesn't support it
because it uses xnnpack which only\n    // supports float32.\n    // \n    // Add the following assert only for the WASM
backend instead of at core op\n    // level.\n    // \n    // TODO: add support for int32 input.\n    util.assert(\n      x.dtype
=== 'float32',\n      () =>\n        `Error in MaxPool: only float32 input
is supported. Got ${x.dtype}.`);\n\n    const {filterSize, strides, pad, dimRoundingMode} = attrs;\n    const convInfo =
backend_util.computePool2DInfo(\n      x.shape, filterSize, strides, 1 /* dilations */, pad, dimRoundingMode);\n\n    const filterHeight = convInfo.filterHeight;\n    const filterWidth = convInfo.filterWidth;\n    const padTop =
convInfo.padInfo.top;\n    const padRight = convInfo.padInfo.right;\n    const padBottom = convInfo.padInfo.bottom;\n    const padLeft = convInfo.padInfo.left;\n    const dilationHeight = convInfo.dilationHeight;\n    const dilationWidth =
convInfo.dilationWidth;\n    const strideHeight = convInfo.strideHeight;\n    const strideWidth =
convInfo.strideWidth;\n    const inputChannels = convInfo.inChannels;\n    const outputChannels =
convInfo.outChannels;\n\n    if (convInfo.dataFormat !== 'channelsLast') {\n      throw new Error(\n        `wasm
backend does not support dataFormat: ` +\n        `${convInfo.dataFormat}`. Please use 'channelsLast'.`);\n    }\n\n    const out =
backend.makeOutput(convInfo.outShape, 'float32');\n    const outId = backend.dataIdMap.get(out.dataId).id;\n\n    wasmMaxPool(\n      xId, x.shape[0], x.shape[1], x.shape[2], filterHeight, filterWidth,\n      padTop, padRight,
padBottom, padLeft, dilationHeight, dilationWidth,\n      strideHeight, strideWidth, inputChannels, outputChannels,
outId);\n    return out;\n  }\n\n  export const maxPoolConfig: KernelConfig = {\n    kernelName: MaxPool,\n    backendName: 'wasm',\n    setupFunc: setup,\n    kernelFunc: maxPool as { } as KernelFunc\n  };\n\n  /**\n   * @license\n   * Copyright 2020 Google LLC. All Rights Reserved.\n   * Licensed under the Apache License, Version 2.0 (the
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agreed to in writing, software\n   * distributed under the License is distributed on an \"AS IS\" BASIS,\n   *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n   * See the License for the specific language
governing permissions and\n   * limitations under the License.\n   */
}
```

```

*\n\nimport {backend_util, KernelConfig, KernelFunc, Mean, MeanAttrs, MeanInputs, TensorInfo, util} from
'@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport {cast} from './Cast';\n\nimport
{permuteAxesAndTranspose} from './kernel_utils';\n\nlet wasmMean: (xId: number, reduceSize: number, outId:
number) => void;\n\nfunction setup(backend: BackendWasm): void {\n  wasmMean =\n  backend.wasm.cwrap(Mean, null /*void*/, ['number, number, number']);\n}\n\nexport function mean(\n  args:
{backend: BackendWasm, inputs: MeanInputs, attrs: MeanAttrs});\n  TensorInfo {\n    const {backend, inputs,
attrs} = args;\n    const {axis, keepDims} = attrs;\n    const {x} = inputs;\n    const xId =
backend.dataIdMap.get(x.dataId).id;\n
    let inputId = xId;\n    let input = x;\n    const {transposed, axes, originalAxes, inputWasTransposed} =\n    permuteAxesAndTranspose(x, axis, backend);\n    let reductionAxes = axes;\n    if (inputWasTransposed) {\n      const
transposedId = backend.dataIdMap.get(transposed.dataId).id;\n      if (transposedId !== xId) {\n        // transpose was
not a no-op. We will need to dispose of this\n        // once we are done.\n        input = transposed;\n        inputId =
transposedId;\n        reductionAxes = backend_util.getInnerMostAxes(\n          reductionAxes.length,\n          input.shape.length);\n      }\n    }\n    backend_util.assertAxesAreInnerMostDims(\n      'mean', reductionAxes,\n      input.shape.length);\n    const [outShape, reduceShape] =\n    backend_util.computeOutAndReduceShapes(input.shape, reductionAxes);\n    const reduceSize =
util.sizeFromShape(reduceShape);\n    let castedInput = input;\n    if (input.dtype !== 'float32') {\n      castedInput =\n      cast({backend, inputs: {x: input}, attrs: {dtype:
'float32'}});\n      inputId = backend.dataIdMap.get(castedInput.dataId).id;\n    }\n    const out =
backend.makeOutput(outShape, 'float32');\n    if (util.sizeFromShape(input.shape) !== 0) {\n      const outId =
backend.dataIdMap.get(out.dataId).id;\n      wasmMean(inputId, reduceSize, outId);\n    }\n    if
(inputWasTransposed) {\n      // dispose of the transposed tensor.\n      backend.disposeData(transposed.dataId);\n    }\n    if (keepDims) {\n      // reshape\n      const newShape = backend_util.expandShapeToKeepDim(out.shape,\n      originalAxes);\n      out.shape = newShape;\n    }\n    if (input.dtype !== 'float32') {\n      backend.disposeData(castedInput.dataId);\n    }\n    return out;\n  }\n}\n\nexport const meanConfig: KernelConfig = {\n  kernelName: Mean,\n  backendName: 'wasm',\n  setupFunc: setup,\n  kernelFunc: mean as {} as
KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the "License");\n * you may not use this
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http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n */
=====
*\n\nimport {backend_util, KernelConfig, KernelFunc, Min, MinAttrs, MinInputs, TensorInfo, util} from
'@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport
{permuteAxesAndTranspose} from './kernel_utils';\n\nimport {CppType} from './types';\n\nlet wasmMin: (xId:
number, dtype: number, reduceSize: number, outId: number) =>\n  void;\n\nfunction setup(backend:
BackendWasm): void {\n  wasmMin = backend.wasm.cwrap(Min,\n    null /*void*/, [\n      'number', // x_id\n      'number', // dtype\n      'number', // reduce_size\n      'number', // out_id\n    ]);\n}\n\nfunction min(args: {backend: BackendWasm, inputs: MinInputs, attrs: MinAttrs});\n  TensorInfo {\n    const {backend, inputs, attrs} = args;\n    const {axis, keepDims} = attrs;\n    const {x} = inputs;\n    const xId =
backend.dataIdMap.get(x.dataId).id;\n    let inputId = xId;\n    let input = x;\n    const {transposed, axes, originalAxes,\n    inputWasTransposed} =\n    permuteAxesAndTranspose(x, axis, backend);\n    if (inputWasTransposed) {\n      const
transposedId = backend.dataIdMap.get(transposed.dataId).id;\n      if (transposedId !== xId) {\n        // transpose
was not a no-op. We will need to dispose of this\n        // once we are done.\n        input = transposed;\n        inputId =
transposedId;\n      }\n    }\n    const inputRank = input.shape.length;\n    backend_util.assertAxesAreInnerMostDims('min', axes, inputRank);\n    const [outShape, reduceShape] =\n

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    backend_util.computeOutAndReduceShapes(input.shape, axes);\n    const reduceSize =
util.sizeFromShape(reduceShape);\n\n    const out = backend.makeOutput(outShape, input.dtype);\n    if
(util.sizeFromShape(input.shape) !== 0) {\n        const outId = backend.dataIdMap.get(out.dataId).id;\n
wasmMin(inputId, CppDType[x.dtype], reduceSize, outId);\n    }\n\n    if (inputWasTransposed) {\n        // dispose of the
transposed tensor.\n        backend.disposeData(transposed.dataId);\n    }\n\n    if (keepDims) {\n        // reshape\n        const
newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n        out.shape = newShape;\n    }\n\n    return out;\n}\n\nexport const minConfig: KernelConfig = {\n    kernelName: Min,\n    backendName: 'wasm',\n
setupFunc: setup,\n    kernelFunc: min as {} as KernelFunc\n};\n\n", "/*\n * @license\n * Copyright 2019 Google
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"AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n\n
 * See the License for the specific language governing permissions and\n * limitations under the License.\n\n
======\n\n
*/\nimport { KernelConfig, Minimum } from '@tensorflow/tfjs-core';\nimport { createBinaryKernelConfig } from
'./binary_kernel';\nconst supportsFullBroadcast = false;\nexport const minimumConfig: KernelConfig =\ncreateBinaryKernelConfig(Minimum, supportsFullBroadcast);\n\n", "/*\n * @license\n * Copyright 2021 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not
use this file except in compliance with the License.\n\n
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"AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n\n
 * See the License for the specific language governing permissions and\n * limitations under the License.\n\n
======\n\n
*/\n\nimport { KernelConfig, KernelFunc, MirrorPad, MirrorPadAttrs, MirrorPadInputs } from '@tensorflow/tfjs-
core';\nimport { BackendWasm } from './backend_wasm';\nimport { CppDType } from './types';\n\n// Must match
enum in MirrorPad.cc\nenum MirrorPaddingMode {\n    reflect = 0,\n    symmetric = 1\n}\n\nlet wasmMirrorPad: (\n
xId: number, xShapeBytes: Uint8Array, xShapeLength: number, xDtype: number,\n    prePaddingsBytes:
Uint8Array, postPaddingsBytes: Uint8Array, mode: number,\n    outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n    wasmMirrorPad =
backend.wasm.cwrap(MirrorPad, null /* void */, [\n        'number', // xId\n        'array', // x.shape\n        'number', //
x.shape.length\n        'number', // x.dtype\n        'array', // pre-paddings\n        'array', // post-paddings\n        'number', //
mode\n        'number', // outId\n    ]);\n\n    function mirrorPad(args: {\n        inputs: MirrorPadInputs,\n        backend:
BackendWasm,\n        attrs: MirrorPadAttrs\n    }) {\n        const { inputs: {x}, backend, attrs: {paddings, mode} } = args;\n\n        const outShape = paddings.map((\n            (p, i) => p[0] /* beforePad */ + x.shape[i] + p[1] /* afterPad */);\n        const xId =
backend.dataIdMap.get(x.dataId).id;\n        const out = backend.makeOutput(outShape, x.dtype);\n        const outId =
backend.dataIdMap.get(out.dataId).id;\n        const xShapeBytes = new Uint8Array(new
Int32Array(x.shape).buffer);\n\n        const prePaddingsFlat = paddings.map(padTuple => padTuple[0]);\n        const
postPaddingsFlat = paddings.map(padTuple
=> padTuple[1]);\n        const prePaddingsBytes =\n            new Uint8Array(new Int32Array(prePaddingsFlat).buffer);\n\n        const postPaddingsBytes =\n            new Uint8Array(new Int32Array(postPaddingsFlat).buffer);\n\n        wasmMirrorPad(\n            xId, xShapeBytes, x.shape.length, CppDType[x.dtype], prePaddingsBytes,\n            postPaddingsBytes, MirrorPaddingMode[mode], outId);\n        return out;\n    }\n\n    export const mirrorPadConfig:
KernelConfig = {\n        kernelName: MirrorPad,\n        backendName: 'wasm',\n        kernelFunc: mirrorPad as {} as
KernelFunc,\n        setupFunc: setup\n    }; \n\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n\n
 * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in
compliance with the License.\n\n
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required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an
"AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n\n
 * See the License for the specific language governing permissions and\n * limitations under the License.\n\n
======\n\n
*/\n\nimport { KernelConfig, MirrorPad, MirrorPadAttrs, MirrorPadInputs } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from './backend_wasm';\nimport { CppDType } from './types';\n\n// Must match
enum in MirrorPad.cc\nenum MirrorPaddingMode {\n    reflect = 0,\n    symmetric = 1\n}\n\nlet wasmMirrorPad: (\n
xId: number, xShapeBytes: Uint8Array, xShapeLength: number, xDtype: number,\n    prePaddingsBytes:
Uint8Array, postPaddingsBytes: Uint8Array, mode: number,\n    outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n    wasmMirrorPad =
backend.wasm.cwrap(MirrorPad, null /* void */, [\n        'number', // xId\n        'array', // x.shape\n        'number', //
x.shape.length\n        'number', // x.dtype\n        'array', // pre-paddings\n        'array', // post-paddings\n        'number', //
mode\n        'number', // outId\n    ]);\n\n    function mirrorPad(args: {\n        inputs: MirrorPadInputs,\n        backend:
BackendWasm,\n        attrs: MirrorPadAttrs\n    }) {\n        const { inputs: {x}, backend, attrs: {paddings, mode} } = args;\n\n        const outShape = paddings.map((\n            (p, i) => p[0] /* beforePad */ + x.shape[i] + p[1] /* afterPad */);\n        const xId =
backend.dataIdMap.get(x.dataId).id;\n        const out = backend.makeOutput(outShape, x.dtype);\n        const outId =
backend.dataIdMap.get(out.dataId).id;\n        const xShapeBytes = new Uint8Array(new
Int32Array(x.shape).buffer);\n\n        const prePaddingsFlat = paddings.map(padTuple => padTuple[0]);\n        const
postPaddingsFlat = paddings.map(padTuple
=> padTuple[1]);\n        const prePaddingsBytes =\n            new Uint8Array(new Int32Array(prePaddingsFlat).buffer);\n\n        const postPaddingsBytes =\n            new Uint8Array(new Int32Array(postPaddingsFlat).buffer);\n\n        wasmMirrorPad(\n            xId, xShapeBytes, x.shape.length, CppDType[x.dtype], prePaddingsBytes,\n            postPaddingsBytes, MirrorPaddingMode[mode], outId);\n        return out;\n    }\n\n    export const mirrorPadConfig:
KernelConfig = {\n        kernelName: MirrorPad,\n        backendName: 'wasm',\n        kernelFunc: mirrorPad as {} as
KernelFunc,\n        setupFunc: setup\n    }; \n\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n\n
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required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an
"AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n\n
 * See the License for the specific language governing permissions and\n * limitations under the License.\n\n
======\n\n
*/\n\nimport { KernelConfig, MirrorPad, MirrorPadAttrs, MirrorPadInputs } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from './backend_wasm';\nimport { CppDType } from './types';\n\n// Must match
enum in MirrorPad.cc\nenum MirrorPaddingMode {\n    reflect = 0,\n    symmetric = 1\n}\n\nlet wasmMirrorPad: (\n
xId: number, xShapeBytes: Uint8Array, xShapeLength: number, xDtype: number,\n    prePaddingsBytes:
Uint8Array, postPaddingsBytes: Uint8Array, mode: number,\n    outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n    wasmMirrorPad =
backend.wasm.cwrap(MirrorPad, null /* void */, [\n        'number', // xId\n        'array', // x.shape\n        'number', //
x.shape.length\n        'number', // x.dtype\n        'array', // pre-paddings\n        'array', // post-paddings\n        'number', //
mode\n        'number', // outId\n    ]);\n\n    function mirrorPad(args: {\n        inputs: MirrorPadInputs,\n        backend:
BackendWasm,\n        attrs: MirrorPadAttrs\n    }) {\n        const { inputs: {x}, backend, attrs: {paddings, mode} } = args;\n\n        const outShape = paddings.map((\n            (p, i) => p[0] /* beforePad */ + x.shape[i] + p[1] /* afterPad */);\n        const xId =
backend.dataIdMap.get(x.dataId).id;\n        const out = backend.makeOutput(outShape, x.dtype);\n        const outId =
backend.dataIdMap.get(out.dataId).id;\n        const xShapeBytes = new Uint8Array(new
Int32Array(x.shape).buffer);\n\n        const prePaddingsFlat = paddings.map(padTuple => padTuple[0]);\n        const
postPaddingsFlat = paddings.map(padTuple
=> padTuple[1]);\n        const prePaddingsBytes =\n            new Uint8Array(new Int32Array(prePaddingsFlat).buffer);\n\n        const postPaddingsBytes =\n            new Uint8Array(new Int32Array(postPaddingsFlat).buffer);\n\n        wasmMirrorPad(\n            xId, xShapeBytes, x.shape.length, CppDType[x.dtype], prePaddingsBytes,\n            postPaddingsBytes, MirrorPaddingMode[mode], outId);\n        return out;\n    }\n\n    export const mirrorPadConfig:
KernelConfig = {\n        kernelName: MirrorPad,\n        backendName: 'wasm',\n        kernelFunc: mirrorPad as {} as
KernelFunc,\n        setupFunc: setup\n    }; \n\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n\n
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"AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n\n
 * See the License for the specific language governing permissions and\n * limitations under the License.\n\n
======\n\n
*/\n\nimport { KernelConfig, MirrorPad, MirrorPadAttrs, MirrorPadInputs } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from './backend_wasm';\nimport { CppDType } from './types';\n\n// Must match
enum in MirrorPad.cc\nenum MirrorPaddingMode {\n    reflect = 0,\n    symmetric = 1\n}\n\nlet wasmMirrorPad: (\n
xId: number, xShapeBytes: Uint8Array, xShapeLength: number, xDtype: number,\n    prePaddingsBytes:
Uint8Array, postPaddingsBytes: Uint8Array, mode: number,\n    outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n    wasmMirrorPad =
backend.wasm.cwrap(MirrorPad, null /* void */, [\n        'number', // xId\n        'array', // x.shape\n        'number', //
x.shape.length\n        'number', // x.dtype\n        'array', // pre-paddings\n        'array', // post-paddings\n        'number', //
mode\n        'number', // outId\n    ]);\n\n    function mirrorPad(args: {\n        inputs: MirrorPadInputs,\n        backend:
BackendWasm,\n        attrs: MirrorPadAttrs\n    }) {\n        const { inputs: {x}, backend, attrs: {paddings, mode} } = args;\n\n        const outShape = paddings.map((\n            (p, i) => p[0] /* beforePad */ + x.shape[i] + p[1] /* afterPad */);\n        const xId =
backend.dataIdMap.get(x.dataId).id;\n        const out = backend.makeOutput(outShape, x.dtype);\n        const outId =
backend.dataIdMap.get(out.dataId).id;\n        const xShapeBytes = new Uint8Array(new
Int32Array(x.shape).buffer);\n\n        const prePaddingsFlat = paddings.map(padTuple => padTuple[0]);\n        const
postPaddingsFlat = paddings.map(padTuple
=> padTuple[1]);\n        const prePaddingsBytes =\n            new Uint8Array(new Int32Array(prePaddingsFlat).buffer);\n\n        const postPaddingsBytes =\n            new Uint8Array(new Int32Array(postPaddingsFlat).buffer);\n\n        wasmMirrorPad(\n            xId, xShapeBytes, x.shape.length, CppDType[x.dtype], prePaddingsBytes,\n            postPaddingsBytes, MirrorPaddingMode[mode], outId);\n        return out;\n    }\n\n    export const mirrorPadConfig:
KernelConfig = {\n        kernelName: MirrorPad,\n        backendName: 'wasm',\n        kernelFunc: mirrorPad as {} as
KernelFunc,\n        setupFunc: setup\n    }; \n\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n\n
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"AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n\n
 * See the License for the specific language governing permissions and\n * limitations under the License.\n\n
======\n\n
*/\n\nimport { KernelConfig, MirrorPad, MirrorPadAttrs, MirrorPadInputs } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from './backend_wasm';\nimport { CppDType } from './types';\n\n// Must match
enum in MirrorPad.cc\nenum MirrorPaddingMode {\n    reflect = 0,\n    symmetric = 1\n}\n\nlet wasmMirrorPad: (\n
xId: number, xShapeBytes: Uint8
```

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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied. See the License for the specific language governing permissions and limitations under the License.

```
=====
\n
*\n\nimport { KernelConfig, Multiply } from '@tensorflow/tfjs-core';\n\nimport { createBinaryKernelConfig } from
'./binary_kernel';\n\nconst supportsFullBroadcast = true;\n\nexport const multiplyConfig: KernelConfig =\ncreateBinaryKernelConfig(Multiply, supportsFullBroadcast);\n\n", "/*\n * @license\n * Copyright 2020 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not
use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
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software distributed under the License is distributed on an "AS IS" BASIS,
```

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```
=====
\n
*\n\nimport { KernelConfig, Neg } from '@tensorflow/tfjs-core';\n\nimport { createUnaryKernelConfig } from
'./unary_kernel';\n\nexport const negConfig: KernelConfig = createUnaryKernelConfig(Neg);\n\n", "/*\n * @license\n
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"License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n
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 *
=====
```

```
\n
*\n\nimport { BackendWasm } from './backend_wasm';\n\n// Analogous to `struct Result` in
`non_max_suppression_impl.h`.\n\ninterface Result {\n  pSelectedIndices: number;\n  selectedSize: number;\n
pSelectedScores: number;\n  pValidOutputs: number;\n}\n\n/*\n * Parse the result of the c++ method, which has the
shape equivalent to\n * `Result`.\n */\n\nexport function parseResultStruct(\n  backend: BackendWasm, resOffset:
number): Result {\n  const result = new Int32Array(backend.wasm.HEAPU8.buffer, resOffset, 4);\n  const
pSelectedIndices = result[0];\n  const selectedSize = result[1];\n  const pSelectedScores = result[2];\n  const
pValidOutputs = result[3];\n  // Since the result was allocated on the heap, we have to delete it.\n
backend.wasm._free(resOffset);\n  return {pSelectedIndices, selectedSize,\n    pSelectedScores, pValidOutputs};\n}\n\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
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software distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and limitations under the License.\n
 *
=====
```

```
\n
*\n\nimport { KernelConfig, KernelFunc, NonMaxSuppressionV3, NonMaxSuppressionV3Attrs,
NonMaxSuppressionV3Inputs, TensorInfo } from '@tensorflow/tfjs-core';\n\nimport { BackendWasm } from
'./backend_wasm';\n\nimport { parseResultStruct } from
'./NonMaxSuppression_util';\n\nlet wasmFunc: (\n  boxesId: number, scoresId: number, maxOutputSize:
number,\n  iouThreshold: number, scoreThreshold: number) => number;\n\nfunction setup(backend:
BackendWasm): void {\n  wasmFunc = backend.wasm.cwrap(\n    NonMaxSuppressionV3,\n    'number', //
Result*\n    [\n      'number', // boxesId\n      'number', // scoresId\n      'number', // maxOutputSize\n
'number', // iouThreshold\n      'number', // scoreThreshold\n    ]);\n\n  function kernelFunc(args: {\n    backend:
```

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BackendWasm,\n inputs: NonMaxSuppressionV3Inputs,\n attrs: NonMaxSuppressionV3Attrs\n)): TensorInfo {\n
const {backend, inputs, attrs} = args;\n const {iouThreshold, maxOutputSize, scoreThreshold} = attrs;\n const
{boxes, scores} = inputs;\n\n const boxesId = backend.dataIdMap.get(boxes.dataId).id;\n const scoresId =
backend.dataIdMap.get(scores.dataId).id;\n\n const resOffset =\n    wasmFunc(boxesId, scoresId, maxOutputSize,
iouThreshold,
scoreThreshold);\n\n const {pSelectedIndices, selectedSize, pSelectedScores, pValidOutputs} =\n
parseResultStruct(backend, resOffset);\n\n // Since we are not using scores for V3, we have to delete it from the
heap.\n backend.wasm._free(pSelectedScores);\n backend.wasm._free(pValidOutputs);\n\n const
selectedIndicesTensor =\n    backend.makeOutput([selectedSize], 'int32', pSelectedIndices);\n\n return
selectedIndicesTensor;\n}\n\nexport const nonMaxSuppressionV3Config: KernelConfig = {\n kernelName:
NonMaxSuppressionV3,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: kernelFunc as {} as
KernelFunc,\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the
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WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific
language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {KernelConfig, KernelFunc, NonMaxSuppressionV4, NonMaxSuppressionV4Attrs,
NonMaxSuppressionV4Inputs, TensorInfo} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from
'./backend_wasm';\n\nimport {parseResultStruct} from './NonMaxSuppression_util';\n\nlet wasmFunc: (\n
boxesId: number, scoresId: number, maxOutputSize: number,\n iouThreshold: number, scoreThreshold: number,\n
padToMaxOutputSize: boolean) => number;\n\nfunction setup(backend: BackendWasm): void {\n    wasmFunc =
backend.wasm.cwrap(\n        NonMaxSuppressionV4,\n        'number', // Result*\n        [\n            'number', // boxesId\n            'number',
// scoresId\n            'number', // maxOutputSize\n            'number', // iouThreshold\n            'number', // scoreThreshold\n            'bool', // padToMaxOutputSize\n        ]);\n\n    function nonMaxSuppressionV4(args: {\n        backend:
BackendWasm,\n        inputs: NonMaxSuppressionV4Inputs,\n        attrs: NonMaxSuppressionV4Attrs\n}): TensorInfo[]
{\n        const {backend, inputs, attrs} = args;\n        const {iouThreshold, maxOutputSize, scoreThreshold,
padToMaxOutputSize} =\n            attrs;\n        const {boxes, scores} = inputs;\n        const boxesId =
backend.dataIdMap.get(boxes.dataId).id;\n        const scoresId = backend.dataIdMap.get(scores.dataId).id;\n        const
resOffset = wasmFunc(\n            boxesId, scoresId, maxOutputSize, iouThreshold, scoreThreshold,\n            padToMaxOutputSize);\n        const {pSelectedIndices, selectedSize, pSelectedScores, pValidOutputs} =\n            parseResultStruct(backend, resOffset);\n        // Since we are not using scores for V4, we have to delete it from the
heap.\n        backend.wasm._free(pSelectedScores);\n        const selectedIndicesTensor =\n            backend.makeOutput([selectedSize], 'int32', pSelectedIndices);\n        const
validOutputsTensor = backend.makeOutput([], 'int32', pValidOutputs);\n        return [selectedIndicesTensor,
validOutputsTensor];\n    }\n\n    export const nonMaxSuppressionV4Config: KernelConfig = {\n        kernelName:
NonMaxSuppressionV4,\n        backendName: 'wasm',\n        setupFunc: setup,\n        kernelFunc: nonMaxSuppressionV4 as {} as
KernelFunc,\n    };\n\n    /**\n     * @license\n     * Copyright 2019 Google LLC. All Rights Reserved.\n     * Licensed under
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implied.\n     * See
the License for the specific language governing permissions and\n     * limitations under the License.\n     *
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*\\n\\nimport { KernelConfig, KernelFunc, NonMaxSuppressionV5, NonMaxSuppressionV5Attrs,
NonMaxSuppressionV5Inputs, TensorInfo } from '@tensorflow/tfjs-core';\\n\\nimport { BackendWasm } from
'./backend_wasm';\\n\\nimport { parseResultStruct } from './NonMaxSuppression_util';\\n\\nlet wasmFunc:\\n
(boxesId: number, scoresId: number, maxOutputSize: number,\\n   iouThreshold: number, scoreThreshold: number,
softNmsSigma: number) =>\\n   number;\\n\\nfunction setup(backend: BackendWasm): void {\\n   wasmFunc =
backend.wasm.cwrap(\\n     NonMaxSuppressionV5,\\n     'number', // Result*\\n     [\\n       'number', // boxesId\\n
       'number', // scoresId\\n       'number', // maxOutputSize\\n       'number', // iouThreshold\\n       'number', //
scoreThreshold\\n       'number', // softNmsSigma\\n     ]);\\n}\\n\\nfunction
kernelFunc(args: {\\n   backend: BackendWasm,\\n   inputs: NonMaxSuppressionV5Inputs,\\n   attrs:
NonMaxSuppressionV5Attrs\\n}): TensorInfo[] {\\n   const { backend, inputs, attrs } = args;\\n   const { iouThreshold,
maxOutputSize, scoreThreshold, softNmsSigma } = attrs;\\n   const { boxes, scores } = inputs;\\n\\n   const boxesId =
backend.dataIdMap.get(boxes.dataId).id;\\n   const scoresId = backend.dataIdMap.get(scores.dataId).id;\\n\\n   const
resOffset = wasmFunc(\\n     boxesId, scoresId, maxOutputSize, iouThreshold, scoreThreshold,\\n
softNmsSigma);\\n\\n   const { pSelectedIndices, selectedSize, pSelectedScores, pValidOutputs } =\\n
parseResultStruct(backend, resOffset);\\n\\n   // Since we are not using validOutputs for V5, we have to delete it from
the\\n   // heap.\\n   backend.wasm._free(pValidOutputs);\\n\\n   const selectedIndicesTensor =\\n
backend.makeOutput([selectedSize], 'int32', pSelectedIndices);\\n   const selectedScoresTensor =\\n
backend.makeOutput([selectedSize], 'float32', pSelectedScores);\\n\\n
   return [selectedIndicesTensor, selectedScoresTensor];\\n}\\n\\nexport const nonMaxSuppressionV5Config:
KernelConfig = {\\n   kernelName: NonMaxSuppressionV5,\\n   backendName: 'wasm',\\n   setupFunc: setup,\\n
kernelFunc: kernelFunc as { } as KernelFunc,\\n};\\n", "/*\\n * @license\\n * Copyright 2020 Google LLC. All Rights
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http://www.apache.org/licenses/LICENSE-2.0\\n * \\n * Unless required by applicable law or agreed to in writing,
software\\n * distributed under the License is distributed on an 'AS IS' BASIS,\\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\\n * See the License for the specific language
governing permissions and\\n * limitations under the License.\\n *
=====\\n
*\\nimport
{ KernelConfig, NotEqual } from '@tensorflow/tfjs-core';\\n\\nimport { createBinaryKernelConfig } from
'./binary_kernel';\\nconst supportsFullBroadcast = false;\\nexport const notEqualConfig: KernelConfig =\\n
createBinaryKernelConfig(NotEqual, supportsFullBroadcast, 'bool');\\n", "/*\\n * @license\\n * Copyright 2020
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may not use this file except in compliance with the License.\\n * You may obtain a copy of the License at\\n * \\n *
http://www.apache.org/licenses/LICENSE-2.0\\n * \\n * Unless required by applicable law or agreed to in writing,
software\\n * distributed under the License is distributed on an 'AS IS' BASIS,\\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\\n * See the License for the specific language
governing permissions and\\n * limitations under the License.\\n *
=====\\n
*\\nimport
{ KernelConfig, KernelFunc, OneHot, OneHotAttrs, OneHotInputs } from '@tensorflow/tfjs-core';\\n\\nimport
{ BackendWasm } from './backend_wasm';\\n\\nlet wasmOneHot: (\\n   indicesId: number, depth: number, onValue:
number, offValue: number,\\n   outId: number) => void;\\n\\nfunction setup(backend: BackendWasm) {\\n
wasmOneHot = backend.wasm.cwrap(OneHot, null /* void */, [\\n   'number', // indices_id\\n   'number', // depth,\\n
'number', // onValue\\n   'number', // offValue\\n   'number' // out_id\\n ]);\\n}\\n\\nfunction oneHot(\\n   args:
{ inputs: OneHotInputs, attrs: OneHotAttrs, backend: BackendWasm }) {\\n   const { inputs, backend, attrs } = args;\\n
const { indices } = inputs;\\n   const { depth, onValue, offValue } = attrs;\\n\\n   const out =
backend.makeOutput([...indices.shape, depth], 'int32');\\n   const outId = backend.dataIdMap.get(out.dataId).id;\\n\\n

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const indicesData = backend.dataIdMap.get(indices.dataId);\n const indicesId = indicesData.id;\n\nwasmOneHot(indicesId, depth,
  onValue, offValue, outId);\n\n return out;\n}\n\nexport const oneHotConfig: KernelConfig = {\n  kernelName:
OneHot,\n  backendName: 'wasm',\n  setupFunc: setup,\n  kernelFunc: oneHot as {} as KernelFunc,\n};\n\n", "/*\n *
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law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport { KernelConfig, KernelFunc, OnesLike, OnesLikeInputs } from
'@tensorflow/tfjs-core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nfunction onesLike(args: { inputs:
OnesLikeInputs, backend: BackendWasm }) {\n  const { inputs: { x }, backend } = args;\n  const out =
backend.makeOutput(x.shape, x.dtype);\n  const outVals = backendtypedArrayFromHeap(out);\n  outVals.fill(1);\n  return out;\n}\n\nexport const onesLikeConfig: KernelConfig = {\n  kernelName: OnesLike,\n  backendName:
'wasm',\n  kernelFunc: onesLike as {} as KernelFunc,\n};\n\n", "/*\n *
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software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express
or implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
=====
*\n\nimport { KernelConfig, KernelFunc, Pack, PackAttrs, PackInputs, TensorInfo, util } from '@tensorflow/tfjs-
core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nimport { concat } from './Concat';\n\nimport
{ expandDims } from './ExpandDims';\n\nexport function pack(\n  args: { inputs: PackInputs, backend:
BackendWasm, attrs: PackAttrs }):\n  TensorInfo {\n  const { inputs, backend, attrs } = args;\n  const { axis } =
attrs;\n\n  if (inputs.length === 1) {\n    return expandDims(\n      { inputs: { input: inputs[0] }, backend, attrs: { dim:
axis } });\n  }\n\n  const shape = inputs[0].shape;\n  const dtype = inputs[0].dtype;\n\n  inputs.forEach(t => {\n    util.assertShapesMatch(\n      shape, t.shape,\n      'All tensors passed to stack must have matching shapes');\n    util.assert(\n
dtype === t.dtype,\n      () => 'All tensors passed to stack must have matching dtypes');\n  });\n\n  const
intermediateTensorInfos: TensorInfo[] = [];\n  const expandedTensors = inputs.map(t => {\n    const expandedT =\n      expandDims({ inputs: { input: t }, backend, attrs: { dim: axis } });\n    intermediateTensorInfos.push(expandedT);\n  });\n\n  const result = concat({ inputs: expandedTensors, backend, attrs: { axis } });\n\n  intermediateTensorInfos.forEach(t => backend.disposeData(t.dataId));\n\n  return result;\n}\n\nexport const
packConfig: KernelConfig = {\n  kernelName: Pack,\n  backendName: 'wasm',\n  kernelFunc: pack as {} as
KernelFunc,\n};\n\n", "/*\n *
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on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
=====
*\n\nimport { KernelConfig, KernelFunc, PadV2, PadV2Attrs, PadV2Inputs, util } from '@tensorflow/tfjs-

```



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core';\n\nimport {BackendWasm} from './backend_wasm';\n\nimport {fill} from './Fill';\n\nimport {CppType}
from './types';\n\nlet wasmPadV2: (\n  xId: number, xShapeBytes: Uint8Array, xShapeLength: number, xDtype:
number,\n  prePaddingsBytes: Uint8Array, postPaddingsBytes: Uint8Array,\n  constantValue: number, outId:
number) => void;\n\nfunction setup(backend: BackendWasm) {\n  wasmPadV2 = backend.wasm.cwrap(PadV2, null
/* void */, [\n  'number', // xId\n  'array', // x.shape\n
  'number', // x.shape.length\n  'number', // x.dtype\n  'array', // pre-paddings\n  'array', // post-paddings\n
  'number', // constantValue\n  'number', // outId\n  ]);\n}\n\nfunction pad(\n  args: {inputs: PadV2Inputs, backend:
BackendWasm, attrs: PadV2Attrs}) {\n  const {inputs: {x}, backend, attrs: {paddings, constantValue}} = args;\n\n
const outShape = paddings.map(\n  (p, i) => p[0] /* beforePad */ + x.shape[i] + p[1] /* afterPad */);\n\n if
(util.sizeFromShape(x.shape) === 0) {\n  // Short-circuit the computation, since x doesn't have value, only\n //
the shape is used to compute output shape to pad.\n  return fill({\n    backend,\n    attrs: {shape: outShape, value:
constantValue, dtype: x.dtype}\n  });\n}\n\n const xId = backend.dataIdMap.get(x.dataId).id;\n const out =
backend.makeOutput(outShape, x.dtype);\n const outTensorData = backend.dataIdMap.get(out.dataId);\n const
outId = outTensorData.id;\n\n const xShapeBytes =
new Uint8Array(new Int32Array(x.shape).buffer);\n\n const prePaddingsFlat = paddings.map(padTuple =>
padTuple[0]);\n const postPaddingsFlat = paddings.map(padTuple => padTuple[1]);\n const prePaddingsBytes =\n
new Uint8Array(new Int32Array(prePaddingsFlat).buffer);\n const postPaddingsBytes =\n new
Uint8Array(new Int32Array(postPaddingsFlat).buffer);\n\n wasmPadV2(\n  xId, xShapeBytes, x.shape.length,
CppType[x.dtype], prePaddingsBytes,\n  postPaddingsBytes, constantValue, outId);\n return out;\n}\n\nexport
const padV2Config: KernelConfig = {\n  kernelName: PadV2,\n  backendName: 'wasm',\n  kernelFunc: pad as {} as
KernelFunc,\n  setupFunc: setup\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n
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http://www.apache.org/licenses/LICENSE-2.0\n *\n *\n
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an 'AS IS' BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
=====
\n
*/\n\nimport {KernelConfig, Pow} from '@tensorflow/tfjs-core';\n\nimport {createBinaryKernelConfig} from
'/binary_kernel';\n\nconst supportsFullBroadcast = false;\n\nexport const powConfig: KernelConfig =\n
createBinaryKernelConfig(Pow, supportsFullBroadcast);\n", "/*\n * @license\n * Copyright 2019 Google LLC. All
Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the 'License');\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n *\n
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BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the
License for the specific language governing permissions and\n * limitations under the License.\n *
=====
\n
*/\n\nimport {KernelConfig, KernelFunc, Prelu, PreluInputs} from '@tensorflow/tfjs-core';\n\nimport
{BackendWasm} from './backend_wasm';\n\nimport {cast} from './Cast';\n\nlet wasmPrelu: (xId: number,
weightsId: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n  wasmPrelu =
backend.wasm.cwrap(Prelu, null /* void */, [\n  'number', // x_id\n  'number', // weights_id\n  'number' //
out_id\n  ]);\n}\n\nfunction prelu(args: {inputs: PreluInputs, backend: BackendWasm}) {\n  const {inputs, backend}
= args;\n  const {x, alpha} = inputs;\n  const xId = backend.dataIdMap.get(x.dataId).id;\n
const weightsId = backend.dataIdMap.get(alpha.dataId).id;\n\n let inputId = xId;\n const input = x;\n let
castedInput = input;\n if (input.dtype !== 'float32') {\n  castedInput = cast({backend, inputs: {x}, attrs: {dtype:
'float32'}});\n  inputId = backend.dataIdMap.get(castedInput.dataId).id;\n }\n\n const out =

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backend.makeOutput(x.shape, 'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n
wasmPrelu(inputId, weightsId, outId);\n\n if (input.dtype !== 'float32') {\n
backend.disposeData(castedInput.dataId);\n }\n return out;\n}\n\nexport const preluConfig: KernelConfig = {\n
kernelName: Prelu,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: prelu as {} as
KernelFunc\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
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WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific
language governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport {backend_util, KernelConfig, KernelFunc, Prod, ProdAttrs, ProdInputs, TensorInfo, util} from
'@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport
{permuteAxesAndTranspose} from './kernel_utils';\n\nimport {CppType} from './types';\n\nlet wasmProd: (\n
xId: number, reduceSize: number,\n dtype: number, outId: number) => void;\n\nfunction setup(backend:
BackendWasm): void {\n  wasmProd = backend.wasm.cwrap(Prod, null /*void*/, [\n    'number',\n    'number',\n    'number',\n    'number'\n  ]);\n}\n\nfunction prod(args: {\n  backend: BackendWasm,\n  inputs: ProdInputs,\n  attrs: ProdAttrs\n}):
TensorInfo {\n  const {backend, inputs, attrs} = args;\n  const {axis, keepDims} = attrs;\n  const {x} = inputs;\n  const xId = backend.dataIdMap.get(x.dataId).id;\n  let inputId = xId;\n  let input = x;\n  const {transposed, axes,
originalAxes, inputWasTransposed} =\n    permuteAxesAndTranspose(x, axis, backend);\n  let reductionAxes =
axes;\n  if (inputWasTransposed) {\n    const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n    if
(transposedId !== xId) {\n      // transpose was not a no-op. We will need to dispose of this\n      // once we are
done.\n      input = transposed;\n      inputId = transposedId;\n      reductionAxes =
backend_util.getInnerMostAxes(\n        reductionAxes.length, input.shape.length);\n    }\n  }\n  backend_util.assertAxesAreInnerMostDims(\n    'prod', reductionAxes, input.shape.length);\n  const [outShape,
reduceShape]\n    =\n    backend_util.computeOutAndReduceShapes(input.shape, reductionAxes);\n  const reduceSize =
util.sizeFromShape(reduceShape);\n  const out = backend.makeOutput(outShape, input.dtype);\n  if
(util.sizeFromShape(input.shape) !== 0) {\n    const outId = backend.dataIdMap.get(out.dataId).id;\n    wasmProd(inputId, reduceSize, CCppType[out.dtype], outId);\n  }\n  if (inputWasTransposed) {\n    // dispose of
the transposed tensor.\n    backend.disposeData(transposed.dataId);\n  }\n  if (keepDims) {\n    // reshape\n    const
newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n    out.shape = newShape;\n  }\n  return out;\n}\n\nexport const prodConfig: KernelConfig = {\n  kernelName: Prod,\n  backendName: 'wasm',\n  setupFunc: setup,\n  kernelFunc: prod as {} as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2020 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not
use this file except in
compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport {KernelConfig, KernelFunc, Range, RangeAttrs, TensorInfo} from '@tensorflow/tfjs-core';\n\nimport
{BackendWasm} from '../backend_wasm';\n\nimport {rangeImplCPU} from './kernel_utils/shared';\n\nexport const
range =\n  (args: {backend: BackendWasm, attrs: RangeAttrs}): TensorInfo => {\n    const {backend, attrs} =
args;\n    const {start, stop, step, dtype} = attrs;\n    const values = rangeImplCPU(start, stop, step, dtype);\n  }

```



```
'number' // halfPixelCenters\n    'number' // outId\n ]);\n}\n\nfunction resizeBilinear(args: {\n    backend:\nBackendWasm,\n    inputs: ResizeBilinearInputs,\n    attrs: ResizeBilinearAttrs\n}): TensorInfo {\n    const {backend,\ninputs, attrs} = args;\n    const {images} = inputs;\n    const {alignCorners, halfPixelCenters, size}\n= attrs;\n    const [newHeight, newWidth] = size;\n    const [batch, oldHeight, oldWidth, numChannels] =\nimages.shape;\n    const outShape = [batch, newHeight, newWidth, numChannels];\n\n    let xData =\nbackend.dataIdMap.get(images.dataId);\n    let castedData;\n    if (xData.dtype !== 'float32') {\n        castedData =\ncast({backend, inputs: {x: images}, attrs: {dtype: 'float32'}});\n        xData =\nbackend.dataIdMap.get(castedData.dataId);\n    }\n    const xId = xData.id;\n    const out =\nbackend.makeOutput(outShape, 'float32');\n    if (util.sizeFromShape(images.shape) === 0) {\n        return out;\n    }\n    const outId = backend.dataIdMap.get(out.dataId).id;\n\n    wasmResizeBilinear(\n        xId, batch, oldHeight,\noldWidth, numChannels, newHeight, newWidth,\n        alignCorners ? 1 : 0, halfPixelCenters ? 1 : 0, outId);\n\n    if\n(castedData != null) {\n        backend.disposeData(castedData.dataId);\n    }\n\n    return out;\n}\n\nexport const\nresizeBilinearConfig: KernelConfig = {\n    kernelName: ResizeBilinear,\n\n    backendName: 'wasm',\n    setupFunc: setup,\n    kernelFunc: resizeBilinear as {} as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version\n2.0 (the \"License\"));\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n\n=====\n*/\nimport {KernelConfig, KernelFunc, Reverse, ReverseAttrs, ReverseInputs, TensorInfo, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nimport {identity} from './Identity';\nimport {reshape} from './Reshape';\n\nlet wasmReverse: (\n    xId: number, axes:\nUint8Array, axesLength: number, outShape: Uint8Array,\n    outShapeLength: number, outId: number)\n=> void;\n\nfunction setup(backend: BackendWasm) {\n    wasmReverse = backend.wasm.cwrap(Reverse, null, [\n'number', // x_id\n'array', // axes\n'number', // axes_length\n'array', // out_shape\n'number', // out_shape_length\n'number' // out_id\n]);\n\n    export function reverse(\nargs: {inputs: ReverseInputs,\nbackend: BackendWasm, attrs: ReverseAttrs}) {\n        TensorInfo {\n            const {inputs, backend, attrs} = args;\n            const {x} = inputs;\n            const {dims} = attrs;\n\n            const axes = util.parseAxisParam(dims, x.shape);\n\n            if (x.shape.length === 0) {\n                return identity({inputs: {x}, backend});\n            }\n\n            const out = backend.makeOutput(x.shape, x.dtype);\n            const xId = backend.dataIdMap.get(x.dataId).id;\n            const outId = backend.dataIdMap.get(out.dataId).id;\n\n            const axesBytes = new Uint8Array(new Int32Array(axes).buffer);\n            const outShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);\n\n            wasmReverse(\n                xId, axesBytes, axes.length, outShapeBytes, x.shape.length,\noutId);\n\n            const reshaped = reshape({inputs: {x: out}, attrs: {shape: x.shape}, backend});\n\n            backend.disposeData(out.dataId);\n            return reshaped;\n        }\n\n        export const reverseConfig: KernelConfig = {\n            kernelName: Reverse,\n            backendName: 'wasm',\n            kernelFunc: reverse as {} as KernelFunc,\n            setupFunc: setup\n        };\n\n        /**\n         * @license\n         * Copyright 2019 Google LLC. All Rights Reserved.\n         * Licensed under the Apache License, Version 2.0 (the \"License\"));\n         * you may not use this file except in compliance with the License.\n         * You may obtain a copy of the License at\n         * http://www.apache.org/licenses/LICENSE-2.0\n         * Unless required by applicable law or agreed to in writing, software\n         * distributed under the License is distributed on an \"AS IS\" BASIS,\n         * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n         * See the License for the specific language governing permissions and\n         * limitations under the License.\n         */\n\n        =====\n\n        /*\n        import {KernelConfig, KernelFunc, RotateWithOffset, RotateWithOffsetAttrs, RotateWithOffsetInputs,\nTensorInfo} from '@tensorflow/tfjs-core';\n        import {backend_util} from '@tensorflow/tfjs-core';\n        import {BackendWasm} from '../backend_wasm';\n\n        let wasmRotate: (\n            xId: number, batch: number, imageHeight:
```

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number, imageWidth: number,\n  numChannels: number, radians: number, centerX: number, centerY: number,\n  fillBytes: Uint8Array, fillLength: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n  wasmRotate = backend.wasm.cwrap(RotateWithOffset, null /* void */, [\n    'number', // xId\n    'number', // batch\n    'number', // imageHeight\n    'number', // imageWidth\n    'number', // numChannels\n    'number', // radians\n    'number', // centerX\n    'number', // centerY\n    'array', // fillBytes\n    'number', // fillLength\n    'number', // outId\n  ]);\n\n  export function rotateWithOffset(args: {\n    inputs: RotateWithOffsetInputs,\n    backend: BackendWasm,\n    attrs: RotateWithOffsetAttrs\n  }): TensorInfo {\n    const {inputs, backend, attrs} = args;\n    const {image} = inputs;\n    const {radians, fillValue, center} = attrs;\n\n    const out = backend.makeOutput(image.shape, image.dtype);\n    const imageId = backend.dataIdMap.get(image.dataId).id;\n    const outId = backend.dataIdMap.get(out.dataId).id;\n\n    const [batch, imageHeight, imageWidth, numChannels] = image.shape;\n    const [centerX, centerY] =\n      backend_util.getImageCenter(center, imageHeight, imageWidth);\n    const fillIsBlack = fillValue === 0;\n    const fullOpacityValue = 255;\n    const fillValues = typeof fillValue === 'number' ?\n      [fillValue, fillValue, fillValue, fillIsBlack ? 0 : fullOpacityValue] :\n      [...fillValue, fullOpacityValue];\n    const fillBytes = new Uint8Array(new\n      Int32Array(fillValues).buffer);\n\n    wasmRotate(\n      imageId, batch, imageHeight, imageWidth, numChannels,\n      radians, centerX,\n      centerY, fillBytes, fillValues.length, outId);\n    return out;\n  }\n\n  export const rotateWithOffsetConfig: KernelConfig = {\n    kernelName: RotateWithOffset,\n    backendName: 'wasm',\n    kernelFunc: rotateWithOffset as {} as KernelFunc,\n    setupFunc: setup\n  };
\n  /**\n   * @license\n   * Copyright 2021 Google LLC. All Rights Reserved.\n   * Licensed under the Apache License, Version 2.0 (the "License");\n   * you may not use this file except in compliance with the License.\n   * You may obtain a copy of the License at\n   * http://www.apache.org/licenses/LICENSE-2.0\n   * Unless required by applicable law or agreed to in writing,\n   * software\n   * distributed under the License is distributed on an "AS IS" BASIS,\n   * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n   * See the License for the specific language governing permissions\n   * and\n   * limitations under the License.\n   */\n\n  =====\n\n  * \n\n  import {KernelConfig, Round} from '@tensorflow/tfjs-core';\n  import {createUnaryKernelConfig} from './unary_kernel';\n  export const roundConfig: KernelConfig = createUnaryKernelConfig(Round);\n\n  /**\n   * @license\n   * Copyright 2019 Google LLC. All Rights Reserved.\n   * Licensed under the Apache License, Version 2.0 (the "License");\n   * you may not use this file except in compliance with the License.\n   * You may obtain a copy of the License at\n   * http://www.apache.org/licenses/LICENSE-2.0\n   * Unless required by applicable law or agreed to in writing, software\n   * distributed under the License is distributed on an "AS IS" BASIS,\n   * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n   * See the License for the specific language governing permissions and\n   * limitations under the License.\n   */\n\n  =====\n\n  * \n\n  import {KernelConfig, Rsqrt} from '@tensorflow/tfjs-core';\n  import {createUnaryKernelConfig} from './unary_kernel';\n  export const rsqrtConfig: KernelConfig = createUnaryKernelConfig(Rsqrt);\n\n  /**\n   * @license\n   * Copyright 2019 Google LLC. All Rights Reserved.\n   * Licensed under the Apache License, Version 2.0 (the "License");\n   * you may not use this file except in compliance with the License.\n   * You may obtain a copy of the License at\n   * http://www.apache.org/licenses/LICENSE-2.0\n   * Unless required by applicable law or agreed to in writing, software\n   * distributed under the License is distributed on an "AS IS" BASIS,\n   * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n   * See the License for the specific language governing permissions and\n   * limitations under the License.\n   */\n\n  =====\n\n  * \n\n  import {KernelConfig, KernelFunc, scatter_util, ScatterNd, ScatterNdAttrs, ScatterNdInputs, TensorInfo, util} from '@tensorflow/tfjs-core';\n  import {BackendWasm} from '../backend_wasm';\n  import {CppType} from './types';\n  let wasmScatterNd: (\n    indicesId: number, updatesId: number, dtype: CppDType, sliceRank:

```

```

number,\n  numUpdates: number, sliceSize: number, strides: Uint8Array,\n  outputSize: number, outId: number)
=> void;\n\nfunction setup(backend: BackendWasm): void {\n  wasmScatterNd = backend.wasm.cwrap(ScatterNd,
null /*void*/, [\n  'number', // indicesId\n  'number', // updatesId\n  'number', // dtype\n  'number', //
sliceRank\n  'number', // numUpdates\n  'number', // sliceSize\n  'array', // strides\n  'number', // outputSize\n  'number' // outId\n  ]);\n}\n\nfunction scatterNd(\n  args:\n    { backend: BackendWasm, inputs:
ScatterNdInputs, attrs:
  ScatterNdAttrs }):\n  TensorInfo {\n    const { backend, inputs, attrs } = args;\n    const { indices, updates } = inputs;\n
const { shape } = attrs;\n\n    const out = backend.makeOutput(shape, updates.dtype);\n    if (util.sizeFromShape(shape)
=== 0) {\n      return out;\n    }\n\n    const { sliceRank, numUpdates, sliceSize, strides, outputSize } =\n
scatter_util.calculateShapes(updates, indices, shape);\n\n    const indicesData =
backend.dataIdMap.get(indices.dataId);\n    const indicesId = indicesData.id;\n\n    const updatesData =
backend.dataIdMap.get(updates.dataId);\n    const updatesId = updatesData.id;\n\n    const stridesBytes = new
Uint8Array(new Int32Array(strides).buffer);\n\n    const outId = backend.dataIdMap.get(out.dataId).id;\n
wasmScatterNd(\n      indicesId, updatesId, CppDType[updates.dtype], sliceRank, numUpdates,\n      sliceSize,
stridesBytes, outputSize, outId);\n\n    return out;\n  }\n}\n\nexport const scatterNdConfig: KernelConfig = {\n
kernelName: ScatterNd,\n  backendName: 'wasm',\n
  setupFunc: setup,\n  kernelFunc: scatterNd as { } as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2020
Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you
may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport { KernelConfig, KernelFunc, Select, SelectInputs, util } from '@tensorflow/tfjs-core';\n\nimport
{ BackendWasm } from '../backend_wasm';\n\nlet wasmSelect: (\n  conditionId: number, tId: number, eId:
number, offset: number,\n  outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n  wasmSelect
= backend.wasm.cwrap('SelectV2', null, [\n  'number', // conditionId\n  'number', // tId\n  'number', // eId\n
'number', // offset\n  'number', // outId\n  ]);\n}\n\nfunction select(args: { inputs: SelectInputs, backend:
BackendWasm }) {\n  const { inputs, backend } = args;\n  const { condition, t, e } = inputs;\n\n  const conditionId =
backend.dataIdMap.get(condition.dataId).id;\n  const tId = backend.dataIdMap.get(t.dataId).id;\n  const eId =
backend.dataIdMap.get(e.dataId).id;\n  const out = backend.makeOutput(t.shape, t.dtype);\n  const outId =
backend.dataIdMap.get(out.dataId).id;\n\n  const cRank = condition.shape.length;\n  const tRank =
t.shape.length;\n\n  const offset = cRank === 0 || cRank > 1 || tRank === 1 ?\n    1 : \n
util.sizeFromShape(t.shape.slice(1));\n\n  wasmSelect(conditionId, tId, eId, offset, outId);\n  return out;\n}\n\nexport
const selectConfig:
  KernelConfig = {\n    kernelName: Select,\n    backendName: 'wasm',\n    kernelFunc: select as { } as KernelFunc,\n
setupFunc: setup\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed
under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
=====
*\n\nimport { KernelConfig, KernelFunc, Sigmoid, SigmoidInputs, TensorInfo, util } from '@tensorflow/tfjs-
core';\n\nimport { BackendWasm }

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from './backend_wasm';\n\nlet wasmFunc: (xId: number, outId: number) => void;\n\nfunction setup(backend:
BackendWasm): void {\n  wasmFunc = backend.wasm.cwrap(Sigmoid, null /* void */, ['number',
'number']);\n}\n\nfunction sigmoid(args: { backend: BackendWasm, inputs: SigmoidInputs }):\n  TensorInfo {\n  const { backend, inputs: { x } } = args;\n  const xId = backend.dataIdMap.get(x.dataId).id;\n  const out =
backend.makeOutput(x.shape, x.dtype);\n  const outId = backend.dataIdMap.get(out.dataId).id;\n  // Short-circuit
zero-sized tensors.\n  if (util.sizeFromShape(out.shape) === 0) {\n    return out;\n  }\n  wasmFunc(xId, outId);\n  return out;\n}\n\nexport const sigmoidConfig: KernelConfig = {\n  kernelName: 'Sigmoid',\n  backendName:
'wasm',\n  setupFunc: setup,\n  kernelFunc: sigmoid as { } as KernelFunc\n};\n\n"/**\n * @license\n * Copyright
2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n *
you may not use this file except
in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
\n
*/\nimport { KernelConfig, Sin } from '@tensorflow/tfjs-core';\nimport { createUnaryKernelConfig } from
'./unary_kernel';\nexport const sinConfig: KernelConfig = createUnaryKernelConfig(Sin);\n\n"/**\n * @license\n *
Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
\"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
\n
*/\nimport { KernelConfig, KernelFunc, Softmax, SoftmaxAttrs, SoftmaxInputs, TensorInfo, util } from
'@tensorflow/tfjs-core';\nimport { BackendWasm } from './backend_wasm';\nlet wasmFunc: (xId: number, outId:
number, channels: number, batch: number) =>\n  void;\n\nfunction setup(backend: BackendWasm): void {\n
  wasmFunc = backend.wasm.cwrap(Softmax, null /* void */, [\n    'number', // xId\n    'number', // outId\n    'number', // channels\n    'number' // batch\n  ]);\n}\n\nfunction softmax(\n  args: { backend: BackendWasm,
inputs: SoftmaxInputs, attrs: SoftmaxAttrs }):\n  TensorInfo {\n  const { backend, inputs: { logits }, attrs: { dim } } =
args;\n  const xId = backend.dataIdMap.get(logits.dataId).id;\n  const out = backend.makeOutput(logits.shape,
logits.dtype);\n  const outId = backend.dataIdMap.get(out.dataId).id;\n  const channels = logits.shape[dim];\n
  const batch = util.sizeFromShape(logits.shape) / channels;\n  // Short-circuit zero-sized tensors.\n  if
(util.sizeFromShape(out.shape) === 0) {\n    return out;\n  }\n  wasmFunc(xId, outId, channels, batch);\n  return
out;\n}\n\nexport const softmaxConfig: KernelConfig = {\n  kernelName: Softmax,\n  backendName: 'wasm',\n
  setupFunc: setup,\n  kernelFunc: softmax as { } as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2021 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not
use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
\n
*/\nimport { backend_util, KernelConfig, KernelFunc, ReshapeAttrs, ReshapeInputs, SpaceToBatchND,
SpaceToBatchNDAttrs, SpaceToBatchNDInputs, TensorInfo, TransposeAttrs, TransposeInputs, util } from
'@tensorflow/tfjs-core';\nimport { BackendWasm } from './backend_wasm';\nimport { padV2Config } from

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'./PadV2';\nimport {reshape} from './Reshape';\nimport {transpose} from './Transpose';\n\nfunction
spaceToBatchND(args: {\n  inputs: SpaceToBatchNDInputs,\n  backend: BackendWasm,\n  attrs:
SpaceToBatchNDAttrs\n}) {\n  const {inputs, backend,
    attrs} = args;\n  const {x} = inputs;\n  const {blockShape, paddings} = attrs;\n\n  const prod =
util.sizeFromShape(blockShape);\n  const completePaddings: Array<[number, number]> = [[0, 0]];\n
completePaddings.push(...(paddings as Array<[number, number]>));\n  for (let i = 1 + blockShape.length; i <
x.shape.length; ++i) {\n    completePaddings.push([0, 0]);\n  }\n  const paddedX = padV2Config.kernelFunc({\n
inputs: {x},\n  backend,\n  attrs: {paddings: completePaddings, constantValue: 0}\n}) as TensorInfo;\n  const
reshapedPaddedShape =\n    backend_util.getReshaped(paddedX.shape, blockShape, prod, false);\n  const
permutedReshapedPaddedPermutation = backend_util.getPermuted(\n    reshapedPaddedShape.length,
blockShape.length, false);\n  const flattenShape =\n    backend_util.getReshapedPermuted(paddedX.shape,
blockShape, prod, false);\n  const reshapeInputs: ReshapeInputs = {x: paddedX};\n  const reshapeAttrs:
ReshapeAttrs = {shape: reshapedPaddedShape};\n
  const paddedXReshaped =\n    reshape({inputs: reshapeInputs, backend, attrs: reshapeAttrs});\n  const
transposeInputs: TransposeInputs = {x: paddedXReshaped};\n  const transposeAttrs:\n    TransposeAttrs = {perm:
permutedReshapedPaddedPermutation};\n  const paddedXT =\n    transpose({inputs: transposeInputs, backend,
attrs: transposeAttrs});\n  const resultReshapeInputs: ReshapeInputs = {x: paddedXT};\n  const
resultReshapeAttrs: ReshapeAttrs = {shape: flattenShape};\n  const result = reshape(\n    {inputs:
resultReshapeInputs, backend, attrs: resultReshapeAttrs});\n  backend.disposeData(paddedX.dataId);\n
backend.disposeData(paddedXReshaped.dataId);\n  backend.disposeData(paddedXT.dataId);\n  return
result;\n}\n\nexport const spaceToBatchNDConfig: KernelConfig = {\n  kernelName: SpaceToBatchND,\n
backendName: 'wasm',\n  kernelFunc: spaceToBatchND as {\n    }\n  as KernelFunc\n};\n\n"/**\n * @license\n *
Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under
the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n */
=====
*\n\nimport {KernelConfig, KernelFunc, SplitV, SplitVAttrs, SplitVInputs, util} from '@tensorflow/tfjs-
core';\nimport {backend_util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from
'./backend_wasm';\nimport {slice} from './Slice';\n\nexport function splitV(\n  args: {inputs: SplitVInputs, attrs:
SplitVAttrs, backend: BackendWasm}) {\n  const {inputs,
    attrs, backend} = args;\n  const {x} = inputs;\n  const {numOrSizeSplits, axis} = attrs;\n\n  const $axis =
util.parseAxisParam(axis, x.shape)[0];\n  const splitSizes = backend_util.prepareSplitSize(x, numOrSizeSplits,
$axis);\n  const begin = new Array(x.shape.length).fill(0);\n  const size = x.shape.slice();\n  return splitSizes.map(s
=> {\n    const xSliceSize = [...size];\n    xSliceSize[$axis] = s;\n    const xSlice =\n      slice({inputs: {x}, attrs:
{begin, size: xSliceSize}, backend});\n    begin[$axis] += s;\n    return xSlice;\n  });\n}\n\nexport const
splitVConfig: KernelConfig = {\n  kernelName: SplitV,\n  backendName: 'wasm',\n  kernelFunc: splitV as {\n    }\n  as
KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n *
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distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n */
=====

```



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*\n\nimport { KernelConfig, Sqrt } from '@tensorflow/tfjs-core';\n\nimport { createUnaryKernelConfig } from
'./unary_kernel';\nexport const sqrtConfig: KernelConfig = createUnaryKernelConfig(Sqrt);\n", "/*\n * @license\n
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agreed to in writing, software\n
 * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR
CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing
permissions and\n * limitations under the License.\n *
=====
*\n\nimport { KernelConfig, Square } from '@tensorflow/tfjs-core';\n\nimport { createUnaryKernelConfig } from
'./unary_kernel';\nexport const squareConfig: KernelConfig = createUnaryKernelConfig(Square);\n", "/*\n * @license\n
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2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a
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WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific
language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport { KernelConfig, SquaredDifference } from '@tensorflow/tfjs-core';\n\nimport { createBinaryKernelConfig }
from './binary_kernel';\nconst supportsFullBroadcast = true;\nexport const squaredDifferenceConfig: KernelConfig
=\n  createBinaryKernelConfig(SquaredDifference, supportsFullBroadcast);\n", "/*\n * @license\n
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IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n *
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=====
*\n\nimport { KernelConfig, KernelFunc, Step, StepAttrs, StepInputs, TensorInfo } from '@tensorflow/tfjs-
core';\n\nimport { BackendWasm } from './backend_wasm';\n\nimport { CppDType } from './types';\n\nlet wasmStep:
(xId: number, alpha: number, dtype: number, outId: number) =>\n  void;\n\nfunction setup(backend:
BackendWasm): void {\n  wasmStep = backend.wasm.cwrap(Step, null /*void*/, [\n    'number', // x_id\n
'number', // alpha\n    'number', // dtype\n    'number', // out_id\n  ]);\n\n  function step(\n    args: { backend:
BackendWasm, inputs: StepInputs, attrs: StepAttrs }):\n    TensorInfo {\n    const { backend, inputs, attrs } = args;\n
const { alpha } = attrs;\n    const { x } = inputs;\n    const xId =
backend.dataIdMap.get(x.dataId).id;\n\n    const out = backend.makeOutput(x.shape, x.dtype);\n    const outId =
backend.dataIdMap.get(out.dataId).id;\n    wasmStep(xId, alpha, CppDType[x.dtype], outId);\n    return
out;\n  }\n\n  export const stepConfig: KernelConfig = {\n    kernelName: Step,\n    backendName: 'wasm',\n    setupFunc:
setup,\n    kernelFunc: step as { } as KernelFunc\n  };\n", "/*\n * @license\n
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the

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*
\n\nimport {KernelConfig, KernelFunc, slice_util, StridedSlice, StridedSliceAttrs, StridedSliceInputs, TensorInfo,
util} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from './backend_wasm';\n\nimport {reshape} from
 './Reshape';\n\nimport {slice} from './Slice';\n\nlet wasmStridedSlice: (\n  xId: number, xStridesBytes: Uint8Array,
xRank: number,\n  beginBytes: Uint8Array, endBytes: Uint8Array, stridesBytes: Uint8Array,\n  outShapeBytes:
Uint8Array, outStridesBytes: Uint8Array,\n  outShapeLength: number, outId: number) => void;\n\nfunction
setup(backend: BackendWasm): void {\n  wasmStridedSlice = backend.wasm.cwrap(StridedSlice, null /*void*/, [\n
'number', // xId\n 'array', // xStrides\n 'number', // xRank\n 'array', // beginBytes\n 'array', // endBytes\n
'array', // stridesBytes\n 'array', // outShapeBytes\n 'array', // outStridesBytes\n 'number',
// outShapeLength\n 'number', // outId\n ]);\n}\n\nexport function stridedSlice(args: {\n  backend:
BackendWasm,\n  inputs: StridedSliceInputs,\n  attrs: StridedSliceAttrs\n}): TensorInfo {\n  const {backend, inputs,
attrs} = args;\n  const {x} = inputs;\n  const {\n    begin,\n    end,\n    strides,\n    beginMask,\n    endMask,\n
ellipsisMask,\n    newAxisMask,\n    shrinkAxisMask\n  } = attrs;\n  const {\n    finalShapeSparse,\n    finalShape,\n    isIdentity,\n    sliceDim0,\n    isSimpleSlice,\n    begin: $begin,\n    end: $end,\n    strides: $strides\n
  } =\n    slice_util.sliceInfo(\n      x.shape, begin, end, strides, beginMask, endMask, ellipsisMask,\n      newAxisMask, shrinkAxisMask);\n  let result;\n  if (isIdentity) {\n    // Optimization #1, slice is a no-op plus
reshape\n    result = reshape({inputs: {x}, backend, attrs: {shape: finalShape}});\n  } else if (sliceDim0 ||
isSimpleSlice) {\n    // Optimization #2, slice is memory contiguous
(only occurs in dim 0)\n    util.assert(\n      x.shape.length >= 1,\n      () => `Input must have rank at least 1, got:
${x.shape.length}`);\n    const size = slice_util.computeOutShape($begin, $end, $strides);\n    // To tolerate
begin[0] > end[0] (a 0-output slice), we min(begin, end).\n    const sliced = slice({inputs: {x}, backend, attrs:
{begin: $begin, size}});\n    result =\n      reshape({inputs: {x: sliced}, backend, attrs: {shape: finalShape}});\n    backend.disposeData(sliced.dataId);\n  } else {\n    const out = backend.makeOutput(finalShapeSparse,
'float32');\n    const xId = backend.dataIdMap.get(x.dataId).id;\n    const xStridesBytes =\n      new
Uint8Array(new Int32Array(util.computeStrides(x.shape)).buffer);\n    const beginBytes = new Uint8Array(new
Int32Array($begin).buffer);\n    const endBytes = new Uint8Array(new Int32Array($end).buffer);\n    const
stridesBytes = new Uint8Array(new Int32Array($strides).buffer);\n    const outputShapeBytes =\n      new
Uint8Array(new Int32Array(finalShapeSparse).buffer);\n    const outStridesBytes = new Uint8Array(\n      new
Int32Array(util.computeStrides(finalShapeSparse)).buffer);\n    const outId =
backend.dataIdMap.get(out.dataId).id;\n    wasmStridedSlice(\n      xId, xStridesBytes, x.shape.length,
beginBytes, endBytes, stridesBytes,\n      outputShapeBytes, outStridesBytes, finalShapeSparse.length, outId);\n\n
result = reshape({inputs: {x: out}, backend, attrs: {shape: finalShape}});\n    backend.disposeData(out.dataId);\n
  }\n  return result;\n}\n\nexport const stridedSliceConfig: KernelConfig = {\n  kernelName: StridedSlice,\n
backendName: 'wasm',\n  setupFunc: setup,\n  kernelFunc: stridedSlice as {} as KernelFunc\n};\n\n"/**\n *
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WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific
language governing permissions and\n * limitations under the License.\n */
\n\nimport {KernelConfig, Sub} from '@tensorflow/tfjs-core';\n\nimport {createBinaryKernelConfig} from
 './binary_kernel';\n\nconst supportsFullBroadcast = true;\n\nexport const subConfig: KernelConfig =\n  createBinaryKernelConfig(Sub, supportsFullBroadcast);\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All
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file except in compliance with the License.\n * You may obtain a copy of the License at\n */

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* \nimport {backend_util, KernelConfig, KernelFunc, Sum, SumAttrs, SumInputs, TensorInfo, util} from
'@tensorflow/tfjs-core'; \nimport {BackendWasm} from './backend_wasm'; \nimport
{permuteAxesAndTranspose} from './kernel_utils'; \nimport {CppType} from './types'; \n\nlet wasmSum: (xId:
number, reduceSize: number, dtype: number, outId: number) => \n void; \n\nfunction setup(backend:
BackendWasm): void { \n  wasmSum = backend.wasm.cwrap(Sum, null /*void*/, [ \n    'number', // input_id \n
'number', // reduce_size \n    'number', // dtype \n
'number', // out_id \n  ]); \n\n  \n\nfunction sum(args: {backend: BackendWasm, inputs: SumInputs, attrs:
SumAttrs}): \n  TensorInfo { \n    const {backend, inputs, attrs} = args; \n    const {axis, keepDims} = attrs; \n    const
{x} = inputs; \n    const xId = backend.dataIdMap.get(x.dataId).id; \n    let inputId = xId; \n    let input = x; \n\n    const
{transposed, axes, originalAxes, inputWasTransposed} = \n      permuteAxesAndTranspose(x, axis, backend); \n\n    let reductionAxes = axes; \n    if (inputWasTransposed) { \n      const transposedId =
backend.dataIdMap.get(transposed.dataId).id; \n      if (transposedId !== xId) { \n        // transpose was not a no-op. We
will need to dispose of this \n        // once we are done. \n        input = transposed; \n        inputId = transposedId; \n
        reductionAxes = backend_util.getInnerMostAxes(\n          reductionAxes.length, input.shape.length); \n      } \n    } \n\n    backend_util.assertAxesAreInnerMostDims(\n      'sum', reductionAxes, input.shape.length); \n    const [outShape,
reduceShape]
= \n      backend_util.computeOutAndReduceShapes(input.shape, reductionAxes); \n    const reduceSize =
util.sizeFromShape(reduceShape); \n\n    const out = backend.makeOutput(outShape, input.dtype); \n    if
(util.sizeFromShape(input.shape) !== 0) { \n      const outId = backend.dataIdMap.get(out.dataId).id; \n
      wasmSum(inputId, reduceSize, CCppType[out.dtype], outId); \n    } \n\n    if (inputWasTransposed) { \n      // dispose of
the transposed tensor. \n      backend.disposeData(transposed.dataId); \n    } \n\n    if (keepDims) { \n      // reshape \n      const
newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes); \n      out.shape = newShape; \n    } \n\n    return out; \n  } \n\n  \n\nexport const sumConfig: KernelConfig = { \n    kernelName: Sum, \n    backendName: 'wasm', \n
    setupFunc: setup, \n    kernelFunc: sum as { } as KernelFunc \n  }; \n\n  /** \n   * @license \n   * Copyright 2021 Google
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* \nimport {KernelConfig, Tan} from '@tensorflow/tfjs-core'; \nimport {createUnaryKernelConfig} from
'/unary_kernel'; \nexport const tanConfig: KernelConfig = createUnaryKernelConfig(Tan); \n\n  /** \n   * @license \n   * Copyright 2019 Google LLC. All Rights Reserved. \n   * Licensed under the Apache License, Version 2.0 (the
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*\\nimport {KernelConfig, Tanh} from '@tensorflow/tfjs-core';\\nimport {createUnaryKernelConfig} from
'./unary_kernel';\\nexport const tanhConfig: KernelConfig = createUnaryKernelConfig(Tanh);\\n", "/*\\n * @license\\n
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\\n * See the License for
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*\\n\\nimport {KernelConfig, KernelFunc, Tile, TileAttrs, TileInputs} from '@tensorflow/tfjs-core';\\nimport
{BackendWasm} from './backend_wasm';\\nimport {CppDType} from './types';\\n\\nlet wasmTile: (\\n  xId:
number, xShape: Uint8Array, xShapeSize: number, newShape: Uint8Array,\\n  newShapeSize: number, dtype:
number, outId: number) => void;\\n\\nfunction setup(backend: BackendWasm) {\\n  wasmTile =
backend.wasm.cwrap(Tile, null /* void */, [\\n    'number', // x_id\\n    'array', // x_shape\\n    'number', //
x_shape.length\\n    'array', // new_shape\\n    'number', // new_shape.length\\n    'number' // out_id\\n
  ]);\\n}\\n\\nfunction tile(\\n  args: {inputs: TileInputs, backend: BackendWasm, attrs: TileAttrs}) {\\n  const {inputs,
backend, attrs} = args;\\n  const {x} = inputs;\\n  const xId = backend.dataIdMap.get(x.dataId).id;\\n  const {reps} =
attrs;\\n\\n  const newShape: number[] = new Array(x.shape.length);\\n  for (let i = 0; i < newShape.length; i++) {\\n
    newShape[i] = x.shape[i] * reps[i];\\n  }\\n  const xShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);\\n
const newShapeBytes = new Uint8Array(new Int32Array(newShape).buffer);\\n\\n  const out =
backend.makeOutput(newShape, x.dtype);\\n  const outId = backend.dataIdMap.get(out.dataId).id;\\n  wasmTile(\\n
    xId, xShapeBytes, x.shape.length, newShapeBytes, newShape.length,\\n    CppDType[out.dtype], outId);\\n  return
out;\\n}\\n\\nexport const tileConfig: KernelConfig = {\\n  kernelName: Tile,\\n  backendName: 'wasm',\\n  setupFunc:
setup,\\n  kernelFunc: tile as {} as KernelFunc\\n};\\n", "/*\\n * @license\\n * Copyright 2020 Google LLC. All
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OR CONDITIONS OF ANY KIND, either express or implied.\\n * See the License for the specific language
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*\\n\\nimport {KernelConfig, KernelFunc, TensorInfo, TopK, TopKAttrs, TopKInputs} from '@tensorflow/tfjs-
core';\\n\\nimport {BackendWasm} from './backend_wasm';\\nimport {CppDType} from './types';\\n\\nlet wasmTopK:
(\\n  xId: number, xShapeBytes: Uint8Array, xShapeLength: number,\\n  xDtype: CppDType, k: number, sorted:
boolean, outValuesId:
number,\\n  outIndicesId: number) => void;\\n\\nfunction setup(backend: BackendWasm) {\\n  wasmTopK =
backend.wasm.cwrap(TopK, null /* void */, [\\n    'number', // xId\\n    'array', // x_shape\\n    'number', //
x_shape.length\\n    'number', // x_dtype\\n    'number', // k\\n    'bool', // sorted\\n    'number', // outValuesId\\n
    'number', // outIndicesId\\n  ]);\\n}\\n\\nexport const topk:\\n  (args: {inputs: TopKInputs, backend: BackendWasm,
attrs: TopKAttrs}) =>\\n    TensorInfo[] | TensorInfo = ({inputs, backend, attrs}) => {\\n    const {x} = inputs;\\n
    const {k, sorted} = attrs;\\n\\n    const xId = backend.dataIdMap.get(x.dataId).id;\\n    const xShapeBytes
= new Uint8Array(new Int32Array(x.shape).buffer);\\n    const outputShape = x.shape.slice();\\n
    outputShape[outputShape.length - 1] = k;\\n    const outValues = backend.makeOutput(outputShape, x.dtype);\\n
    const outValuesId = backend.dataIdMap.get(outValues.dataId).id;\\n
    const outIndices = backend.makeOutput(outputShape, 'int32');\\n    const outIndicesId =
backend.dataIdMap.get(outIndices.dataId).id;\\n\\n    wasmTopK(\\n      xId, xShapeBytes, x.shape.length,
CppDType[x.dtype], k, sorted,\\n      outValuesId, outIndicesId);\\n\\n    return [outValues, outIndices];\\n
  };\\n\\nexport const topKConfig: KernelConfig = {\\n  kernelName: TopK,\\n  backendName: 'wasm',\\n  setupFunc:

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setup,\n kernelFunc: topk as { } as KernelFunc,\n};\n", "/*\n * @license\n * Copyright 2021 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS

OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *

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=====
*\n\nimport { KernelConfig, KernelFunc, TensorInfo, Transform, TransformAttrs, TransformInputs, util } from
'@tensorflow/tfjs-core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nlet wasmTransform: (\n  imageId:
number, transformsId: number, isBatchTransform: boolean,\n  batch: number, outHeight: number, outWidth:
number, numChannels: number,\n  imageWidth: number, imageHeight: number, strides: Uint8Array,\n  stridesLength: number, interpolationModeId: number, fillModeId: number,\n  fillValue: number, outId: number)
=> void;\n\nfunction setup(backend: BackendWasm): void {\n  wasmTransform = backend.wasm.cwrap(Transform,
null /*void*/, [\n    'number', // imageId\n    'number', // transformsId\n    'bool', // isBatchTransform\n    'number', // batch\n    'number', // outHeight\n    'number', // outWidth\n    'number', // numChannels\n    'number', // imageWidth\n    'number', // imageHeight\n    'array', // strides\n    'number', // stridesLength\n    'number', // interpolationModeId\n    'number', // fillModeId\n    'number', // fillValue\n    'number' // outId\n  ]);\n\n  function transform(\n    args: \n      { backend: BackendWasm, inputs: TransformInputs, attrs:
TransformAttrs });\n    TensorInfo {\n      const { backend, inputs, attrs } = args;\n      const { image, transforms } = inputs;\n      const { interpolation, fillMode, fillValue, outputShape } = attrs;\n      const [batch, imageHeight, imageWidth,
numChannels] = image.shape;\n      const [outHeight, outWidth] =\n        outputShape != null ? outputShape :
[imageHeight, imageWidth];\n      const outShape =\n        [batch, outHeight, outWidth,\n        numChannels] as
[number, number, number, number];\n      const strides =\n        new Uint8Array(new
Int32Array(util.computeStrides(image.shape)).buffer);\n      \n      const out = backend.makeOutput(outShape, image.dtype);\n      const outId =
backend.dataIdMap.get(out.dataId).id;\n      \n      const imageData = backend.dataIdMap.get(image.dataId);\n      const
imageId = imageData.id;\n      \n      const transformsData = backend.dataIdMap.get(transforms.dataId);\n      const
transformsId = transformsData.id;\n      \n      const interpolationModeId = interpolation === 'nearest' ? 1 : 2;\n      let
fillModeId;\n      switch (fillMode) {\n        case 'constant':\n          fillModeId = 1;\n          break;\n        case 'reflect':\n          fillModeId = 2;\n          break;\n        case 'wrap':\n          fillModeId = 3;\n          break;\n        case 'nearest':\n          fillModeId = 4;\n          break;\n        default:\n          fillModeId = 1;\n          break;\n      }\n      \n      wasmTransform(\n        imageId, transformsId,
(transforms.shape[0] > 1), batch, outHeight,\n        outWidth, numChannels, imageWidth, imageHeight, strides,\n        image.shape.length - 1, interpolationModeId, fillModeId, fillValue,\n        outId);\n      \n      return out;\n    }\n\n    export const transformConfig: KernelConfig = {\n      kernelName: Transform,\n      backendName:
'wasm',\n      setupFunc: setup,\n      kernelFunc: transform as { } as KernelFunc\n    };\n  }\n\n  /*\n   * @license\n   * Copyright 2019 Google LLC. All Rights Reserved.\n   * Licensed under the Apache License, Version 2.0 (the \"License\");\n   * you may not use this file except in compliance with the License.\n   * You may obtain a copy of the License at\n   * \n   * http://www.apache.org/licenses/LICENSE-2.0\n   * \n   * Unless required by applicable law or agreed to in writing, software\n   * distributed under the License is distributed on an \"AS IS\" BASIS,\n   * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n   * See the License for the specific language governing permissions and\n   * limitations under the License.\n   */
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*\n\nimport { KernelConfig, KernelFunc, TensorInfo, Unpack, UnpackAttrs, UnpackInputs }
from '@tensorflow/tfjs-core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nimport { slice } from
'./Slice';\n\nfunction unpack(\n  args: { inputs: UnpackInputs, backend: BackendWasm, attrs: UnpackAttrs });\n  TensorInfo[] {\n    const { inputs, backend, attrs } = args;\n    const { value } = inputs;\n    let { axis } = attrs;\n    if (axis <
```

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0) {\n  axis += value.shape.length;\n }\n\n const numOutputs = value.shape[axis];\n const rank =
value.shape.length;\n const outShape: number[] = new Array(rank - 1);\n let outIndex = 0;\n for (let i = 0; i < rank;
i++) {\n  if (i !== axis) {\n    outShape[outIndex++] = value.shape[i];\n  }\n }\n const outs: TensorInfo[] = new
Array(numOutputs);\n const begin = new Array(rank).fill(0);\n const size = value.shape.slice();\n size[axis] = 1;\n
for (let i = 0; i < outs.length; i++) {\n  begin[axis] = i;\n  outs[i] = slice({inputs: {x: value}, attrs: {begin, size},
backend});\n }\n return outs.map(({dataId, dtype}) => ({dataId, dtype,
shape: outShape}));\n}\n\nexport const unpackConfig: KernelConfig = {\n  kernelName: Unpack,\n  backendName:
'wasm',\n  kernelFunc: unpack as { } as KernelFunc,\n};\n\n", "/*\n * @license\n * Copyright 2020 Google LLC. All
Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *

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=====
*\n\nimport { KernelConfig, KernelFunc, ZerosLike, ZerosLikeInputs } from '@tensorflow/tfjs-core';\n\nimport
{ BackendWasm }
from './backend_wasm';\n\nfunction zerosLike(args: {inputs: ZerosLikeInputs, backend: BackendWasm}) {\n
const {inputs: {x}, backend} = args;\n const out = backend.makeOutput(x.shape, x.dtype);\n const outVals =
backend.typedArrayFromHeap(out);\n outVals.fill(0);\n return out;\n}\n\nexport const zerosLikeConfig:
KernelConfig = {\n  kernelName: ZerosLike,\n  backendName: 'wasm',\n  kernelFunc: zerosLike as { } as
KernelFunc,\n};\n\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *

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\n *\n//

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We explicitly import the modular kernels so they get registered in the\n// global registry when we compile the
library. A modular build would replace\n// the contents of this file and import only the kernels that are
needed.\n\nimport { KernelConfig, registerKernel } from '@tensorflow/tfjs-core';\n\nimport { fusedMatMulConfig }
from './kernels/_FusedMatMul';\nimport { absConfig } from './kernels/Abs';\nimport { addConfig } from
'./kernels/Add';\nimport { addNConfig } from './kernels/AddN';\nimport { allConfig } from './kernels/All';\nimport
{ anyConfig } from './kernels/Any';\nimport { argMaxConfig } from './kernels/ArgMax';\nimport { avgPoolConfig }
from './kernels/AvgPool';\nimport { batchMatMulConfig } from './kernels/BatchMatMul';\nimport
{ batchToSpaceNDConfig } from './kernels/BatchToSpaceND';\nimport { castConfig } from './kernels/Cast';\nimport
{ ceilConfig } from './kernels/Ceil';\nimport { clipByValueConfig } from './kernels/ClipByValue';\nimport
{ concatConfig } from './kernels/Concat';\nimport { conv2DConfig } from './kernels/Conv2D';\nimport
{ conv2DBackpropInputConfig } from './kernels/Conv2DBackpropInput';\nimport { cosConfig } from
'./kernels/Cos';\nimport { coshConfig } from './kernels/Cosh';\nimport { cropAndResizeConfig } from
'./kernels/CropAndResize';\nimport { cumsumConfig } from './kernels/Cumsum';\nimport { depthToSpaceConfig }
from './kernels/DepthToSpace';\nimport { depthwiseConv2dNativeConfig } from
'./kernels/DepthwiseConv2dNative';\nimport { eluConfig } from './kernels/Elu';\nimport { equalConfig } from
'./kernels/Equal';\nimport { expConfig } from './kernels/Exp';\nimport { expandDimsConfig } from
'./kernels/ExpandDims';\nimport { fillConfig } from './kernels/Fill';\nimport { flipLeftRightConfig } from
'./kernels/FlipLeftRight';\nimport { floorConfig } from './kernels/Floor';\nimport { floorDivConfig } from
'./kernels/FloorDiv';\nimport

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{fusedBatchNormConfig} from './kernels/FusedBatchNorm';\nimport {fusedConv2DConfig} from
 './kernels/FusedConv2D';\nimport {fusedDepthwiseConv2DConfig} from
 './kernels/FusedDepthwiseConv2D';\nimport {gatherNdConfig} from './kernels/GatherNd';\nimport
 {gatherV2Config} from './kernels/GatherV2';\nimport {greaterConfig} from './kernels/Greater';\nimport
 {greaterEqualConfig} from './kernels/GreaterEqual';\nimport {identityConfig} from './kernels/Identity';\nimport
 {leakyReluConfig} from './kernels/LeakyRelu';\nimport {lessConfig} from './kernels/Less';\nimport
 {lessEqualConfig} from './kernels/LessEqual';\nimport {logConfig} from './kernels/Log';\nimport
 {logicalAndConfig} from './kernels/LogicalAnd';\nimport {maxConfig} from './kernels/Max';\nimport
 {maximumConfig} from './kernels/Maximum';\nimport {maxPoolConfig} from './kernels/MaxPool';\nimport
 {meanConfig} from './kernels/Mean';\nimport {minConfig} from './kernels/Min';\nimport {minimumConfig} from
 './kernels/Minimum';\nimport
 {mirrorPadConfig} from './kernels/MirrorPad';\nimport {multiplyConfig} from './kernels/Multiply';\nimport
 {negConfig} from './kernels/Neg';\nimport {nonMaxSuppressionV3Config} from
 './kernels/NonMaxSuppressionV3';\nimport {nonMaxSuppressionV4Config} from
 './kernels/NonMaxSuppressionV4';\nimport {nonMaxSuppressionV5Config} from
 './kernels/NonMaxSuppressionV5';\nimport {notEqualConfig} from './kernels/NotEqual';\nimport {oneHotConfig}
 from './kernels/OneHot';\nimport {onesLikeConfig} from './kernels/OnesLike';\nimport {packConfig} from
 './kernels/Pack';\nimport {padV2Config} from './kernels/PadV2';\nimport {powConfig} from
 './kernels/Pow';\nimport {preluConfig} from './kernels/Prelu';\nimport {prodConfig} from './kernels/Prod';\nimport
 {rangeConfig} from './kernels/Range';\nimport {realDivConfig} from './kernels/RealDiv';\nimport {reluConfig}
 from './kernels/Relu';\nimport {relu6Config} from './kernels/Relu6';\nimport {reshapeConfig} from
 './kernels/Reshape';\nimport {resizeBilinearConfig}
 from './kernels/ResizeBilinear';\nimport {reverseConfig} from './kernels/Reverse';\nimport
 {rotateWithOffsetConfig} from './kernels/RotateWithOffset';\nimport {roundConfig} from
 './kernels/Round';\nimport {rsqrtConfig} from './kernels/Rsqrt';\nimport {scatterNdConfig} from
 './kernels/ScatterNd';\nimport {selectConfig} from './kernels/Select';\nimport {sigmoidConfig} from
 './kernels/Sigmoid';\nimport {sinConfig} from './kernels/Sin';\nimport {sliceConfig} from './kernels/Slice';\nimport
 {softmaxConfig} from './kernels/Softmax';\nimport {spaceToBatchNDConfig} from
 './kernels/SpaceToBatchND';\nimport {splitVConfig} from './kernels/SplitV';\nimport {sqrtConfig} from
 './kernels/Sqrt';\nimport {squareConfig} from './kernels/Square';\nimport {squaredDifferenceConfig} from
 './kernels/SquaredDifference';\nimport {stepConfig} from './kernels/Step';\nimport {stridedSliceConfig} from
 './kernels/StridedSlice';\nimport {subConfig} from './kernels/Sub';\nimport {sumConfig} from
 './kernels/Sum';\nimport
 {tanConfig} from './kernels/Tan';\nimport {tanhConfig} from './kernels/Tanh';\nimport {tileConfig} from
 './kernels/Tile';\nimport {topKConfig} from './kernels/TopK';\nimport {transformConfig} from
 './kernels/Transform';\nimport {transposeConfig} from './kernels/Transpose';\nimport {unpackConfig} from
 './kernels/Unpack';\nimport {zerosLikeConfig} from './kernels/ZerosLike';\n\n// List all kernel configs here\nconst
 kernelConfigs: KernelConfig[] = [\n  absConfig,\n  addConfig,\n  addNConfig,\n  allConfig,\n  anyConfig,\n
  argMaxConfig,\n  avgPoolConfig,\n  batchMatMulConfig,\n  batchToSpaceNDConfig,\n  castConfig,\n
  ceilConfig,\n  clipByValueConfig,\n  concatConfig,\n  conv2DConfig,\n  conv2DBackpropInputConfig,\n
  cosConfig,\n  coshConfig,\n  cropAndResizeConfig,\n  cumsumConfig,\n  depthToSpaceConfig,\n
  depthwiseConv2dNativeConfig,\n  eluConfig,\n  equalConfig,\n  expConfig,\n  expandDimsConfig,\n  fillConfig,\n
  flipLeftRightConfig,\n  floorConfig,\n  floorDivConfig,\n  fusedMatMulConfig,\n
  fusedBatchNormConfig,\n  fusedConv2DConfig,\n  fusedDepthwiseConv2DConfig,\n  gatherNdConfig,\n
  gatherV2Config,\n  greaterConfig,\n  greaterEqualConfig,\n  identityConfig,\n  leakyReluConfig,\n  lessConfig,\n
  lessEqualConfig,\n  logConfig,\n  logicalAndConfig,\n  maxConfig,\n  maximumConfig,\n  maxPoolConfig,\n
  meanConfig,\n  minConfig,\n  minimumConfig,\n  mirrorPadConfig,\n  multiplyConfig,\n  negConfig,\n
  nonMaxSuppressionV3Config,\n  nonMaxSuppressionV4Config,\n  nonMaxSuppressionV5Config,\n

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notEqualConfig,\n oneHotConfig,\n onesLikeConfig,\n packConfig,\n padV2Config,\n powConfig,\n
preluConfig,\n prodConfig,\n rangeConfig,\n realDivConfig,\n reluConfig,\n relu6Config,\n reshapeConfig,\n
resizeBilinearConfig,\n reverseConfig,\n rotateWithOffsetConfig,\n rsqrtConfig,\n roundConfig,\n
scatterNdConfig,\n selectConfig,\n sigmoidConfig,\n sinConfig,\n sliceConfig,\n softmaxConfig,\n
spaceToBatchNDConfig,\n splitVConfig,\n sqrtConfig,\n
squareConfig,\n squaredDifferenceConfig,\n stepConfig,\n stridedSliceConfig,\n subConfig,\n sumConfig,\n
tanConfig,\n tanhConfig,\n tileConfig,\n topKConfig,\n transformConfig,\n transposeConfig,\n unpackConfig,\n
zerosLikeConfig\n);\n\nfor (const kernelConfig of kernelConfigs) {\n  registerKernel(kernelConfig);\n}\n", "/*\n *
@license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version
2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n */\n
=====
\n
*/\n\nimport {env} from 'tensorflow/tfjs-core';\n\nconst ENV = env();\n\n/*\n * True if SIMD is supported.\n
*/\n\n// From: https://github.com/GoogleChromeLabs/wasm-feature-detect\nENV.registerFlag(\n  // This typed array
passed in to WebAssembly.validate is WebAssembly binary\n  // code. In this case it is a small program that
contains SIMD\n  // instructions.\n  'WASM_HAS_SIMD_SUPPORT', async () => WebAssembly.validate(new
Uint8Array([\n    0, 97, 115, 109, 1, 0, 0, 0, 1, 4, 1, 96, 0, 0, 3,\n    2, 1, 0, 10, 9, 1, 7, 0, 65, 0, 253, 15, 26,
11\n  ])));\n\n/*\n * True if threads are supported.\n
*/\n\n// From: https://github.com/GoogleChromeLabs/wasm-
feature-detect\nENV.registerFlag('WASM_HAS_MULTITHREAD_SUPPORT', async () => {\n  //
TODO(annxingyuan): Enable node support once this is resolved:\n  //
https://github.com/tensorflow/tfjs/issues/3830\n  if (ENV.get('IS_NODE')) {\n    return false;\n  }\n  try {\n
    // Test for transferability of SABs (needed for Firefox)\n    //
https://groups.google.com/forum/#!msg/mozilla.dev.platform/IHkBZIHETpA/dwsMNchWEQAJ\n    new
MessageChannel().port1.postMessage(new SharedArrayBuffer(1));\n    // This typed array is a WebAssembly
program containing threaded\n    // instructions.\n    return WebAssembly.validate(new Uint8Array([\n    0, 97,
115, 109, 1, 0, 0, 0, 1, 4, 1, 96, 0, 0, 3, 2, 1, 0, 5,\n    4, 1, 3, 1, 10, 11, 1, 9, 0, 65, 0, 254, 16, 2, 0, 26,
11\n  ]));\n  } catch (e) {\n    return false;\n  }\n});\n\n", "\nvar WasmBackendModuleThreadedSimd = (function() {\n
var _scriptDir = typeof document !== 'undefined' && document.currentScript ? document.currentScript.src :
undefined;\n  if (typeof __filename !== 'undefined') _scriptDir = _scriptDir || __filename;\n  return
(function(WasmBackendModuleThreadedSimd) {\n    WasmBackendModuleThreadedSimd =
WasmBackendModuleThreadedSimd || {};\n\nfunction
GROWABLE_HEAP_I8(){if(wasmMemory.buffer!=buffer){updateGlobalBufferAndViews(wasmMemory.buffer)}
return
HEAP8}function
GROWABLE_HEAP_U8(){if(wasmMemory.buffer!=buffer){updateGlobalBufferAndViews(wasmMemory.buffer)}
return HEAPU8}function
GROWABLE_HEAP_I32(){if(wasmMemory.buffer!=buffer){updateGlobalBufferAndViews(wasmMemory.buffer)}
return HEAP32}function
GROWABLE_HEAP_U32(){if(wasmMemory.buffer!=buffer){updateGlobalBufferAndViews(wasmMemory.buffer)}
return HEAPU32}function
GROWABLE_HEAP_F64(){if(wasmMemory.buffer!=buffer){updateGlobalBufferAndViews(wasmMemory.buffer)}
return HEAPF64}var Module=typeof
WasmBackendModuleThreadedSimd!="undefined"?WasmBackendModuleThreadedSimd:{};var
readyPromiseResolve,readyPromiseReject;Module["ready"]=new
Promise(function(resolve,reject){readyPromiseResolve=resolve;readyPromiseReject=reject});var

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moduleOverrides={};var key;for(key in
Module){if(Module.hasOwnProperty(key)){ moduleOverrides[key]=Module[key]}}var arguments_=[];var
thisProgram=\.this.program\";var quit_=function(status,toThrow){throw
toThrow};var ENVIRONMENT_IS_WEB=false;var ENVIRONMENT_IS_WORKER=false;var
ENVIRONMENT_IS_NODE=false;var ENVIRONMENT_IS_SHELL=false;ENVIRONMENT_IS_WEB=typeof
window===\"object\";ENVIRONMENT_IS_WORKER=typeof
importScripts===\"function\";ENVIRONMENT_IS_NODE=typeof process===\"object\"&&typeof
process.versions===\"object\"&&typeof
process.versions.node===\"string\";ENVIRONMENT_IS_SHELL=!ENVIRONMENT_IS_WEB&&!ENVIRONM
ENT_IS_NODE&&!ENVIRONMENT_IS_WORKER;var
ENVIRONMENT_IS_PTHREAD=Module[\"ENVIRONMENT_IS_PTHREAD\"]||false;if(ENVIRONMENT_IS_P
THREAD){buffer=Module[\"buffer\"]}var scriptDirectory=\"\";function
locateFile(path){if(Module[\"locateFile\"]){return Module[\"locateFile\"](path,scriptDirectory)}return
scriptDirectory+path}var read_,readAsync,readBinary,setWindowTitle;var nodeFS;var
nodePath;if(ENVIRONMENT_IS_NODE){if(ENVIRONMENT_IS_WORKER){scriptDirectory=require(\"path\").
dirname(scriptDirectory)+\"/\"}else{scriptDirectory=__dirname+\"/\"}read_=function
shell_read(filename,binary){if(!nodeFS)nodeFS=require(\"fs\");if(!nodePath)nodePath=require(\"path\");filename=n
odePath[\"normalize\"](filename);return
nodeFS[\"readFileSync\"](filename,binary?null:\"utf8\");}readBinary=function readBinary(filename){var
ret=read_(filename,true);if(!ret.buffer){ret=new Uint8Array(ret)}assert(ret.buffer);return
ret};if(process[\"argv\"].length>1){thisProgram=process[\"argv\"][1].replace(/\\\\\\\\g,\"/\"))arguments_=process[\"arg
v\"].slice(2);process[\"on\"](\"uncaughtException\",function(ex){if(!(ex instanceof ExitStatus)){throw
ex}});process[\"on\"](\"unhandledRejection\",abort);quit_=function(status){process[\"exit\"](status)};Module[\"insp
ect\"]=function(){return\"[Emscripten Module object]\";}var
nodeWorkerThreads;try{nodeWorkerThreads=require(\"worker_threads\")}catch(e){console.error('The
\"worker_threads\" module is not supported in this node.js build - perhaps a newer version is needed?');throw
e}global.Worker=nodeWorkerThreads.Worker}else if(ENVIRONMENT_IS_SHELL){if(typeof
read!=\"undefined\"){read_=function shell_read(f){return read(f)}}readBinary=function readBinary(f){var
data;if(typeof readbuffer===\"function\"){return new
Uint8Array(readbuffer(f))}data=read(f,\"binary\");assert(typeof data===\"object\");return data};if(typeof
scriptArgs!=\"undefined\"){arguments_=scriptArgs}else if(typeof
arguments!=\"undefined\"){arguments_=arguments}if(typeof
quit===\"function\"){quit_=function(status){quit(status)}}if(typeof print!=\"undefined\"){if(typeof
console===\"undefined\")console={};console.log=print;console.warn=console.error=typeof
printErr!=\"undefined\"?printErr:print}}else
if(ENVIRONMENT_IS_WEB||ENVIRONMENT_IS_WORKER){if(ENVIRONMENT_IS_WORKER){scriptDire
ctory=self.location.href}else if(typeof
document!=\"undefined\"&&document.currentScript){scriptDirectory=document.currentScript.src}if(typeof
_scriptDir !=\"undefined\" &&
_scriptDir){scriptDirectory=_scriptDir}if(scriptDirectory.indexOf(\"blob:\")!==0){scriptDirectory=scriptDirectory.s
ubstr(0,scriptDirectory.lastIndexOf(\"/\")+1)}else{scriptDirectory=\"\"}if(ENVIRONMENT_IS_NODE){read_=fun
ction
shell_read(filename,binary){if(!nodeFS)nodeFS=require(\"fs\");if(!nodePath)nodePath=require(\"path\");filename=n
odePath[\"normalize\"](filename);return
nodeFS[\"readFileSync\"](filename,binary?null:\"utf8\");}readBinary=function readBinary(filename){var
ret=read_(filename,true);if(!ret.buffer){ret=new Uint8Array(ret)}assert(ret.buffer);return
ret}}else{read_=function(url){var xhr=new XMLHttpRequest;xhr.open(\"GET\",url,false);xhr.send(null);return
xhr.responseText};if(ENVIRONMENT_IS_WORKER){readBinary=function(url){var xhr=new

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XMLHttpRequest;xhr.open(\"GET\",url,false);xhr.responseType=\"arraybuffer\";xhr.send(null);return new
Uint8Array(xhr.response)}}readAsync=function(url,onload,onerror){var xhr=new
XMLHttpRequest;xhr.open(\"GET\",url,true);xhr.responseType=\"arraybuffer\";xhr.onload=function(){if(xhr.status
==200||xhr.status==0&&xhr.response){onload(xhr.response);return}onerror();}xhr.onerror=onerror;xhr.send(null)}
}setWindowTitle=function(title){document.title=title}else{if(ENVIRONMENT_IS_NODE){if(typeof
performance===\"undefined\"){global.performance=require(\"perf_hooks\").performance}}var
out=Module[\"print\"]||console.log.bind(console);var err=Module[\"printErr\"]||console.warn.bind(console);for(key
in
moduleOverrides){if(moduleOverrides.hasOwnProperty(key)){Module[key]=moduleOverrides[key]}}moduleOverr
ides=null;if(Module[\"arguments\"]arguments_=Module[\"arguments\"];if(Module[\"thisProgram\"]thisProgram=
Module[\"thisProgram\"];if(Module[\"quit\"]quit_=Module[\"quit\"];function
warnOnce(text){if(!warnOnce.shown)warnOnce.shown={};if(!warnOnce.shown[text]){warnOnce.shown[text]=1;er
r(text)}}var Atomics_load=Atomics.load;var Atomics_store=Atomics.store;var
Atomics_compareExchange=Atomics.compareExchange;var
wasmBinary;if(Module[\"wasmBinary\"]wasmBinary=Module[\"wasmBinary\"];var
noExitRuntime=Module[\"noExitRuntime\"]||true;if(typeof WebAssembly!=\"object\"){abort(\"no
native wasm support detected\")}var wasmMemory;var wasmModule;var ABORT=false;var
EXITSTATUS;function assert(condition,text){if(!condition){abort(\"Assertion failed: \"+text)}}function
getCFunc(ident){var func=Module[\"_\"+ident];assert(func,\"Cannot call unknown function \"+ident+\", make sure
it is exported\");return func}function ccall(ident,returnType,argTypes,args,opts){var
toC={\"string\":function(str){var ret=0;if(str!==null&&str!==undefined&&str!==0){var
len=(str.length<<2)+1;ret=stackAlloc(len);stringToUTF8(str,ret,len)}return ret},\"array\":function(arr){var
ret=stackAlloc(arr.length);writeArrayToMemory(arr,ret);return ret}};function
convertReturnValue(ret){if(returnType===\"string\")return UTF8ToString(ret);if(returnType===\"boolean\")return
Boolean(ret);return ret}var func=getCFunc(ident);var cArgs=[];var stack=0;if(args){for(var
i=0;i<args.length;i++){var
converter=toC[argTypes[i]];if(converter){if(stack===0)stack=stackSave();cArgs[i]=converter(args[i])}else{cArgs[i
]=args[i]}}var
ret=func.apply(null,cArgs);ret=convertReturnValue(ret);if(stack!==0)stackRestore(stack);return ret}function
cwrap(ident,returnType,argTypes,opts){argTypes=argTypes||[];var
numericArgs=argTypes.every(function(type){return type===\"number\"});var
numericRet=returnType!=\"string\";if(numericRet&&numericArgs&&!opts){return getCFunc(ident)}return
function(){return ccall(ident,returnType,argTypes,arguments,opts)}}function
UTF8ArrayToString(heap,idx,maxBytesToRead){var endIdx=idx+maxBytesToRead;var
str=\"\";while(!(idx>=endIdx)){var u0=heap[idx++];if(!u0)return
str;if(!(u0&128)){str+=String.fromCharCode(u0);continue}var
u1=heap[idx++]&63;if((u0&224)==192){str+=String.fromCharCode((u0&31)<<6|u1);continue}var
u2=heap[idx++]&63;if((u0&240)==224){u0=(u0&15)<<12|u1<<6|u2}else{u0=(u0&7)<<18|u1<<12|u2<<6|heap[id
x++]&63;if(u0<65536){str+=String.fromCharCode(u0)}else{var ch=u0-
65536;str+=String.fromCharCode(55296|ch>>10,56320|ch&1023)}}return str}function
UTF8ToString(ptr,maxBytesToRead){return
ptr?UTF8ArrayToString(GROWABLE_HEAP_U8(),ptr,maxBytesToRead):\"\"}function
stringToUTF8Array(str,heap,outIdx,maxBytesToWrite){if(!(maxBytesToWrite>0))return 0;var startIdx=outIdx;var
endIdx=outIdx+maxBytesToWrite-1;for(var i=0;i<str.length;++i){var
u=str.charCodeAt(i);if(u>=55296&&u<=57343){var
u1=str.charCodeAt(++i);u=65536+((u&1023)<<10|u1&1023)}if(u<=127){if(outIdx>=endIdx)break;heap[outIdx++]
=u}else if(u<=2047){if(outIdx+1>=endIdx)break;heap[outIdx++]=192|u>>6;heap[outIdx++]=128|u&63}else
if(u<=65535){if(outIdx+2>=endIdx)break;heap[outIdx++]=224|u>>12;heap[outIdx++]=128|u>>6&63;heap[outIdx

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++]=128|u&63}else{if(outIdx+3>=endIdx)break;heap[outIdx++]=240|u>>18;heap[outIdx++]=128|u>>12&63;heap[
outIdx++]=128|u>>6&63;heap[outIdx++]=128|u&63}}heap[outIdx]=0;return outIdx-startIdx}function
stringToUTF8(str,outPtr,maxBytesToWrite){return
stringToUTF8Array(str,GROWABLE_HEAP_U8(),outPtr,maxBytesToWrite)}function lengthBytesUTF8(str){var
len=0;for(var i=0;i<str.length;++i){var
u=str.charCodeAt(i);if(u>=55296&&u<=57343)u=65536+((u&1023)<<10)|str.charCodeAt(++i)&1023;if(u<=127)+
+len;else if(u<=2047)len+=2;else if(u<=65535)len+=3;else len+=4}return len}function
writeArrayToMemory(array,buffer){GROWABLE_HEAP_I8().set(array,buffer)}function
alignUp(x,multiple){if(x%multiple>0){x+=multiple-x%multiple}return x}var
buffer,HEAP8,HEAPU8,HEAP16,HEAPU16,HEAP32,HEAPU32,HEAPF32,HEAPF64;function
updateGlobalBufferAndViews(buf){buffer=buf;Module["HEAP8"]=HEAP8=new
Int8Array(buf);Module["HEAP16"]=HEAP16=new Int16Array(buf);Module["HEAP32"]=HEAP32=new
Int32Array(buf);Module["HEAPU8"]=HEAPU8=new Uint8Array(buf);Module["HEAPU16"]=HEAPU16=new
Uint16Array(buf);Module["HEAPU32"]=HEAPU32=new
Uint32Array(buf);Module["HEAPF32"]=HEAPF32=new
Float32Array(buf);Module["HEAPF64"]=HEAPF64=new Float64Array(buf)}var
INITIAL_MEMORY=Module["INITIAL_MEMORY"]||16777216;if(ENVIRONMENT_IS_PTHREAD){wasmmM
emory=Module["wasmmMemory"];buffer=Module["buffer"]}else{if(Module["wasmmMemory"]){wasmmMemory=
Module["wasmmMemory"]}else{wasmmMemory=new
WebAssembly.Memory({\"initial\":INITIAL_MEMORY/65536,\"maximum\":2147483648/65536,\"shared\":true});
if(!(wasmmMemory.buffer instanceof SharedArrayBuffer)){err(\"requested a shared WebAssembly.Memory but the
returned buffer is not a SharedArrayBuffer, indicating that while the browser has SharedArrayBuffer it does not
have WebAssembly threads support - you may need to set a
flag\");if(ENVIRONMENT_IS_NODE){console.log(\"(on node you may need: --experimental-wasm-threads --
experimental-wasm-bulk-memory and also use a recent version)\")}throw Error(\"bad
memory\")}}if(wasmmMemory){buffer=wasmmMemory.buffer}INITIAL_MEMORY=buffer.byteLength;updateGlob
alBufferAndViews(buffer);var wasmTable;var __ATPRERUN__=[];var __ATINIT__=[];var __ATMAIN__=[];var
__ATEXIT__=[];var __ATPOSTRUN__=[];var runtimeInitialized=false;var
runtimeExited=false;if(!ENVIRONMENT_IS_PTHREAD)__ATINIT__.push({func:function(){__wasm_call_ctors
()}});function
preRun(){if(ENVIRONMENT_IS_PTHREAD)return;if(Module["preRun"]){if(typeof
Module["preRun"]=="function")Module["preRun"]=[Module["preRun"]];while(Module["preRun"].length){a
ddOnPreRun(Module["preRun"].shift())}callRuntimeCallbacks(__ATPRERUN__)}function
initRuntime(){runtimeInitialized=true;if(ENVIRONMENT_IS_PTHREAD)return;callRuntimeCallbacks(__ATINIT
__)}function
preMain(){if(ENVIRONMENT_IS_PTHREAD)return;callRuntimeCallbacks(__ATMAIN__)}function
exitRuntime(){if(ENVIRONMENT_IS_PTHREAD)return;runtimeExited=true}function
postRun(){if(ENVIRONMENT_IS_PTHREAD)return;if(Module["postRun"]){if(typeof
Module["postRun"]=="function")Module["postRun"]=[Module["postRun"]];while(Module["postRun"].lengt
h){addOnPostRun(Module["postRun"].shift())}callRuntimeCallbacks(__ATPOSTRUN__)}function
addOnPreRun(cb){__ATPRERUN__.unshift(cb)}function addOnPostRun(cb){__ATPOSTRUN__.unshift(cb)}var
runDependencies=0;var runDependencyWatcher=null;var dependenciesFulfilled=null;function
addRunDependency(id){assert(!ENVIRONMENT_IS_PTHREAD,\"addRunDependency cannot be used in a
pthread
worker\");runDependencies++;if(Module["monitorRunDependencies"]){Module["monitorRunDependencies"]((ru
nDependencies))}function removeRunDependency(id){runDependencies--
;if(Module["monitorRunDependencies"]){Module["monitorRunDependencies"]((runDependencies))}if(runDepend
encies==0){if(runDependencyWatcher!=null){clearInterval(runDependencyWatcher);runDependencyWatcher=nul

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    }if(dependenciesFulfilled){ var
callback=dependenciesFulfilled;dependenciesFulfilled=null;callback() } }Module["preloadedImages"]={};Module
["preloadedAudios"]={};function
abort(what){if(Module["onAbort"]){Module["onAbort"](what)}if(ENVIRONMENT_IS_PTHREAD)console.err
or("\Pthread aborting at \"+(new
Error).stack);what+="\";err(what);ABORT=true;EXITSTATUS=1;what="\abort(\"+what+\"). Build with -s
ASSERTIONS=1 for more info.\";var e=new WebAssembly.RuntimeError(what);readyPromiseReject(e);throw
e}function hasPrefix(str,prefix){return
String.prototype.startsWith?str.startsWith(prefix):str.indexOf(prefix)===0}var
dataURIPrefix=\"data:application/octet-stream;base64,\";function isDataURI(filename){return
hasPrefix(filename,dataURIPrefix)}var fileURIPrefix=\"file://\";function isFileURI(filename){return
hasPrefix(filename,fileURIPrefix)}var wasmBinaryFile=\"tfjs-backend-wasm-threaded-
simd.wasm\";if(!isDataURI(wasmBinaryFile)){wasmBinaryFile=locateFile(wasmBinaryFile)}function
getBinary(file){try{if(file===wasmBinaryFile&&wasmBinary){return new
Uint8Array(wasmBinary)}if(readBinary){return readBinary(file)}else{throw\"both async and sync fetching of the
wasm failed\"}}catch(err){abort(err)}}function
getBinaryPromise(){if(!wasmBinary&&(ENVIRONMENT_IS_WEB||ENVIRONMENT_IS_WORKER)){if(typeof
fetch===\"function\"&&!isFileURI(wasmBinaryFile)){return fetch(wasmBinaryFile,{credentials:\"same-
origin\"}).then(function(response){if(!response[\"ok\"]){throw\"failed to load wasm binary file at
\"+wasmBinaryFile+\"\"})return
response[\"arrayBuffer\"]()}).catch(function(){return getBinary(wasmBinaryFile)})}else{if(readAsync){return new
Promise(function(resolve,reject){readAsync(wasmBinaryFile,function(response){resolve(new
Uint8Array(response)),reject}))})}return Promise.resolve().then(function(){return
getBinary(wasmBinaryFile)})}function createWasm(){var info={\"a\":asmLibraryArg};function
receiveInstance(instance,module){var
exports=instance.exports;Module[\"asm\"]=exports;wasmTable=Module[\"asm\"][\"t\"];wasmModule=module;if(!E
NVIRONMENT_IS_PTHREAD){var
numWorkersToLoad=PThread.unusedWorkers.length;PThread.unusedWorkers.forEach(function(w){PThread.load
WasmModuleToWorker(w,function(){if(!--numWorkersToLoad)removeRunDependency(\"wasm-
instantiate\")}))}if(!ENVIRONMENT_IS_PTHREAD){addRunDependency(\"wasm-instantiate\")}function
receiveInstantiatedSource(output){receiveInstance(output[\"instance\"],output[\"module\"])}function
instantiateArrayBuffer(receiver){return getBinaryPromise().then(function(binary){return
WebAssembly.instantiate(binary,info)}).then(receiver,function(reason){err(\"failed to asynchronously prepare
wasm: \"+reason);abort(reason)})}function instantiateAsync(){if(!wasmBinary&&typeof
WebAssembly.instantiateStreaming===\"function\"&&!isDataURI(wasmBinaryFile)&&!isFileURI(wasmBinaryFil
e)&&typeof fetch===\"function\"){return fetch(wasmBinaryFile,{credentials:\"same-
origin\"}).then(function(response){var result=WebAssembly.instantiateStreaming(response,info);return
result.then(receiveInstantiatedSource,function(reason){err(\"wasm streaming compile failed: \"+reason);err(\"falling
back to ArrayBuffer instantiation\");return instantiateArrayBuffer(receiveInstantiatedSource)})})}else{return
instantiateArrayBuffer(receiveInstantiatedSource)}if(Module[\"instantiateWasm\"]){try{var
exports=Module[\"instantiateWasm\"](info,receiveInstance);return exports}catch(e){err(\"Module.instantiateWasm
callback failed with error: \"+e);return false}}instantiateAsync().catch(readyPromiseReject);return{}}var
ASM_CONSTS={10520:function(){throw\"Canceled!\"},10538:function($0,$1){setTimeout(function(){__emscript
en_do_dispatch_to_thread($0,$1),0}}};function initPthreadsJS(){PThread.initRuntime()}function
callRuntimeCallbacks(callbacks){while(callbacks.length>0){var callback=callbacks.shift();if(typeof
callback===\"function\"){callback(Module);continue}var func=callback.func;if(typeof
func===\"number\"){if(callback.arg===undefined){wasmTable.get(func())}else{wasmTable.get(func)(callback.arg)
}}else{func(callback.arg===undefined?null:callback.arg)}}}var

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ERRNO_CODES={ EPERM:63,ENOENT:44,ESRCH:71,EINTR:27,EIO:29,ENXIO:60,E2BIG:1,ENOEXEC:45,EBADFD:8,ECHILD:12,EAGAIN:6,EWOULDBLOCK:6,ENOMEM:48,EACCES:2,EFAULT:21,ENOTBLK:105,EBUSY:10,EEXIST:20,EXDEV:75,ENODEV:43,ENOTDIR:54,EISDIR:31,EINVAL:28,ENFILE:41,EMFILE:33,ENOTTY:59,ETXTBSY:74,EFBIG:22,ENOSPC:51,ESPIPE:70,EROFS:69,EMLINK:34,EPIPE:64,EDOM:18,ERANGE:68,ENOMSG:49,EIDRM:24,ECHRNQ:106,EL2NSYNC:156,EL3HLT:107,EL3RST:108,ELNRNG:109,EUNATCH:110,ENOSYS:111,EL2HLT:112,EDEADLK:16,ENOLCK:46,EBADF:113,EBADR:114,EXFULL:115,ENOANO:104,EBADRQC:103,EBADSLT:102,EDEADLOCK:16,EBFONT:101,ENOSTR:100,ENODATA:116,ETIME:117,ENOSR:118,ENONET:119,ENOPKG:120,EREMOTE:121,ENOLINK:47,EADV:122,ESRMNT:123,ECOMM:124,EPROTO:65,EMULTIHOP:36,EDOTDOT:125,EBADMSG:9,ENOTUNIQ:126,EBADFD:127,EREMCHG:128,ELIBACC:129,ELIBBAD:130,ELIBSCN:131,ELIBMAX:132,ELIBEXEC:133,ENOSYS:52,ENOTEMPTY:55,ENAMETOOLONG:37,ELOOP:32,EOPNOTSUPP:138,EPFNOSUPPORT:139,ECONNRESET:15,ENOBUFS:42,EAFNOSUPPORT:5,EPROTOTYPE:67,ENOTSOK:57,ENOPROTOOPT:50,ESHUTDOWN:140,ECONNREFUSED:14,EADDRINUSE:3,ECONNABORTED:13,ENETUNREACH:40,ENETDOWN:38,ETIMEDOUT:73,EHOSTDOWN:142,EHOSTUNREACH:23,EINPROGRESS:26,EALREADY:7,EDESTADDRREQ:17,EMSGSIZE:35,EPROTONOSUPPORT:66,ESOCKTNOSUPPORT:137,EADDRNOTAVAIL:4,ENETRESET:39,EISCONN:30,ENOTCONN:53,ETOOMANYREFS:141,EUSERS:136,EDQUOT:19,ESTALE:72,ENOTSUP:138,ENOMEDIUM:148,EILSEQ:25,E_OVERFLOW:61,ECANCELED:11,ENOTRECOVERABLE:56,EOWNERDEAD:62,ESTRPIPE:135};function
__emscripten_futex_wake(addr,count){ if(addr<=0||addr>GROWABLE_HEAP_I32().length||addr&3!=0||count<0)return -28;if(count==0)return 0;if(count>=2147483647)count=Infinity;var
mainThreadWaitAddress=Atomics.load(GROWABLE_HEAP_I32(),__emscripten_main_thread_futex>>2);var
mainThreadWoken=0;if(mainThreadWaitAddress==addr){ var
loadedAddr=Atomics.compareExchange(GROWABLE_HEAP_I32(),__emscripten_main_thread_futex>>2,mainThreadWaitAddress,0);if(loadedAddr==mainThreadWaitAddress){ --count;mainThreadWoken=1;if(count<=0)return 1 } }var ret=Atomics.notify(GROWABLE_HEAP_I32(),addr>>2,count);if(ret>=0)return
ret+mainThreadWoken;throw\"Atomics.notify returned an unexpected value
\"+ret}Module[\"_emscripten_futex_wake\"]=__emscripten_futex_wake;function
killThread(pthread_ptr){ if(ENVIRONMENT_IS_PTHREAD)throw\"Internal Error! killThread() can only ever be
called from main application thread!\";if(!pthread_ptr)throw\"Internal Error! Null pthread_ptr in
killThread!\";GROWABLE_HEAP_I32()[pthread_ptr+12>>2]=0;var
pthread=PThread.threads[pthread_ptr];pthread.worker.terminate();PThread.freeThreadData(pthread);PThread.runningWorkers.splice(PThread.runningWorkers.indexOf(pthread.worker),1);pthread.worker pthread=undefined}function
cancelThread(pthread_ptr){ if(ENVIRONMENT_IS_PTHREAD)throw\"Internal Error! cancelThread() can only
ever be called from main application thread!\";if(!pthread_ptr)throw\"Internal Error! Null pthread_ptr in
cancelThread!\";var
pthread=PThread.threads[pthread_ptr];pthread.worker.postMessage({\"cmd\": \"cancel\"})}function
cleanupThread(pthread_ptr){ if(ENVIRONMENT_IS_PTHREAD)throw\"Internal Error! cleanupThread() can only
ever be called from main application thread!\";if(!pthread_ptr)throw\"Internal Error! Null pthread_ptr in
cleanupThread!\";var
pthread=PThread.threads[pthread_ptr];if(pthread){ GROWABLE_HEAP_I32()[pthread_ptr+12>>2]=0;var
worker=pthread.worker;PThread.returnWorkerToPool(worker)} }var
PThread={ unusedWorkers:[],runningWorkers:[],initMainThreadBlock:function(){ var
pthreadPoolSize=8;for(var
i=0;i<pthreadPoolSize;++i){ PThread.allocateUnusedWorker() } },initRuntime:function(){ var
tb=_malloc(228);for(var
i=0;i<228/4;++i)GROWABLE_HEAP_U32()[tb/4+i]=0;GROWABLE_HEAP_I32()[tb+12>>2]=tb;var
headPtr=tb+152;GROWABLE_HEAP_I32()[headPtr>>2]=headPtr;var tlsMemory=_malloc(512);for(var
i=0;i<128;++i)GROWABLE_HEAP_U32()[tlsMemory/4+i]=0;Atomics.store(GROWABLE_HEAP_U32(),tb+100

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>>2,tlsMemory);Atomics.store(GROWABLE_HEAP_U32(),tb+40>>2,tb);__emscripten_thread_init(tb,!ENVIRON
MENT_IS_WORKER,1);_emscripten_register_main_browser_thread_id(tb)},initWorker:function(){},pthreads:{},t
hreadExitHandlers:[],setThreadStatus:function(){},runExitHandlers:function(){while(PThread.threadExitHandlers.l
ength>0){PThread.threadExitHandlers.pop()};if(ENVIRONMENT_IS_PTHREAD&&_pthread_self())__pthread
_tsd_run_dtors()},runExitHandlersAndDeinitThread:function(tb,exitCode){Atomics.store(GROWABLE_HEAP_U
32(),tb+56>>2,1);Atomics.store(GROWABLE_HEAP_U32(),tb+60>>2,0);PThread.runExitHandlers();Atomics.stor
e(GROWABLE_HEAP_U32(),tb+4>>2,exitCode);Atomics.store(GROWABLE_HEAP_U32(),tb+0>>2,1);_emscri
pten_futex_wake(tb+0,2147483647);__emscripten_thread_init(0,0,0)},threadExit:function(exitCode){var
tb=_pthread_self();if(tb){PThread.runExitHandlersAndDeinitThread(tb,exitCode);if(ENVIRONMENT_IS_PTHRE
AD){postMessage({"cmd\\":\\"exit\\"})}}},threadCancel:function(){PThread.runExitHandlersAndDeinitThread(_pthr
ead_self(),-1);postMessage({"cmd\\":\\"cancelDone\\"})},terminateAllThreads:function(){for(var t in
PThread.pthreads){var
pthread=PThread.pthreads[t];if(pthread&&pthread.worker){PThread.returnWorkerToPool(pthread.worker)}PThre
ad.pthreads={};for(var i=0;i<PThread.unusedWorkers.length;++i){var
worker=PThread.unusedWorkers[i];worker.terminate()}PThread.unusedWorkers=[];for(var
i=0;i<PThread.runningWorkers.length;++i){var worker=PThread.runningWorkers[i];var
pthread=worker.pthread;PThread.freeThreadData(pthread);worker.terminate()}PThread.runningWorkers=[],freeTh
readData:function(pthread){if(!pthread)return;if(pthread.threadInfoStruct){var
tlsMemory=GROWABLE_HEAP_I32()[pthread.threadInfoStruct+100>>2];GROWABLE_HEAP_I32()[pthread.thr
eadInfoStruct+100>>2]=0;_free(tlsMemory);_free(pthread.threadInfoStruct)}pthread.threadInfoStruct=0;if(pthread.
allocatedOwnStack&&pthread.stackBase)_free(pthread.stackBase);pthread.stackBase=0;if(pthread.worker)pthread.
worker.pthread=null},returnWorkerToPool:function(worker){PThread.runWithoutMainThreadQueuedCalls(funcio
n){delete
PThread.pthreads[worker.pthread.threadInfoStruct];PThread.unusedWorkers.push(worker);PThread.runningWorker
s.splice(PThread.runningWorkers.indexOf(worker),1);PThread.freeThreadData(worker.pthread);worker.pthread=un
defined}}},runWithoutMainThreadQueuedCalls:function(func){GROWABLE_HEAP_I32()[__emscripten_allow_ma
in_runtime_queued_calls>>2]=0;try{func()}finally{GROWABLE_HEAP_I32()[__emscripten_allow_main_runti
me_queued_calls>>2]=1}},receiveObjectTransfer:function(data){},loadWasmModuleToWorker:function(worker,o
nFinishedLoading){worker.onmessage=function(e){var
d=e["data"];var
cmd=d["cmd"];if(worker.pthread)PThread.currentProxiedOperationCallerThread=worker.pthread.threadInfoStruct;
if(d["targetThread"]&&d["targetThread"]!="_pthread_self()){var
thread=PThread.pthreads[d.targetThread];if(thread){thread.worker.postMessage(e.data,d["transferList"])}else{con
sole.error('Internal error! Worker sent a message \''+cmd+'\" to target pthread '+d["targetThread"]+\"', but that
thread no longer
exists!')}PThread.currentProxiedOperationCallerThread=undefined;return;if(cmd===\\"processQueuedMainThread
Work\\"){_emscripten_main_thread_process_queued_calls()}else
if(cmd===\\"spawnThread\\"){spawnThread(e.data)}else
if(cmd===\\"cleanupThread\\"){cleanupThread(d["thread"])}else
if(cmd===\\"killThread\\"){killThread(d["thread"])}else
if(cmd===\\"cancelThread\\"){cancelThread(d["thread"])}else
if(cmd===\\"loaded\\"){worker.loaded=true;if(onFinishedLoading)onFinishedLoading(worker);if(worker.runPthread)
{worker.runPthread();delete
worker.runPthread}}else if(cmd===\\"print\\"){out("\\Thread \"+d["threadId"]+\\": \"+d["text"])}else
if(cmd===\\"printErr\\"){err("\\Thread \"+d["threadId"]+\\": \"+d["text"])}else if(cmd===\\"alert\\"){alert("\\Thread
\\"+d["threadId"]+\\": \"+d["text"])}else if(cmd===\\"exit\\"){var
detached=worker.pthread&&Atomics.load(GROWABLE_HEAP_U32(),worker.pthread.threadInfoStruct+64>>2);if
(detached){PThread.returnWorkerToPool(worker)}}else

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if(cmd===\exitProcess\"){try{exit(d[\returnCode\])}catch(e){if(e instanceof ExitStatus)return;throw e}}else
if(cmd===\cancelDone\"){PThread.returnWorkerToPool(worker)}else
if(cmd===\objectTransfer\"){PThread.receiveObjectTransfer(e.data)}else
if(e.data.target===\setimmediate\"){worker.postMessage(e.data)}else{err(\worker sent an unknown command
\"+cmd)}PThread.currentProxiedOperationCallerThread=undefined;worker.onerror=function(e){err(\pthread sent
an error!\"+e.filename+\":\"+e.lineno+\":
\"+e.message)};if(ENVIRONMENT_IS_NODE){worker.on(\"message\",function(data){worker.onmessage({data:d
ata});});worker.on(\"error\",function(data){worker.onerror(data)});worker.on(\"exit\",function(data){})}worker.post
Message({\"cmd\":\load\",urlOrBlob\":Module[\mainScriptUrlOrBlob\]\|_scriptDir,\wasmMemory\":wasmMe
memory,\wasmModule\":wasmModule)),allocateUnusedWorker:function(){var
pthreadMainJs=locateFile(\tfjs-backend-wasm-threaded-simd.worker.js\");PThread.unusedWorkers.push(new
Worker(pthreadMainJs)),getNewWorker:function(){if(PThread.unusedWorkers.length==0){PThread.allocateUnus
edWorker();PThread.loadWasmModuleToWorker(PThread.unusedWorkers[0])}if(PThread.unusedWorkers.length>
0)return PThread.unusedWorkers.pop();else return null},busySpinWait:function(msecs){var
t=performance.now()+msecs;while(performance.now()<t){}}};function
establishStackSpace(stackTop,stackMax){_emscripten_stack_set_limits(stackTop,stackMax);stackRestore(stackTop
)}Module[\establishStackSpace\]=establishStackSpace;function getNoExitRuntime(){return
noExitRuntime}Module[\getNoExitRuntime\]=getNoExitRuntime;function invokeEntryPoint(ptr,arg){return
wasmTable.get(ptr)(arg)}Module[\invokeEntryPoint\]=invokeEntryPoint;function
__assert_fail(condition,filename,line,func){abort(\"Assertion failed: \"+UTF8ToString(condition)+\", at:
\"+[filename?UTF8ToString(filename):\unknown filename],line,func?UTF8ToString(func):\unknown
function\")}function __call_main(argc,argv){var returnCode=_main(argc,argv)}var
_emscripten_get_now;if(ENVIRONMENT_IS_NODE){_emscripten_get_now=function(){var
t=process[\hrtime\]();return t[0]*1e3+t[1]/1e6}}else
if(ENVIRONMENT_IS_PTHREAD){_emscripten_get_now=function(){return performance.now()-
Module[\__performance_now_clock_drift\]}}else if(typeof
dateNow!=\"undefined\"){_emscripten_get_now=dateNow}else _emscripten_get_now=function(){return
performance.now()};function setErrNo(value){GROWABLE_HEAP_I32()[__errno_location()>>2]=value;return
value}function _atexit(func,arg){if(ENVIRONMENT_IS_PTHREAD)return
_emscripten_proxy_to_main_thread_js(1,1,func,arg)}function
__emscripten_notify_thread_queue(targetThreadId,mainThreadId){if(targetThreadId==mainThreadId){postMessag
e({\"cmd\":\processQueuedMainThreadWork\})}else
if(ENVIRONMENT_IS_PTHREAD){postMessage({\"targetThread\":targetThreadId,\"cmd\":\processThreadQueue
e\})}else{var pthread=PThread.pthreads[targetThreadId];var
worker=pthread&&pthread.worker;if(!worker){return}worker.postMessage({\"cmd\":\processThreadQueue\})}ret
urn 1}function _abort(){abort()}function _emscripten_asm_const_int(code,sigPtr,argbuf){var
args=readAsmConstArgs(sigPtr,argbuf);return ASM_CONSTS[code].apply(null,args)}function
_emscripten_conditional_set_current_thread_status(expectedStatus,newStatus){}function
_emscripten_futex_wait(addr,val,timeout){if(addr<=0||addr>GROWABLE_HEAP_I8().length||addr&3!=0)return-
28;if(!ENVIRONMENT_IS_WEB){var
ret=Atomics.wait(GROWABLE_HEAP_I32(),addr>>2,val,timeout);if(ret===\"timed-out\")return-
73;if(ret===\"not-equal\")return-6;if(ret===\"ok\")return
0;throw\"Atomics.wait returned an unexpected value
\"+ret}else{if(Atomics.load(GROWABLE_HEAP_I32(),addr>>2)!=val){return-6}var
tNow=performance.now();var tEnd=tNow+timeout;var
lastAddr=Atomics.exchange(GROWABLE_HEAP_I32(),__emscripten_main_thread_futex>>2,addr);while(1){tNo
w=performance.now();if(tNow>tEnd){lastAddr=Atomics.exchange(GROWABLE_HEAP_I32(),__emscripten_mai
n_thread_futex>>2,0);return-

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73}lastAddr=Atomics.exchange(GROWABLE_HEAP_I32(),__emscripten_main_thread_futex>>2,0);if(lastAddr==
0){break}_emscripten_main_thread_process_queued_calls();if(Atomics.load(GROWABLE_HEAP_I32()),addr>>2)!
=val){return-
6}lastAddr=Atomics.exchange(GROWABLE_HEAP_I32(),__emscripten_main_thread_futex>>2,addr)}return
0}}function
_emscripten_memcpy_big(dest,src,num){GROWABLE_HEAP_U8().copyWithin(dest,src,src+num)}function
_emscripten_num_logical_cores(){if(ENVIRONMENT_IS_NODE)return require("\os").cpus().length;return
navigator["hardwareConcurrency"]}function
_emscripten_proxy_to_main_thread_js(index,sync){var numCallArgs=arguments.length-2;var
stack=stackSave();var serializedNumCallArgs=numCallArgs;var args=stackAlloc(serializedNumCallArgs*8);var
b=args>>3;for(var i=0;i<numCallArgs;i++){var arg=arguments[2+i];GROWABLE_HEAP_F64()[b+i]=arg}var
ret=_emscripten_run_in_main_runtime_thread_js(index,serializedNumCallArgs,args,sync);stackRestore(stack);retur
n ret}var _emscripten_receive_on_main_thread_js_callArgs=[];var readAsmConstArgsArray=[];function
readAsmConstArgs(sigPtr,buf){readAsmConstArgsArray.length=0;var
ch;buf>>=2;while(ch=GROWABLE_HEAP_U8()[sigPtr++){var
double=ch<105;if(double&&buf&1)buf++;readAsmConstArgsArray.push(double?GROWABLE_HEAP_F64()[buf
++>>1]:GROWABLE_HEAP_I32()[buf]);++buf}return readAsmConstArgsArray}function
_emscripten_receive_on_main_thread_js(index,numCallArgs,args){_emscripten_receive_on_main_thread_js_callA
rgs.length=numCallArgs;var b=args>>3;for(var
i=0;i<numCallArgs;i++){_emscripten_receive_on_main_thread_js_callArgs[i]=GROWABLE_HEAP_F64()[b+i]}v
ar
isEmAsmConst=index<0;var func=!isEmAsmConst?proxiedFunctionTable[index]:ASM_CONSTS[-index-
1];return func.apply(null,_emscripten_receive_on_main_thread_js_callArgs)}function
_emscripten_get_heap_size(){return GROWABLE_HEAP_U8().length}function
emscripten_realloc_buffer(size){try{wasmmemory.grow(size-
buffer.byteLength+65535>>>16);updateGlobalBufferAndViews(wasmmemory.buffer);return
1}catch(e){}}function _emscripten_resize_heap(requestedSize){var
oldSize=_emscripten_get_heap_size();if(requestedSize<=oldSize){return false}var
maxHeapSize=2147483648;if(requestedSize>maxHeapSize){return false}for(var
cutDown=1;cutDown<=4;cutDown*=2){var
overGrownHeapSize=oldSize*(1+.2/cutDown);overGrownHeapSize=Math.min(overGrownHeapSize,requestedSize
+100663296);var
newSize=Math.min(maxHeapSize,alignUp(Math.max(requestedSize,overGrownHeapSize),65536));var
replacement=emscripten_realloc_buffer(newSize);if(replacement){return true}}return false}var
JSEvents={inEventHandler:0,removeAllEventListeners:function(){for(var
i=JSEvents.eventHandlers.length-1;i>=0;--
i){JSEvents._removeHandler(i)}JSEvents.eventHandlers=[];JSEvents.deferredCalls=[]},registerRemoveEventListen
ers:function(){if(!JSEvents.removeAllEventListenersRegistered){__ATEXIT__.push(JSEvents.removeAllEventListene
rs);JSEvents.removeAllEventListenersRegistered=true}},deferredCalls:[],deferCall:function(targetFunction,precedence
,argsList){function arraysHaveEqualContent(arrA,arrB){if(arrA.length!=arrB.length)return false;for(var i in
arrA){if(arrA[i]!=arrB[i])return false}return true}for(var i in JSEvents.deferredCalls){var
call=JSEvents.deferredCalls[i];if(call.targetFunction==targetFunction&&arraysHaveEqualContent(call.argsList,args
List))){return}}JSEvents.deferredCalls.push({targetFunction:targetFunction,precedence:precedence,argsList:argsList
});JSEvents.deferredCalls.sort(function(x,y){return
x.precedence<y.precedence}),removeDeferredCalls:function(targetFunction){for(var
i=0;i<JSEvents.deferredCalls.length;++i){if(JSEvents.deferredCalls[i].targetFunction==targetFunction){JSEvents.d
eferredCalls.splice(i,1);--i}}},canPerformEventHandlerRequests:function(){return

```



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JSEvents.inEventHandler&&JSEvents.currentEventHandler.allowsDeferredCalls},runDeferredCalls:function(){if(!J
SEvents.canPerformEventHandlerRequests()){return}for(var i=0;i<JSEvents.deferredCalls.length;++i){var
call=JSEvents.deferredCalls[i];JSEvents.deferredCalls.splice(i,1);--
i;call.targetFunction.apply(null,call.argsList)}},eventHandlers:[],removeAllHandlersOnTarget:function(target,event
TypeString){for(var
i=0;i<JSEvents.eventHandlers.length;++i){if(JSEvents.eventHandlers[i].target==target&&(!eventTypeString||event
TypeString==JSEvents.eventHandlers[i].eventTypeString)){JSEvents._removeHandler(i--
)}}},_removeHandler:function(i){var
h=JSEvents.eventHandlers[i];h.target.removeEventListener(h.eventTypeString,h.eventListenerFunc,h.useCapture);J
SEvents.eventHandlers.splice(i,1)},registerOrRemoveHandler:function(eventHandler){var
jsEventHandler=function
jsEventHandler(event){++JSEvents.inEventHandler;JSEvents.currentEventHandler=eventHandler;JSEvents.runDef
erredCalls();eventHandler.handlerFunc(event);JSEvents.runDeferredCalls();--
JSEvents.inEventHandler};if(eventHandler.callbackfunc){eventHandler.eventListenerFunc=jsEventHandler;eventH
andler.target.addEventListener(eventHandler.eventTypeString,jsEventHandler,eventHandler.useCapture);JSEvents.e
ventHandlers.push(eventHandler);JSEvents.registerRemoveEventListeners()}else{for(var
i=0;i<JSEvents.eventHandlers.length;++i){if(JSEvents.eventHandlers[i].target==eventHandler.target&&JSEvents.e
ventHandlers[i].eventTypeString==eventHandler.eventTypeString){JSEvents._removeHandler(i--
)}}},queueEventHandlerOnThread_iiii:function(targetThread,eventHandlerFunc,eventTypeId,eventData,userData)
{var stackTop=stackSave();var
varargs=stackAlloc(12);GROWABLE_HEAP_I32()[varargs>>2]=eventTypeId;GROWABLE_HEAP_I32()[varargs
+4>>2]=eventData;GROWABLE_HEAP_I32()[varargs+8>>2]=userData;__emscripten_call_on_thread(0,targetThr
ead,637534208,eventHandlerFunc,eventData,varargs);stackRestore(stackTop)},getTargetThreadForEventCallback:f
unction(targetThread){switch(targetThread){case
1:return 0;case 2:return PThread.currentProxiedOperationCallerThread;default:return
targetThread}},getNodeNameForTarget:function(target){if(!target)return\"\";if(target==window)return\"#window\";
if(target==screen)return\"#screen\";return
target&&target.nodeName?target.nodeName:\"\"},fullscreenEnabled:function(){return
document.fullscreenEnabled||document.webkitFullscreenEnabled}};function stringToNewUTF8(jsString){var
length=lengthBytesUTF8(jsString)+1;var cString=_malloc(length);stringToUTF8(jsString,cString,length);return
cString}function
_emsripten_set_offscreencanvas_size_on_target_thread_js(targetThread,targetCanvas,width,height){var
stackTop=stackSave();var varargs=stackAlloc(12);var
targetCanvasPtr=0;if(targetCanvas){targetCanvasPtr=stringToNewUTF8(targetCanvas)}GROWABLE_HEAP_I32(
)[varargs>>2]=targetCanvasPtr;GROWABLE_HEAP_I32()[varargs+4>>2]=width;GROWABLE_HEAP_I32()[var
args+8>>2]=height;__emscripten_call_on_thread(0,targetThread,657457152,0,targetCanvasPtr,varargs);stackRestor
e(stackTop)}function
_emsripten_set_offscreencanvas_size_on_target_thread(targetThread,targetCanvas,width,height){targetCanvas=tar
getCanvas?UTF8ToString(targetCanvas):\"\";_emsripten_set_offscreencanvas_size_on_target_thread_js(targetThr
ead,targetCanvas,width,height)}function maybeCStringToJsString(cString){return
cString>2?UTF8ToString(cString):cString}var specialHTMLTargets=[0,typeof
document!=\"undefined\"?document:0,typeof window!=\"undefined\"?window:0];function
findEventTarget(target){target=maybeCStringToJsString(target);var
domElement=specialHTMLTargets[target]||(typeof
document!=\"undefined\"?document.querySelector(target):undefined);return domElement}function
findCanvasEventTarget(target){return findEventTarget(target)}function
_emsripten_set_canvas_element_size_calling_thread(target,width,height){var

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    canvas=findCanvasEventTarget(target);if(!canvas)return-
4;if(canvas.canvasSharedPtr){GROWABLE_HEAP_I32()[canvas.canvasSharedPtr>>2]=width;GROWABLE_HEA
P_I32()[canvas.canvasSharedPtr+4>>2]=height}if(canvas.offscreenCanvas||!canvas.controlTransferredOffscreen){if
(canvas.offscreenCanvas)canvas=canvas.offscreenCanvas;var
autoResizeViewport=false;if(canvas.GLctxObject&&canvas.GLctxObject.GLctx){var
prevViewport=canvas.GLctxObject.GLctx.getParameter(2978);autoResizeViewport=prevViewport[0]===0&&prev
Viewport[1]===0&&prevViewport[2]===canvas.width&&prevViewport[3]===canvas.height}canvas.width=width;
canvas.height=height;if(autoResizeViewport){canvas.GLctxObject.GLctx.viewport(0,0,width,height)}}else
if(canvas.canvasSharedPtr){var
targetThread=GROWABLE_HEAP_I32()[canvas.canvasSharedPtr+8>>2];_emscripten_set_offscreencanvas_size_o
n_target_thread(targetThread,target,width,height);return 1}else{return-4}return 0}function
_emscripten_set_canvas_element_size_main_thread(target,width,height){if(ENVIRONMENT_IS_PTHREAD)retur
n
_emscripten_proxy_to_main_thread_js(2,1,target,width,height);return
_emscripten_set_canvas_element_size_calling_thread(target,width,height)}function
_emscripten_set_canvas_element_size(target,width,height){var
canvas=findCanvasEventTarget(target);if(canvas){return
_emscripten_set_canvas_element_size_calling_thread(target,width,height)}else{return
_emscripten_set_canvas_element_size_main_thread(target,width,height)}}function
_emscripten_set_current_thread_status(newStatus){}function
_emscripten_set_thread_name(threadId,name){}function __webgl_enable_ANGLE_instanced_arrays(ctx){var
ext=ctx.getExtension("\ANGLE_instanced_arrays");if(ext){ctx["vertexAttribDivisor"]=function(index,divisor){ex
t["vertexAttribDivisorANGLE"](index,divisor)};ctx["drawArraysInstanced"]=function(mode,first,count,primcou
nt){ext["drawArraysInstancedANGLE"](mode,first,count,primcount)};ctx["drawElementsInstanced"]=function(
mode,count,type,indices,primcount){ext["drawElementsInstancedANGLE"](mode,count,type,indices,primcount)};
return
1}}function __webgl_enable_OES_vertex_array_object(ctx){var
ext=ctx.getExtension("\OES_vertex_array_object");if(ext){ctx["createVertexArray"]=function(){return
ext["createVertexArrayOES"]();};ctx["deleteVertexArray"]=function(vao){ext["deleteVertexArrayOES"](vao)};
ctx["bindVertexArray"]=function(vao){ext["bindVertexArrayOES"](vao)};ctx["isVertexArray"]=function(vao)
{return ext["isVertexArrayOES"](vao)};return 1}}function __webgl_enable_WEBGL_draw_buffers(ctx){var
ext=ctx.getExtension("\WEBGL_draw_buffers");if(ext){ctx["drawBuffers"]=function(n,bufs){ext["drawBuffers
WEBGL"](n,bufs)};return 1}}function
__webgl_enable_WEBGL_multi_draw(ctx){return!(ctx.multiDrawWebgl=ctx.getExtension("\WEBGL_multi_dra
w"))}var
GL={counter:1,buffers:[],programs:[],framebuffers:[],renderbuffers:[],textures:[],uniforms:[],shaders:[],vaos:[],cont
exts:{},offscreenCanvases:{},timerQueriesEXT:[],programInfos:{},stringCache:{},unpackAlignment:4,recordError:
function
recordError(errorCode){if(!GL.lastError){GL.lastError=errorCode}},getNewId:function(table){var
ret=GL.counter++;for(var i=table.length;i<ret;i++){table[i]=null}return
ret},getSource:function(shader,count,string,length){var source="";for(var i=0;i<count;++i){var
len=length?GROWABLE_HEAP_I32()[length+i*4>>2]:-
1;source+=UTF8ToString(GROWABLE_HEAP_I32()[string+i*4>>2],len<0?undefined:len)}return
source},createContext:function(canvas,webGLContextAttributes){var
ctx=canvas.getContext("\webgl",webGLContextAttributes);if(!ctx)return 0;var
handle=GL.registerContext(ctx,webGLContextAttributes);return
handle},registerContext:function(ctx,webGLContextAttributes){var
handle=_malloc(8);GROWABLE_HEAP_I32()[handle+4>>2]=_pthread_self();var

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context={ handle:handle,attributes:webGLContextAttributes,version:webGLContextAttributes.majorVersion,GLctx:
ctx };if(ctx.canvas)ctx.canvas.GLctxObject=context;GL.contexts[handle]=context;if(typeof
webGLContextAttributes.enableExtensionsByDefault===\"undefined\"||webGLContextAttributes.enableExtensions
ByDefault){ GL.initExtensions(context)}return
handle},makeContextCurrent:function(contextHandle){ GL.currentContext=GL.contexts[contextHandle];Module.ctx
=GLctx=GL.currentContext&&GL.currentContext.GLctx;return!(contextHandle&&!GLctx)},getContext:function(c
ontextHandle){ return
GL.contexts[contextHandle]},deleteContext:function(contextHandle){ if(GL.currentContext===GL.contexts[context
Handle])GL.currentContext=null;if(typeof
JSEvents===\"object\")JSEvents.removeAllHandlersOnTarget(GL.contexts[contextHandle].GLctx.canvas);if(GL.co
ntexts[contextHandle]&&GL.contexts[contextHandle].GLctx.canvas)GL.contexts[contextHandle].GLctx.canvas.GL
ctxObject=undefined;_free(GL.contexts[contextHandle].handle);GL.contexts[contextHandle]=null},initExtensions:f
unction(context){ if(!context)context=GL.currentContext;if(context.initExtensionsDone)return;context.initExtension
sDone=true;var
GLctx=context.GLctx;__webgl_enable_ANGLE_instanced_arrays(GLctx);__webgl_enable_OES_vertex_array_obj
ect(GLctx);__webgl_enable_WEBGL_draw_buffers(GLctx);GLctx.disjointTimerQueryExt=GLctx.getExtension(\"
EXT_disjoint_timer_query\");__webgl_enable_WEBGL_multi_draw(GLctx);var
exts=GLctx.getSupportedExtensions()||[];exts.forEach(function(ext){ if(ext.indexOf(\"lose_context\")<0&&ext.inde
xOf(\"debug\")<0){ GLctx.getExtension(ext) } } ),populateUniformTable:function(program){ var
p=GL.programs[program];var
ptable=GL.programInfos[program]={ uniforms: { },maxUniformLength:0,maxAttributeLength:-
1,maxUniformBlockNameLength:-1 };var utable=ptable.uniforms;var
numUniforms=GLctx.getProgramParameter(p,35718);for(var i=0;i<numUniforms;++i){ var
u=GLctx.getActiveUniform(p,i);var
name=u.name;ptable.maxUniformLength=Math.max(ptable.maxUniformLength,name.length+1);if(name.slice(-
1)===\"\\\"){ name=name.slice(0,name.lastIndexOf(\"\\\"))}var loc=GLctx.getUniformLocation(p,name);if(loc){ var
id=GL.getNewId(GL.uniforms);utable[name]=[u.size,id];GL.uniforms[id]=loc;for(var
j=1;j<u.size;++j){ var
n=name+\"\\\"+j+\"\\\"\";loc=GLctx.getUniformLocation(p,n);id=GL.getNewId(GL.uniforms);GL.uniforms[id]=loc } }
} };var __emscripten_webgl_power_preferences=[\"default\",\"low-power\",\"high-performance\"];function
__emscripten_webgl_do_create_context(target,attributes){ var a=attributes>>2;var
powerPreference=GROWABLE_HEAP_I32()[a+(24>>2)];var
contextAttributes={ \"alpha\":!!GROWABLE_HEAP_I32()[a+(0>>2)],\"depth\":!!GROWABLE_HEAP_I32()[a+(4
>>2)],\"stencil\":!!GROWABLE_HEAP_I32()[a+(8>>2)],\"antialias\":!!GROWABLE_HEAP_I32()[a+(12>>2)],\"p
remultipliedAlpha\":!!GROWABLE_HEAP_I32()[a+(16>>2)],\"preserveDrawingBuffer\":!!GROWABLE_HEAP_
I32()[a+(20>>2)],\"powerPreference\":__emscripten_webgl_power_preferences[powerPreference],\"failIfMajorPerf
ormanceCaveat\":!!GROWABLE_HEAP_I32()[a+(28>>2)],majorVersion:GROWABLE_HEAP_I32()[a+(32>>2)],
minorVersion:GROWABLE_HEAP_I32()[a+(36>>2)],enableExtensionsByDefault:GROWABLE_HEAP_I32()[a+(
40>>2)],explicitSwapControl:GROWABLE_HEAP_I32()[a+(44>>2)],proxyContextToMainThread:GROWABLE_
HEAP_I32()[a+(48>>2)],renderViaOffscreenBackBuffer:GROWABLE_HEAP_I32()[a+(52>>2)] };var
canvas=findCanvasEventTarget(target);if(!canvas){ return 0}if(contextAttributes.explicitSwapControl){ return
0}var contextHandle=GL.createContext(canvas,contextAttributes);return contextHandle}function
__emscripten_webgl_create_context(a0,a1){ return __emscripten_webgl_do_create_context(a0,a1)}var
SYSCALLS={ mappings: { },buffers:[null,[],[]],printChar:function(stream,curr){ var
buffer=SYSCALLS.buffers[stream];if(curr===0||curr===10){ (stream===1?out:err)(UTF8ArrayToString(buffer,0));
buffer.length=0}else{ buffer.push(curr) } },varargs:undefined,get:function(){ SYSCALLS.varargs+=4;var
ret=GROWABLE_HEAP_I32()[SYSCALLS.varargs-4>>2];return ret},getStr:function(ptr){ var
ret=UTF8ToString(ptr);return ret},get64:function(low,high){ return low } };function

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_fd_close(fd){if(ENVIRONMENT_IS_PTHREAD)return _emscripten_proxy_to_main_thread_js(3,1,fd);return
0}function _fd_seek(fd,offset_low,offset_high,whence,newOffset){if(ENVIRONMENT_IS_PTHREAD)return
_emscripten_proxy_to_main_thread_js(4,1,fd,offset_low,offset_high,whence,newOffset)}function
_fd_write(fd,iow,iovcnt,pnum){if(ENVIRONMENT_IS_PTHREAD)return
_emscripten_proxy_to_main_thread_js(5,1,fd,iow,iovcnt,pnum);var num=0;for(var i=0;i<iovcnt;i++){var
ptr=GROWABLE_HEAP_I32()[iow+i*8>>2];var len=GROWABLE_HEAP_I32()[iow+(i*8+4)>>2];for(var
j=0;j<len;j++){SYSCALLS.printChar(fd,GROWABLE_HEAP_U8()[ptr+j])}num+=len}GROWABLE_HEAP_I32
()[pnum>>2]=num;return 0}function _pthread_cleanup_pop(execute){var
routine=PThread.threadExitHandlers.pop();if(execute)routine()}function
_pthread_cleanup_push(routine,arg){PThread.threadExitHandlers.push(function(){wasnTable.get(routine)(arg)})}f
unction spawnThread(threadParams){if(ENVIRONMENT_IS_PTHREAD)throw"Internal Error! spawnThread()
can only ever be called from main application thread!";var
worker=PThread.getNewWorker();if(worker.pthread!==undefined)throw"Internal
error!";if(!threadParams.pthread_ptr)throw"Internal
error, no pthread ptr!";PThread.runningWorkers.push(worker);var tlsMemory=_malloc(128*4);for(var
i=0;i<128;++i){GROWABLE_HEAP_I32()[tlsMemory+i*4>>2]=0}var
stackHigh=threadParams.stackBase+threadParams.stackSize;var
pthread=PThread.pthreads[threadParams.pthread_ptr]={worker:worker,stackBase:threadParams.stackBase,stackSize
:threadParams.stackSize,allocatedOwnStack:threadParams.allocatedOwnStack,threadInfoStruct:threadParams.pthrea
d_ptr};var
tis=pthread.threadInfoStruct>>2;Atomics.store(GROWABLE_HEAP_U32(),tis+(64>>2),threadParams.detached);A
tomics.store(GROWABLE_HEAP_U32(),tis+(100>>2),tlsMemory);Atomics.store(GROWABLE_HEAP_U32(),tis
+(40>>2),pthread.threadInfoStruct);Atomics.store(GROWABLE_HEAP_U32(),tis+(80>>2),threadParams.stackSiz
e);Atomics.store(GROWABLE_HEAP_U32(),tis+(76>>2),stackHigh);Atomics.store(GROWABLE_HEAP_U32(),t
is+(104>>2),threadParams.stackSize);Atomics.store(GROWABLE_HEAP_U32(),tis+(104+8>>2),stackHigh);Atom
ics.store(GROWABLE_HEAP_U32(),tis+(104+12>>2),threadParams.detached);var
global_libc=_emscripten_get_global_libc();var
global_locale=global_libc+40;Atomics.store(GROWABLE_HEAP_U32(),tis+(172>>2),global_locale);worker.pthr
ead=pthread;var
msg={"cmd":"run","start_routine":threadParams.startRoutine,"arg":threadParams.arg,"threadInfoStruct":thre
adParams.pthread_ptr,"stackBase":threadParams.stackBase,"stackSize":threadParams.stackSize};worker.runPthr
ead=function(){msg.time=performance.now();worker.postMessage(msg,threadParams.transferList)};if(worker.loaded
){worker.runPthread();delete worker.runPthread}}function
_pthread_create(pthread_ptr,attr,start_routine,arg){if(typeof SharedArrayBuffer==="undefined"){err("Current
environment does not support SharedArrayBuffer, pthreads are not available!");return
6}if(!pthread_ptr){err("pthread_create called with a null thread pointer!");return 28}var transferList=[];var
error=0;if(ENVIRONMENT_IS_PTHREAD&&(transferList.length===0||error)){return
_emscripten_sync_run_in_main_thread_4(687865856,pthread_ptr,attr,start_routine,arg)}if(error)return
error;var stackSize=0;var stackBase=0;var detached=0;if(attr&&attr!=
1){stackSize=GROWABLE_HEAP_I32()[attr>>2];stackSize+=81920;stackBase=GROWABLE_HEAP_I32()[attr+
8>>2];detached=GROWABLE_HEAP_I32()[attr+12>>2]!==0}else{stackSize=2097152}var
allocatedOwnStack=stackBase===0;if(allocatedOwnStack){stackBase=_memalign(16,stackSize)}else{stackBase=
stackSize;assert(stackBase>0)}var threadInfoStruct=_malloc(228);for(var
i=0;i<228>>2;++i)GROWABLE_HEAP_U32()[threadInfoStruct>>2+i]=0;GROWABLE_HEAP_I32()[pthread_p
tr>>2]=threadInfoStruct;GROWABLE_HEAP_I32()[threadInfoStruct+12>>2]=threadInfoStruct;var
headPtr=threadInfoStruct+152;GROWABLE_HEAP_I32()[headPtr>>2]=headPtr;var
threadParams={stackBase:stackBase,stackSize:stackSize,allocatedOwnStack:allocatedOwnStack,detached:detached
,startRoutine:start_routine,pthread_ptr:threadInfoStruct,arg:arg,transferList:transferList};if(ENVIRONMENT_IS_P

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THREAD){threadParams.cmd="\spawnThread\";postMessage(threadParams,transferList)}else{spawnThread(thread
Params)}return
0}function __pthread_testcancel_js(){if(!ENVIRONMENT_IS_PTHREAD)return;var
tb=__pthread_self();if(!tb)return;var
cancelDisabled=Atomics.load(GROWABLE_HEAP_U32(),tb+56>>2);if(cancelDisabled)return;var
canceled=Atomics.load(GROWABLE_HEAP_U32(),tb+0>>2);if(canceled==2)throw"Canceled!"}function
__emscripten_check_blocking_allowed(){if(ENVIRONMENT_IS_NODE)return;if(ENVIRONMENT_IS_WORKE
R)return;warnOnce("Blocking on the main thread is very dangerous, see
https://emscripten.org/docs/porting/pthreads.html#blocking-on-the-main-browser-thread")}function
__emscripten_do_pthread_join(thread,status,block){if(!thread){err("pthread_join attempted on a null thread
pointer!");return
ERRNO_CODES.ESRCH}if(ENVIRONMENT_IS_PTHREAD&&__pthread_self()==thread){err("PThread
\"+thread+\" is attempting to join to itself!");return ERRNO_CODES.EDEADLK}else
if(!ENVIRONMENT_IS_PTHREAD&&__emscripten_main_browser_thread_id()==thread){err("Main
thread \"+thread+\" is attempting to join to itself!");return ERRNO_CODES.EDEADLK}var
self=GROWABLE_HEAP_I32()[thread+12>>2];if(self!=thread){err("pthread_join attempted on thread
\"+thread+\", which does not point to a valid thread, or does not exist anymore!");return
ERRNO_CODES.ESRCH}var
detached=Atomics.load(GROWABLE_HEAP_U32(),thread+64>>2);if(detached){err("Attempted to join thread
\"+thread+\", which was already detached!");return
ERRNO_CODES.EINVAL}if(block){__emscripten_check_blocking_allowed()}for(;;){var
threadStatus=Atomics.load(GROWABLE_HEAP_U32(),thread+0>>2);if(threadStatus==1){var
threadExitCode=Atomics.load(GROWABLE_HEAP_U32(),thread+4>>2);if(status)GROWABLE_HEAP_I32()[sta
tus>>2]=threadExitCode;Atomics.store(GROWABLE_HEAP_U32(),thread+64>>2,1);if(!ENVIRONMENT_IS_PT
HREAD)cleanupThread(thread);else postMessage({"cmd":"cleanupThread","thread":thread});return
0}if(!block){return
ERRNO_CODES.EBUSY}}__pthread_testcancel_js();if(!ENVIRONMENT_IS_PTHREAD)__emscripten_main_thre
ad_process_queued_calls();__emscripten_futex_wait(thread+0,threadStatus,ENVIRONMENT_IS_PTHREAD?100:1
))}function
__pthread_join(thread,status){return __emscripten_do_pthread_join(thread,status,true)}function
__sysconf(name){if(ENVIRONMENT_IS_PTHREAD)return
__emscripten_proxy_to_main_thread_js(6,1,name);switch(name){case 30:return 16384;case 85:var
maxHeapSize=2147483648;return maxHeapSize/16384;case 132:case 133:case 12:case 137:case 138:case 15:case
235:case 16:case 17:case 18:case 19:case 20:case 149:case 13:case 10:case 236:case 153:case 9:case 21:case 22:case
159:case 154:case 14:case 77:case 78:case 139:case 82:case 68:case 67:case 164:case 11:case 29:case 47:case
48:case 95:case 52:case 51:case 46:return 200809;case 27:case 246:case 127:case 128:case 23:case 24:case 160:case
161:case 181:case 182:case 242:case 183:case 184:case 243:case 244:case 245:case 165:case 178:case 179:case
49:case 50:case 168:case 169:case 175:case 170:case 171:case 172:case
97:case 76:case 32:case 173:case 35:case 80:case 81:case 79:return-1;case 176:case 177:case 7:case 155:case 8:case
157:case 125:case 126:case 92:case 93:case 129:case 130:case 131:case 94:case 91:return 1;case 74:case 60:case
69:case 70:case 4:return 1024;case 31:case 42:case 72:return 32;case 87:case 26:case 33:return 2147483647;case
34:case 1:return 47839;case 38:case 36:return 99;case 43:case 37:return 2048;case 0:return 2097152;case 3:return
65536;case 28:return 32768;case 44:return 32767;case 75:return 16384;case 39:return 1e3;case 89:return 700;case
71:return 256;case 40:return 255;case 2:return 100;case 180:return 64;case 25:return 20;case 5:return 16;case
6:return 6;case 73:return 4;case 84:{if(typeof navigator===\"object\")return
navigator[\"hardwareConcurrency\"]||1;return 1}}setErrNo(28);return-
1}if(!ENVIRONMENT_IS_PTHREAD)PThread.initMainThreadBlock();var GLctx;var
proxiedFunctionTable=[null,_atexit,__emscripten_set_canvas_element_size_main_thread,_fd_close,_fd_seek,_fd_wr

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ite,_sysconf];var
asmLibraryArg={\"e\":__assert_fail,\"r\":__call_main,\"x\":__emscripten_notify_thread_queue,\"b\":_abort,\"y\":
_emscripten_asm_const_int,\"j\":_emscripten_conditional_set_current_thread_status,\"d\":_emscripten_futex_wait,\"
c\":_emscripten_futex_wake,\"f\":_emscripten_get_now,\"p\":_emscripten_memcpy_big,\"A\":_emscripten_num_l
ogical_cores,\"u\":_emscripten_receive_on_main_thread_js,\"q\":_emscripten_resize_heap,\"v\":_emscripten_set_ca
nvas_element_size,\"i\":_emscripten_set_current_thread_status,\"s\":_emscripten_set_thread_name,\"w\":_emscript
en_webgl_create_context,\"l\":_fd_close,\"n\":_fd_seek,\"g\":_fd_write,\"o\":initPthreadsJS,\"a\":wasmMemory||Mo
dule[\"wasmMemory\"],\"z\":_pthread_cleanup_pop,\"k\":_pthread_cleanup_push,\"h\":_pthread_create,\"m\":_pthr
ead_join,\"t\":_sysconf};var asm=createWasm();var
__wasm_call_ctors=Module[\"__wasm_call_ctors\"]=function(){return(__wasm_call_ctors=Module[\"__wasm
_call_ctors\"]=Module[\"asm\"][\"B\"]).apply(null,arguments)};var
_init=Module[\"_init\"]=function(){return(_init=Module[\"_init\"]=Module[\"asm\"][\"C\"]).apply(null,arguments)};
var
_init_with_threads_count=Module[\"_init_with_threads_count\"]=function(){return(_init_with_threads_count=Mod
ule[\"_init_with_threads_count\"]=Module[\"asm\"][\"D\"]).apply(null,arguments)};var
_get_threads_count=Module[\"_get_threads_count\"]=function(){return(_get_threads_count=Module[\"_get_threads
_count\"]=Module[\"asm\"][\"E\"]).apply(null,arguments)};var
_register_tensor=Module[\"_register_tensor\"]=function(){return(_register_tensor=Module[\"_register_tensor\"]=M
odule[\"asm\"][\"F\"]).apply(null,arguments)};var
_dispose_data=Module[\"_dispose_data\"]=function(){return(_dispose_data=Module[\"_dispose_data\"]=Module[\"
asm\"][\"G\"]).apply(null,arguments)};var
_dispose=Module[\"_dispose\"]=function(){return(_dispose=Module[\"_dispose\"]=Module[\"asm\"][\"H\"]).apply(
null,arguments)};var
_Abs=Module[\"_Abs\"]=function(){return(_Abs=Module[\"_Abs\"]=Module[\"asm\"][\"J\"]).apply(null,arguments
)};var
_Add=Module[\"_Add\"]=function(){return(_Add=Module[\"_Add\"]=Module[\"asm\"][\"K\"]).apply(null,argumen
ts)};var
_AddN=Module[\"_AddN\"]=function(){return(_AddN=Module[\"_AddN\"]=Module[\"asm\"][\"L\"]).apply(null,ar
guments)};var
_All=Module[\"_All\"]=function(){return(_All=Module[\"_All\"]=Module[\"asm\"][\"M\"]).apply(null,arguments)};
var
_Any=Module[\"_Any\"]=function(){return(_Any=Module[\"_Any\"]=Module[\"asm\"][\"N\"]).apply(null,argumen
ts)};var
_ArgMax=Module[\"_ArgMax\"]=function(){return(_ArgMax=Module[\"_ArgMax\"]=Module[\"asm\"][\"O\"]).ap
ply(null,arguments)};var
_AvgPool=Module[\"_AvgPool\"]=function(){return(_AvgPool=Module[\"_AvgPool\"]=Module[\"asm\"][\"P\"]).a
pply(null,arguments)};var
_BatchMatMul=Module[\"_BatchMatMul\"]=function(){return(_BatchMatMul=Module[\"_BatchMatMul\"]=Modu
le[\"asm\"][\"Q\"]).apply(null,arguments)};var
_Ceil=Module[\"_Ceil\"]=function(){return(_Ceil=Module[\"_Ceil\"]=Module[\"asm\"][\"R\"]).apply(null,argument
s)};var
_ClipByValue=Module[\"_ClipByValue\"]=function(){return(_ClipByValue=Module[\"_ClipByValue\"]=Module[\"
asm\"][\"S\"]).apply(null,arguments)};var
_Conv2D=Module[\"_Conv2D\"]=function(){return(_Conv2D=Module[\"_Conv2D\"]=Module[\"asm\"][\"T\"]).app
ly(null,arguments)};var
_Conv2DBackpropInput=Module[\"_Conv2DBackpropInput\"]=function(){return(_Conv2DBackpropInput=Modul
e[\"_Conv2DBackpropInput\"]=Module[\"asm\"][\"U\"]).apply(null,arguments)};var
_Cos=Module[\"_Cos\"]=function(){return(_Cos=Module[\"_Cos\"]=Module[\"asm\"][\"V\"]).apply(null,arguments

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});var
_Cosh=Module["_Cosh"]=function(){return(_Cosh=Module["_Cosh"]=Module["asm\"][["W"]]).apply(null,arguments)};var
_CropAndResize=Module["_CropAndResize"]=function(){return(_CropAndResize=Module["_CropAndResize"]=Module["asm\"][["X"]]).apply(null,arguments)};var
_Cumsum=Module["_Cumsum"]=function(){return(_Cumsum=Module["_Cumsum"]=Module["asm\"][["Y"]]).apply(null,arguments)};var
_DepthToSpace=Module["_DepthToSpace"]=function(){return(_DepthToSpace=Module["_DepthToSpace"]=Module["asm\"][["Z"]]).apply(null,arguments)};var
_DepthwiseConv2dNative=Module["_DepthwiseConv2dNative"]=function(){return(_DepthwiseConv2dNative=Module["_DepthwiseConv2dNative"]=Module["asm\"][["_"]]).apply(null,arguments)};var
_Elu=Module["_Elu"]=function(){return(_Elu=Module["_Elu"]=Module["asm\"][["$"]]).apply(null,arguments)};var
_Equal=Module["_Equal"]=function(){return(_Equal=Module["_Equal"]=Module["asm\"][["aa"]]).apply(null,arguments)};var
_Exp=Module["_Exp"]=function(){return(_Exp=Module["_Exp"]=Module["asm\"][["ba"]]).apply(null,arguments)};var
_FlipLeftRight=Module["_FlipLeftRight"]=function(){return(_FlipLeftRight=Module["_FlipLeftRight"]=Module["asm\"][["ca"]]).apply(null,arguments)};var
_Floor=Module["_Floor"]=function(){return(_Floor=Module["_Floor"]=Module["asm\"][["da"]]).apply(null,arguments)};var
_FloorDiv=Module["_FloorDiv"]=function(){return(_FloorDiv=Module["_FloorDiv"]=Module["asm\"][["ea"]]).apply(null,arguments)};var
_FusedBatchNorm=Module["_FusedBatchNorm"]=function(){return(_FusedBatchNorm=Module["_FusedBatchNorm"]=Module["asm\"][["fa"]]).apply(null,arguments)};var
_FusedConv2D=Module["_FusedConv2D"]=function(){return(_FusedConv2D=Module["_FusedConv2D"]=Module["asm\"][["ga"]]).apply(null,arguments)};var
_FusedDepthwiseConv2D=Module["_FusedDepthwiseConv2D"]=function(){return(_FusedDepthwiseConv2D=Module["_FusedDepthwiseConv2D"]=Module["asm\"][["ha"]]).apply(null,arguments)};var
_Gather=Module["_Gather"]=function(){return(_Gather=Module["_Gather"]=Module["asm\"][["ia"]]).apply(null,arguments)};var
_GatherNd=Module["_GatherNd"]=function(){return(_GatherNd=Module["_GatherNd"]=Module["asm\"][["ja"]]).apply(null,arguments)};var
_Greater=Module["_Greater"]=function(){return(_Greater=Module["_Greater"]=Module["asm\"][["ka"]]).apply(null,arguments)};var
_GreaterEqual=Module["_GreaterEqual"]=function(){return(_GreaterEqual=Module["_GreaterEqual"]=Module["asm\"][["la"]]).apply(null,arguments)};var
_LeakyRelu=Module["_LeakyRelu"]=function(){return(_LeakyRelu=Module["_LeakyRelu"]=Module["asm\"][["ma"]]).apply(null,arguments)};var
_Less=Module["_Less"]=function(){return(_Less=Module["_Less"]=Module["asm\"][["na"]]).apply(null,arguments)};var
_LessEqual=Module["_LessEqual"]=function(){return(_LessEqual=Module["_LessEqual"]=Module["asm\"][["oa"]]).apply(null,arguments)};var
_Log=Module["_Log"]=function(){return(_Log=Module["_Log"]=Module["asm\"][["pa"]]).apply(null,arguments)};var
_LogicalAnd=Module["_LogicalAnd"]=function(){return(_LogicalAnd=Module["_LogicalAnd"]=Module["asm\"][["qa"]]).apply(null,arguments)};var
_Max=Module["_Max"]=function(){return(_Max=Module["_Max"]=Module["asm\"][["ra"]]).apply(null,arguments)};

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nts));var
_MaxPool=Module["_MaxPool"]=function(){return(_MaxPool=Module["_MaxPool"]=Module["asm"]()["sa"]).
apply(null,arguments));var
_Maximum=Module["_Maximum"]=function(){return(_Maximum=Module["_Maximum"]=Module["asm"]()["t
a"]).apply(null,arguments));var
_Mean=Module["_Mean"]=function(){return(_Mean=Module["_Mean"]=Module["asm"]()["ua"]).apply(null,ar
guments));var
_Min=Module["_Min"]=function(){return(_Min=Module["_Min"]=Module["asm"]()["va"]).apply(null,argumen
ts));var
_Minimum=Module["_Minimum"]=function(){return(_Minimum=Module["_Minimum"]=Module["asm"]()["wa
"]).apply(null,arguments));var
_MirrorPad=Module["_MirrorPad"]=function(){return(_MirrorPad=Module["_MirrorPad"]=Module["asm"]()["x
a"]).apply(null,arguments));var
_Multiply=Module["_Multiply"]=function(){return(_Multiply=Module["_Multiply"]=Module["asm"]()["ya"]).a
pply(null,arguments));var
_Neg=Module["_Neg"]=function(){return(_Neg=Module["_Neg"]=Module["asm"]()["za"]).apply(null,argumen
ts));var
_NonMaxSuppressionV3=Module["_NonMaxSuppressionV3"]=function(){return(_NonMaxSuppressionV3=Mod
ule["_NonMaxSuppressionV3"]=Module["asm"]()["Aa"]).apply(null,arguments));var
_NonMaxSuppressionV4=Module["_NonMaxSuppressionV4"]=function(){return(_NonMaxSuppressionV4=Mod
ule["_NonMaxSuppressionV4"]=Module["asm"]()["Ba"]).apply(null,arguments));var
_NonMaxSuppressionV5=Module["_NonMaxSuppressionV5"]=function(){return(_NonMaxSuppressionV5=Mod
ule["_NonMaxSuppressionV5"]=Module["asm"]()["Ca"]).apply(null,arguments));var
_NotEqual=Module["_NotEqual"]=function(){return(_NotEqual=Module["_NotEqual"]=Module["asm"]()["Da"
]).apply(null,arguments));var
_OneHot=Module["_OneHot"]=function(){return(_OneHot=Module["_OneHot"]=Module["asm"]()["Ea"]).appl
y(null,arguments));var
_PadV2=Module["_PadV2"]=function(){return(_PadV2=Module["_PadV2"]=Module["asm"]()["Fa"]).apply(nu
ll,arguments));var
_Pow=Module["_Pow"]=function(){return(_Pow=Module["_Pow"]=Module["asm"]()["Ga"]).apply(null,argume
nts));var
_Prelu=Module["_Prelu"]=function(){return(_Prelu=Module["_Prelu"]=Module["asm"]()["Ha"]).apply(null,arg
uments));var
_Prod=Module["_Prod"]=function(){return(_Prod=Module["_Prod"]=Module["asm"]()["Ia"]).apply(null,argum
ents));var
_RealDiv=Module["_RealDiv"]=function(){return(_RealDiv=Module["_RealDiv"]=Module["asm"]()["Ja"]).app
ly(null,arguments));var
_Relu=Module["_Relu"]=function(){return(_Relu=Module["_Relu"]=Module["asm"]()["Ka"]).apply(null,argum
ents));var
_Relu6=Module["_Relu6"]=function(){return(_Relu6=Module["_Relu6"]=Module["asm"]()["La"]).apply(null,a
rguments));var
_ResizeBilinear=Module["_ResizeBilinear"]=function(){return(_ResizeBilinear=Module["_ResizeBilinear"]=Mo
dule["asm"]()["Ma"]).apply(null,arguments));var
_Reverse=Module["_Reverse"]=function(){return(_Reverse=Module["_Reverse"]=Module["asm"]()["Na"]).app
ly(null,arguments));var
_RotateWithOffset=Module["_RotateWithOffset"]=function(){return(_RotateWithOffset=Module["_RotateWith
Offset"]=Module["asm"]()["Oa"]).apply(null,arguments));var
_Round=Module["_Round"]=function(){return(_Round=Module["_Round"]=Module["asm"]()["Pa"]).apply(nul

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l,arguments));var
_Rsqrt=Module["_Rsqrt"]=function(){return(_Rsqrt=Module["_Rsqrt"]=Module["asm"]()["Qa"]).apply(null,arguments));var
_ScatterNd=Module["_ScatterNd"]=function(){return(_ScatterNd=Module["_ScatterNd"]=Module["asm"]()["Ra"]()).apply(null,arguments));var
_SelectV2=Module["_SelectV2"]=function(){return(_SelectV2=Module["_SelectV2"]=Module["asm"]()["Sa"]).apply(null,arguments));var
_Sigmoid=Module["_Sigmoid"]=function(){return(_Sigmoid=Module["_Sigmoid"]=Module["asm"]()["Ta"]).apply(null,arguments));var
_Sin=Module["_Sin"]=function(){return(_Sin=Module["_Sin"]=Module["asm"]()["Ua"]).apply(null,arguments)};var
_Softmax=Module["_Softmax"]=function(){return(_Softmax=Module["_Softmax"]=Module["asm"]()["Va"]).apply(null,arguments));var
_Sqrt=Module["_Sqrt"]=function(){return(_Sqrt=Module["_Sqrt"]=Module["asm"]()["Wa"]).apply(null,arguments));var
_Square=Module["_Square"]=function(){return(_Square=Module["_Square"]=Module["asm"]()["Xa"]).apply(null,arguments));var
_SquaredDifference=Module["_SquaredDifference"]=function(){return(_SquaredDifference=Module["_SquaredDifference"]=Module["asm"]()["Ya"]).apply(null,arguments));var
_Step=Module["_Step"]=function(){return(_Step=Module["_Step"]=Module["asm"]()["Za"]).apply(null,arguments));var
_StridedSlice=Module["_StridedSlice"]=function(){return(_StridedSlice=Module["_StridedSlice"]=Module["asm"]()["_a"]).apply(null,arguments));var
_Sub=Module["_Sub"]=function(){return(_Sub=Module["_Sub"]=Module["asm"]()["$a"]).apply(null,arguments)};var
_Sum=Module["_Sum"]=function(){return(_Sum=Module["_Sum"]=Module["asm"]()["ab"]).apply(null,arguments)};var
_Tan=Module["_Tan"]=function(){return(_Tan=Module["_Tan"]=Module["asm"]()["bb"]).apply(null,arguments)};var
_Tanh=Module["_Tanh"]=function(){return(_Tanh=Module["_Tanh"]=Module["asm"]()["cb"]).apply(null,arguments)};var
_Tile=Module["_Tile"]=function(){return(_Tile=Module["_Tile"]=Module["asm"]()["db"]).apply(null,arguments)};var
_TopK=Module["_TopK"]=function(){return(_TopK=Module["_TopK"]=Module["asm"]()["eb"]).apply(null,arguments)};var
_Transform=Module["_Transform"]=function(){return(_Transform=Module["_Transform"]=Module["asm"]()["fb"]).apply(null,arguments)};var
_Transpose=Module["_Transpose"]=function(){return(_Transpose=Module["_Transpose"]=Module["asm"]()["gb"]).apply(null,arguments)};var
__FusedMatMul=Module["__FusedMatMul"]=function(){return(__FusedMatMul=Module["__FusedMatMul"]=Module["asm"]()["hb"]).apply(null,arguments)};var
_malloc=Module["_malloc"]=function(){return(_malloc=Module["_malloc"]=Module["asm"]()["ib"]).apply(null,arguments)};var
_free=Module["_free"]=function(){return(_free=Module["_free"]=Module["asm"]()["jb"]).apply(null,arguments)};var
__errno_location=Module["__errno_location"]=function(){return(__errno_location=Module["__errno_location"]=Module["asm"]()["kb"]).apply(null,arguments)};var

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_emsripten_get_global_libc=Module["_emsripten_get_global_libc"]=function(){return(_emsripten_get_global
_libc=Module["_emsripten_get_global_libc"]=Module["_asm"][_"lb"]).apply(null,arguments));var
_thread_self=Module["_thread_self"]=function(){return(_thread_self=Module["_thread_self"]=Module["_as
m"][_"mb"]).apply(null,arguments));var
__pthread_tsd_run_dtors=Module["__pthread_tsd_run_dtors"]=function(){return(__pthread_tsd_run_dtors=M
odule["__pthread_tsd_run_dtors"]=Module["_asm"][_"nb"]).apply(null,arguments));var
_emsripten_main_thread_process_queued_calls=Module["_emsripten_main_thread_process_queued_calls"]=fu
nction(){return(_emsripten_main_thread_process_queued_calls=Module["_emsripten_main_thread_process_que
ued_calls"]=Module["_asm"][_"ob"]).apply(null,arguments));var
_emsripten_current_thread_process_queued_calls=Module["_emsripten_current_thread_process_queued_calls"]
=function(){return(_emsripten_current_thread_process_queued_calls=Module["_emsripten_current_thread_proc
ess_queued_calls"]=Module["_asm"][_"pb"]).apply(null,arguments));var
_emsripten_register_main_browser_thread_id=Module["_emsripten_register_main_browser_thread_id"]=functi
on(){return(_emsripten_register_main_browser_thread_id=Module["_emsripten_register_main_browser_thread
_id"]=Module["_asm"][_"qb"]).apply(null,arguments));var
_emsripten_main_browser_thread_id=Module["_emsripten_main_browser_thread_id"]=function(){return(_ems
ripten_main_browser_thread_id=Module["_emsripten_main_browser_thread_id"]=Module["_asm"][_"rb"]).app
ly(null,arguments));var
__emsripten_do_dispatch_to_thread=Module["__emsripten_do_dispatch_to_thread"]=function(){return(__ems
ripten_do_dispatch_to_thread=Module["__emsripten_do_dispatch_to_thread"]=Module["_asm"][_"sb"]).apply(n
ull,arguments));var
_emsripten_sync_run_in_main_thread_4=Module["_emsripten_sync_run_in_main_thread_4"]=function(){retur
n(_emsripten_sync_run_in_main_thread_4=Module["_emsripten_sync_run_in_main_thread_4"]=Module["_asm"]
[_"tb"]).apply(null,arguments));var
_emsripten_run_in_main_runtime_thread_js=Module["_emsripten_run_in_main_runtime_thread_js"]=function(
){return(_emsripten_run_in_main_runtime_thread_js=Module["_emsripten_run_in_main_runtime_thread_js"]=
Module["_asm"][_"ub"]).apply(null,arguments));var
__emsripten_call_on_thread=Module["__emsripten_call_on_thread"]=function(){return(__emsripten_call_on_t
hread=Module["__emsripten_call_on_thread"]=Module["_asm"][_"vb"]).apply(null,arguments));var
_emsripten_tls_init=Module["_emsripten_tls_init"]=function(){return(_emsripten_tls_init=Module["_emsc
ripten_tls_init"]=Module["_asm"][_"wb"]).apply(null,arguments));var
__emsripten_thread_init=Module["__emsripten_thread_init"]=function(){return(__emsripten_thread_init=Mod
ule["_emsripten_thread_init"]=Module["_asm"][_"xb"]).apply(null,arguments));var
stackSave=Module["stackSave"]=function(){return(stackSave=Module["stackSave"]=Module["_asm"][_"yb"]).a
pply(null,arguments));var
stackRestore=Module["stackRestore"]=function(){return(stackRestore=Module["stackRestore"]=Module["_asm"]
[_"zb"]).apply(null,arguments));var
stackAlloc=Module["stackAlloc"]=function(){return(stackAlloc=Module["stackAlloc"]=Module["_asm"][_"Ab"]
)].apply(null,arguments));var
_emsripten_stack_set_limits=Module["_emsripten_stack_set_limits"]=function(){return(_emsripten_stack_set_
limits=Module["_emsripten_stack_set_limits"]=Module["_asm"][_"Bb"]).apply(null,arguments));var
_memalign=Module["_memalign"]=function(){return(_memalign=Module["_memalign"]=Module["_asm"][_"Cb"]
)].apply(null,arguments));var
__emsripten_allow_main_runtime_queued_calls=Module["__emsripten_allow_main_runtime_queued_calls"]=1
0512;var
__emsripten_main_thread_futex=Module["__emsripten_main_thread_futex"]=12148;Module["cwrap"]=cwrap
;Module["PThread"]=PThread;Module["PThread"]=PThread;Module["wasmMemory"]=wasmMemory;Module
["ExitStatus"]=ExitStatus;var

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[illegible]

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ex}}}]else
if(e.data.cmd===\"cancel\"){if(Module[\"_pthread_self\"]()){Module[\"PThread\"].threadCancel()}else
if(e.data.target===\"setimmediate\")}{else
if(e.data.cmd===\"processThreadQueue\"){if(Module[\"_pthread_self\"]()){Module[\"_emscripten_current_thread_
process_queued_calls\"]())}{else{err(\"worker.js received unknown command
\"+e.data.cmd);err(e.data)}}catch(ex){err(\"worker.js onmessage() captured an uncaught exception:
\"+ex);if(ex&&ex.stack)err(ex.stack);throw ex}};if(typeof process===\"object\"&&typeof
process.versions===\"object\"&&typeof process.versions.node===\"string\"){self={location:{href:__filename}};var
onmessage=this.onmessage;var
nodeWorkerThreads=require(\"worker_threads\");global.Worker=nodeWorkerThreads.Worker;var
parentPort=nodeWorkerThreads.parentPort;parentPort.on(\"message\",function(data){onmessage({data:data})});var
nodeFS=require(\"fs\");var nodeRead=function(filename){return
nodeFS.readFileSync(filename,\"utf8\")};function
globalEval(x){global.require=require;global.Module=Module;eval.call(null,x)}importScripts=function(f){globalEva
l(nodeRead(f));postMessage=function(msg){parentPort.postMessage(msg)};if(typeof
performance===\"undefined\"){performance={now:function(){return Date.now()}}};\", \"nvar
WasmBackendModule = (function() {\n  var _scriptDir = typeof document !== 'undefined' &&
document.currentScript ? document.currentScript.src : undefined;\n  if (typeof __filename !== 'undefined')
_scriptDir = _scriptDir || __filename;\n  return (\nfunction(WasmBackendModule) {\n    WasmBackendModule =
WasmBackendModule || {};\n\nvar Module=typeof
WasmBackendModule!==\"undefined\"?WasmBackendModule:{};var
readyPromiseResolve,readyPromiseReject;Module[\"ready\"]=new
Promise(function(resolve,reject){readyPromiseResolve=resolve;readyPromiseReject=reject});var
moduleOverrides={};var key;for(key in
Module){if(Module.hasOwnProperty(key)){moduleOverrides[key]=Module[key]}}var
arguments_=[];var thisProgram= \"/this.program\";var quit_=function(status,toThrow){throw toThrow};var
ENVIRONMENT_IS_WEB=false;var ENVIRONMENT_IS_WORKER=false;var
ENVIRONMENT_IS_NODE=false;var ENVIRONMENT_IS_SHELL=false;ENVIRONMENT_IS_WEB=typeof
window===\"object\";ENVIRONMENT_IS_WORKER=typeof
importScripts===\"function\";ENVIRONMENT_IS_NODE=typeof process===\"object\"&&typeof
process.versions===\"object\"&&typeof
process.versions.node===\"string\";ENVIRONMENT_IS_SHELL=!ENVIRONMENT_IS_WEB&&!ENVIRONM
ENT_IS_NODE&&!ENVIRONMENT_IS_WORKER;var scriptDirectory=\"\";function
locateFile(path){if(Module[\"locateFile\"]){return Module[\"locateFile\"](path,scriptDirectory)}return
scriptDirectory+path}var read_,readAsync,readBinary,setWindowTitle;var nodeFS;var
nodePath;if(ENVIRONMENT_IS_NODE){if(ENVIRONMENT_IS_WORKER){scriptDirectory=require(\"path\").
dirname(scriptDirectory)+\"/\"}else{scriptDirectory=__dirname+\"/\"}read_=function
shell_read(filename,binary){if(!nodeFS)nodeFS=require(\"fs\");if(!nodePath)nodePath=require(\"path\");filename=n
odePath[\"normalize\"](filename);return
nodeFS[\"readFileSync\"](filename,binary?null:\"utf8\");}readBinary=function readBinary(filename){var
ret=read_(filename,true);if(!ret.buffer){ret=new Uint8Array(ret)}assert(ret.buffer);return
ret};if(process[\"argv\"].length>1){thisProgram=process[\"argv\"][1].replace(/\\\\\\\\g,\"/\");arguments_=process[\"arg
v\"].slice(2);process[\"on\"](\"uncaughtException\",function(ex){if(!(ex instanceof ExitStatus)){throw
ex}});process[\"on\"](\"unhandledRejection\",abort);quit_=function(status){process[\"exit\"](status)};Module[\"insp
ect\"]=function(){return\"[Emscripten Module object]\"}}else if(ENVIRONMENT_IS_SHELL){if(typeof
read!=\"undefined\"){read_=function shell_read(f){return read(f)}}readBinary=function readBinary(f){var
data;if(typeof readbuffer===\"function\"){return new
Uint8Array(readbuffer(f))}data=read(f,\"binary\");assert(typeof data===\"object\");return data};if(typeof

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scriptArgs!="undefined"){arguments_=scriptArgs}else
  if(typeof arguments!="undefined"){arguments_=arguments}if(typeof
quit==="function"){quit_=function(status){quit(status)}}if(typeof print!="undefined"){if(typeof
console==="undefined")console={};console.log=print;console.warn=console.error=typeof
printErr!="undefined"?printErr:print}else
if(ENVIRONMENT_IS_WEB||ENVIRONMENT_IS_WORKER){if(ENVIRONMENT_IS_WORKER){scriptDire
ctory=self.location.href}else if(typeof
document!="undefined"&&document.currentScript){scriptDirectory=document.currentScript.src}if(!_scriptDir){s
criptDirectory=_scriptDir}if(scriptDirectory.indexOf("blob:")!==0){scriptDirectory=scriptDirectory.substr(0,script
Directory.lastIndexOf("/")+1)}else{scriptDirectory=""}}{read_=function(url){var xhr=new
XMLHttpRequest;xhr.open("GET",url,false);xhr.send(null);return
xhr.responseText};if(ENVIRONMENT_IS_WORKER){readBinary=function(url){var xhr=new
XMLHttpRequest;xhr.open("GET",url,false);xhr.responseType="arraybuffer";xhr.send(null);return
new Uint8Array(xhr.response)}}readAsync=function(url,onload,onerror){var xhr=new
XMLHttpRequest;xhr.open("GET",url,true);xhr.responseType="arraybuffer";xhr.onload=function(){if(xhr.status
===200||xhr.status===0&&xhr.response){onload(xhr.response);return}onerror();}xhr.onerror=onerror;xhr.send(null)}
}setWindowTitle=function(title){document.title=title}}else{var
out=Module["print"]||console.log.bind(console);var err=Module["printErr"]||console.warn.bind(console);for(key
in
moduleOverrides){if(moduleOverrides.hasOwnProperty(key)){Module[key]=moduleOverrides[key]}}moduleOverr
ides=null;if(Module["arguments"])arguments_=Module["arguments"];if(Module["thisProgram"])thisProgram=
Module["thisProgram"];if(Module["quit"])quit_=Module["quit"];var
wasmBinary;if(Module["wasmBinary"])wasmBinary=Module["wasmBinary"];var
noExitRuntime=Module["noExitRuntime"]||true;if(typeof WebAssembly!="object"){abort("no native wasm
support detected")}var wasmMemory;var
ABORT=false;var EXITSTATUS;function assert(condition,text){if(!condition){abort("Assertion failed:
"+text)}}function getCFunc(ident){var func=Module["_"+ident];assert(func,"Cannot call unknown function
"+ident+", make sure it is exported");return func}function ccall(ident,returnType,argTypes,args,opts){var
toC={"string":function(str){var ret=0;if(str!==null&&str!==undefined&&str!==0){var
len=(str.length<<2)+1;ret=stackAlloc(len);stringToUTF8(str,ret,len)}return ret},"array":function(arr){var
ret=stackAlloc(arr.length);writeArrayToMemory(arr,ret);return ret}};function
convertReturnValue(ret){if(returnType==="string")return UTF8ToString(ret);if(returnType==="boolean")return
Boolean(ret);return ret}var func=getCFunc(ident);var cArgs=[];var stack=0;if(args){for(var
i=0;i<args.length;i++){var
converter=toC[argTypes[i]];if(converter){if(stack===0)stack=stackSave();cArgs[i]=converter(args[i])}else{cArgs[i
]=args[i]}}var ret=func.apply(null,cArgs);ret=convertReturnValue(ret);if(stack!==0)stackRestore(stack);return
ret}function cwrap(ident,returnType,argTypes,opts){argTypes=argTypes||[];var
numericArgs=argTypes.every(function(type){return type==="number"});var
numericRet=returnType!="string";if(numericRet&&numericArgs&&!opts){return getCFunc(ident)}return
function(){return ccall(ident,returnType,argTypes,arguments,opts)}}var UTF8Decoder=typeof
TextDecoder!="undefined"?new TextDecoder("utf8"):undefined;function
UTF8ArrayToString(heap,idx,maxBytesToRead){var endIdx=idx+maxBytesToRead;var
endPtr=idx;while(heap[endPtr]&&!(endPtr>=endIdx))++endPtr;if(endPtr-
idx>16&&heap.subarray&&UTF8Decoder){return UTF8Decoder.decode(heap.subarray(idx,endPtr))}else{var
str="";while(idx<endPtr){var u0=heap[idx++];if(!(u0&128)){str+=String.fromCharCode(u0);continue}var
u1=heap[idx++]&63;if((u0&224)===192){str+=String.fromCharCode((u0&31)<<6|u1);continue}var
u2=heap[idx++]&63;if((u0&240)===224){u0=(u0&15)<<12|u1<<6|u2}else{u0=(u0&7)<<18|u1<<12|u2<<6|heap[id
x++]&63;if(u0<65536){str+=String.fromCharCode(u0)}else{var

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ch=u0-65536;str+=String.fromCharCode(55296|ch>>10,56320|ch&1023)} }return str}function
UTF8ToString(ptr,maxBytesToRead){return
ptr?UTF8ArrayToString(HEAPU8,ptr,maxBytesToRead):\""}function
stringToUTF8Array(str,heap,outIdx,maxBytesToWrite){if(!(maxBytesToWrite>0))return 0;var startIdx=outIdx;var
endIdx=outIdx+maxBytesToWrite-1;for(var i=0;i<str.length;++i){ var
u=str.charCodeAtAt(i);if(u>=55296&&u<=57343){ var
u1=str.charCodeAtAt(++i);u=65536+((u&1023)<<10)|u1&1023 }if(u<=127){ if(outIdx>=endIdx)break;heap[outIdx++]=
u} else if(u<=2047){ if(outIdx+1>=endIdx)break;heap[outIdx++]=192|u>>6;heap[outIdx++]=128|u&63 } else
if(u<=65535){ if(outIdx+2>=endIdx)break;heap[outIdx++]=224|u>>12;heap[outIdx++]=128|u>>6&63;heap[outIdx
++]=128|u&63 } else { if(outIdx+3>=endIdx)break;heap[outIdx++]=240|u>>18;heap[outIdx++]=128|u>>12&63;heap[
outIdx++]=128|u>>6&63;heap[outIdx++]=128|u&63 } }heap[outIdx]=0;return outIdx-startIdx }function
stringToUTF8(str,outPtr,maxBytesToWrite){ return
stringToUTF8Array(str,HEAPU8,outPtr,maxBytesToWrite)}function
writeArrayToMemory(array,buffer){HEAP8.set(array,buffer)}function
alignUp(x,multiple){if(x%multiple>0){ x+=multiple-x%multiple }return x }var
buffer,HEAP8,HEAPU8,HEAP16,HEAPU16,HEAP32,HEAPU32,HEAPF32,HEAPF64;function
updateGlobalBufferAndViews(buf){ buffer=buf;Module[\"HEAP8\"] =HEAP8=new
Int8Array(buf);Module[\"HEAP16\"] =HEAP16=new Int16Array(buf);Module[\"HEAP32\"] =HEAP32=new
Int32Array(buf);Module[\"HEAPU8\"] =HEAPU8=new Uint8Array(buf);Module[\"HEAPU16\"] =HEAPU16=new
Uint16Array(buf);Module[\"HEAPU32\"] =HEAPU32=new
Uint32Array(buf);Module[\"HEAPF32\"] =HEAPF32=new
Float32Array(buf);Module[\"HEAPF64\"] =HEAPF64=new Float64Array(buf)} var
INITIAL_MEMORY=Module[\"INITIAL_MEMORY\"]||16777216;var wasmTable;var __ATPRERUN__=[];var
__ATINIT__=[];var __ATMAIN__=[];var __ATPOSTRUN__=[];var
runtimeInitialized=false;__ATINIT__.push({func:function(){__wasm_call_ctors()}});function
preRun(){if(Module[\"preRun\"]){if(typeof
Module[\"preRun\"]==\"function\")Module[\"preRun\"]=[Module[\"preRun\"]];while(Module[\"preRun\"].length){ a
ddOnPreRun(Module[\"preRun\"].shift()) } }callRuntimeCallbacks(__ATPRERUN__)}function
initRuntime(){runtimeInitialized=true;callRuntimeCallbacks(__ATINIT__)}function
preMain(){callRuntimeCallbacks(__ATMAIN__)}function postRun(){if(Module[\"postRun\"]){if(typeof
Module[\"postRun\"]==\"function\")Module[\"postRun\"]=[Module[\"postRun\"]];while(Module[\"postRun\"].lengt
h){ addOnPostRun(Module[\"postRun\"].shift()) } }callRuntimeCallbacks(__ATPOSTRUN__)}function
addOnPreRun(cb){__ATPRERUN__.unshift(cb)}function addOnPostRun(cb){__ATPOSTRUN__.unshift(cb)}var
runDependencies=0;var runDependencyWatcher=null;var dependenciesFulfilled=null;function
addRunDependency(id){runDependencies++;if(Module[\"monitorRunDependencies\"]){Module[\"monitorRunDep
endencies\"](runDependencies)} }function removeRunDependency(id){runDependencies--
;if(Module[\"monitorRunDependencies\"]){Module[\"monitorRunDependencies\"](runDependencies)}if(runDepend
encies==0){if(runDependencyWatcher!=null){ clearInterval(runDependencyWatcher);runDependencyWatcher=null
}if(dependenciesFulfilled){ var
callback=dependenciesFulfilled;dependenciesFulfilled=null;callback() } } }Module[\"preloadedImages\"]={ };Module
[\"preloadedAudios\"]={ };function
abort(what){if(Module[\"onAbort\"]){Module[\"onAbort\"](what)}what+=\"\\n\";err(what);ABORT=true;EXITSTAT
US=1;what=\"abort(\\n+what+\\n). Build with -s ASSERTIONS=1 for more info.\";var e=new
WebAssembly.RuntimeError(what);readyPromiseReject(e);throw e}function hasPrefix(str,prefix){return
String.prototype.startsWith?str.startsWith(prefix):str.indexOf(prefix)===0}var
dataURIPrefix=\"data:application/octet-stream;base64,\";function isDataURI(filename){return
hasPrefix(filename,dataURIPrefix)}var fileURIPrefix=\"file://\";function isFileURI(filename){return
hasPrefix(filename,fileURIPrefix)}var wasmBinaryFile=\"tfjs-backend-

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wasm.wasm\");if(!isDataURI(wasmBinaryFile)){wasmBinaryFile=locateFile(wasmBinaryFile)}function
getBinary(file){try{if(file==wasmBinaryFile&&wasmBinary){return new
Uint8Array(wasmBinary)}if(readBinary){return readBinary(file)}else{throw\"both async and sync fetching of the
wasm failed\"}}catch(err){abort(err)}}function
getBinaryPromise(){if(!wasmBinary&&(ENVIRONMENT_IS_WEB||ENVIRONMENT_IS_WORKER)){if(typeof
fetch===\"function\"&&!isFileURI(wasmBinaryFile)){return fetch(wasmBinaryFile,{credentials:\"same-
origin\"}).then(function(response){if(!response[\"ok\"]){throw\"failed to load wasm binary file at
\"+wasmBinaryFile+\"\"})return response[\"arrayBuffer\"]()).catch(function(){return
getBinary(wasmBinaryFile)})}else{if(readAsync){return new
Promise(function(resolve,reject){readAsync(wasmBinaryFile,function(response){resolve(new
Uint8Array(response))},reject)}))}}return Promise.resolve().then(function(){return
getBinary(wasmBinaryFile)})}function createWasm(){var info={\"a\":asmLibraryArg};function
receiveInstance(instance,module){var
exports=instance.exports;Module[\"asm\"]=exports;wasmMemory=Module[\"asm\"][\"j\"];updateGlobalBufferAnd
Views(wasmMemory.buffer);wasmTable=Module[\"asm\"][\"t\"];removeRunDependency(\"wasm-
instantiate\")addRunDependency(\"wasm-instantiate\");function
receiveInstantiatedSource(output){receiveInstance(output[\"instance\"])}function
instantiateArrayBuffer(receiver){return getBinaryPromise().then(function(binary){return
WebAssembly.instantiate(binary,info)}).then(receiver,function(reason){err(\"failed to asynchronously prepare
wasm: \" +reason);abort(reason)})}function instantiateAsync(){if(!wasmBinary&&typeof
WebAssembly.instantiateStreaming===\"function\"&&!isDataURI(wasmBinaryFile)&&!isFileURI(wasmBinaryFil
e)&&typeof fetch===\"function\"){return fetch(wasmBinaryFile,{credentials:\"same-
origin\"}).then(function(response){var result=WebAssembly.instantiateStreaming(response,info);return
result.then(receiveInstantiatedSource,function(reason){err(\"wasm streaming compile failed: \" +reason);err(\"falling
back to ArrayBuffer
instantiate\")});return instantiateArrayBuffer(receiveInstantiatedSource)})}else{return
instantiateArrayBuffer(receiveInstantiatedSource)}}if(Module[\"instantiateWasm\"]){try{var
exports=Module[\"instantiateWasm\"](info,receiveInstance);return exports}catch(e){err(\"Module.instantiateWasm
callback failed with error: \" +e);return false}}instantiateAsync().catch(rejectedPromiseReject);return{}}function
callRuntimeCallbacks(callbacks){while(callbacks.length>0){var callback=callbacks.shift();if(typeof
callback===\"function\"){callback(Module);continue}var func=callback.func;if(typeof
func===\"number\"){if(callback.arg===undefined){wasmTable.get(func)()}else{wasmTable.get(func)(callback.arg)
}}else{func(callback.arg===undefined?null:callback.arg)}}function _abort(){abort()}function
_emscripten_memcpy_big(dest,src,num){HEAPU8.copyWithin(dest,src,src+num)}function
_emscripten_get_heap_size(){return HEAPU8.length}function
emscripten_realloc_buffer(size){try{wasmMemory.grow(size-
buffer.byteLength+65535>>>16);updateGlobalBufferAndViews(wasmMemory.buffer);return
1}catch(e){}}function _emscripten_resize_heap(requestedSize){var oldSize=_emscripten_get_heap_size();var
maxHeapSize=2147483648;if(requestedSize>maxHeapSize){return false}for(var
cutDown=1;cutDown<=4;cutDown*=2){var
overGrownHeapSize=oldSize*(1+.2/cutDown);overGrownHeapSize=Math.min(overGrownHeapSize,requestedSize
+100663296);var
newSize=Math.min(maxHeapSize,alignUp(Math.max(requestedSize,overGrownHeapSize),65536));var
replacement=emscripten_realloc_buffer(newSize);if(replacement){return true}}return false}var
SYSCALLS={mappings:{},buffers:[null,[],[]],printChar:function(stream,curr){var
buffer=SYSCALLS.buffers[stream];if(curr===0||curr===10){(stream===1?out:err)(UTF8ArrayToString(buffer,0));
buffer.length=0}else{buffer.push(curr)}},varargs:undefined,get:function(){SYSCALLS.varargs+=4;var
ret=HEAP32[SYSCALLS.varargs-4>>2];return ret},getStr:function(ptr){var ret=UTF8ToString(ptr);return

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ret},get64:function(low,high){return
low}};function _fd_close(fd){return 0}function _fd_seek(fd,offset_low,offset_high,whence,newOffset){}function
_fd_write(fd,iov,iovcnt,pnum){var num=0;for(var i=0;i<iovcnt;i++){var ptr=HEAP32[iov+i*8>>2];var
len=HEAP32[iov+(i*8+4)>>2];for(var
j=0;j<len;j++){SYSCALLS.printChar(fd,HEAPU8[ptr+j])}num+=len}HEAP32[pnum>>2]=num;return 0}function
_pthread_create(){return 6}function _pthread_join(){return 28}function
setErrNo(value){HEAP32[___errno_location()>>2]=value;return value}function
_sysconf(name){switch(name){case 30:return 16384;case 85:var maxHeapSize=2147483648;return
maxHeapSize/16384;case 132:case 133:case 12:case 137:case 138:case 15:case 235:case 16:case 17:case 18:case
19:case 20:case 149:case 13:case 10:case 236:case 153:case 9:case 21:case 22:case 159:case 154:case 14:case
77:case 78:case 139:case 82:case 68:case 67:case 164:case 11:case 29:case 47:case 48:case 95:case 52:case 51:case
46:return 200809;case 27:case 246:case 127:case 128:case 23:case 24:case 160:case
161:case 181:case 182:case 242:case 183:case 184:case 243:case 244:case 245:case 165:case 178:case 179:case
49:case 50:case 168:case 169:case 175:case 170:case 171:case 172:case 97:case 76:case 32:case 173:case 35:case
80:case 81:case 79:return -1;case 176:case 177:case 7:case 155:case 8:case 157:case 125:case 126:case 92:case
93:case 129:case 130:case 131:case 94:case 91:return 1;case 74:case 60:case 69:case 70:case 4:return 1024;case
31:case 42:case 72:return 32;case 87:case 26:case 33:return 2147483647;case 34:case 1:return 47839;case 38:case
36:return 99;case 43:case 37:return 2048;case 0:return 2097152;case 3:return 65536;case 28:return 32768;case
44:return 32767;case 75:return 16384;case 39:return 1e3;case 89:return 700;case 71:return 256;case 40:return
255;case 2:return 100;case 180:return 64;case 25:return 20;case 5:return 16;case 6:return 6;case 73:return 4;case
84:{if(typeof navigator===\"object\")return navigator[\"hardwareConcurrency\"]||1;return 1}}setErrNo(28);return-
1}var
asmLibraryArg={\"a\":_abort,\"d\":_emscripten_memcpy_big,\"e\":_emscripten_resize_heap,\"f\":_fd_close,\"c\":_f
d_seek,\"b\":_fd_write,\"h\":_pthread_create,\"g\":_pthread_join,\"i\":_sysconf};var asm=createWasm();var
___wasm_call_ctors=Module[\"___wasm_call_ctors\"]=function(){return(___wasm_call_ctors=Module[\"___wasm
_call_ctors\"]=Module[\"asm\"][\"k\"]).apply(null,arguments)};var
_init=Module[\"_init\"]=function(){return(_init=Module[\"_init\"]=Module[\"asm\"][\"l\"]).apply(null,arguments)};
var
_init_with_threads_count=Module[\"_init_with_threads_count\"]=function(){return(_init_with_threads_count=Mod
ule[\"_init_with_threads_count\"]=Module[\"asm\"][\"m\"]).apply(null,arguments)};var
_get_threads_count=Module[\"_get_threads_count\"]=function(){return(_get_threads_count=Module[\"_get_threads
_count\"]=Module[\"asm\"][\"n\"]).apply(null,arguments)};var
_register_tensor=Module[\"_register_tensor\"]=function(){return(_register_tensor=Module[\"_register_tensor\"]=M
odule[\"asm\"][\"o\"]).apply(null,arguments)};var
_dispose_data=Module[\"_dispose_data\"]=function(){return(_dispose_data=Module[\"_dispose_data\"]=Module[\"
asm\"][\"p\"]).apply(null,arguments)};var
_dispose=Module[\"_dispose\"]=function(){return(_dispose=Module[\"_dispose\"]=Module[\"asm\"][\"q\"]).apply(n
ull,arguments)};var
_Abs=Module[\"_Abs\"]=function(){return(_Abs=Module[\"_Abs\"]=Module[\"asm\"][\"s\"]).apply(null,arguments
)};var
_Add=Module[\"_Add\"]=function(){return(_Add=Module[\"_Add\"]=Module[\"asm\"][\"t\"]).apply(null,argument
s)};var
_AddN=Module[\"_AddN\"]=function(){return(_AddN=Module[\"_AddN\"]=Module[\"asm\"][\"u\"]).apply(null,ar
guments)};var
_All=Module[\"_All\"]=function(){return(_All=Module[\"_All\"]=Module[\"asm\"][\"v\"]).apply(null,arguments)};
var
_Any=Module[\"_Any\"]=function(){return(_Any=Module[\"_Any\"]=Module[\"asm\"][\"w\"]).apply(null,argumen
ts)};var

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_ArgMax=Module["_ArgMax"]=function(){return(_ArgMax=Module["_ArgMax"]=Module["asm"]()["x"]).apply(
null,arguments)};var
_AvgPool=Module["_AvgPool"]=function(){return(_AvgPool=Module["_AvgPool"]=Module["asm"]()["y"]).a
pply(null,arguments)};var
_BatchMatMul=Module["_BatchMatMul"]=function(){return(_BatchMatMul=Module["_BatchMatMul"]=Modu
le["asm"]()["z"]).apply(null,arguments)};var
_Ceil=Module["_Ceil"]=function(){return(_Ceil=Module["_Ceil"]=Module["asm"]()["A"]).apply(null,argument
s)};var
_ClipByValue=Module["_ClipByValue"]=function(){return(_ClipByValue=Module["_ClipByValue"]=Module[
"asm"]()["B"]).apply(null,arguments)};var
_Conv2D=Module["_Conv2D"]=function(){return(_Conv2D=Module["_Conv2D"]=Module["asm"]()["C"]).ap
ply(null,arguments)};var
_Conv2DBackpropInput=Module["_Conv2DBackpropInput"]=function(){return(_Conv2DBackpropInput=Modul
e["_Conv2DBackpropInput"]=Module["asm"]()["D"]).apply(null,arguments)};var
_Cos=Module["_Cos"]=function(){return(_Cos=Module["_Cos"]=Module["asm"]()["E"]).apply(null,arguments
)};var
_Cosh=Module["_Cosh"]=function(){return(_Cosh=Module["_Cosh"]=Module["asm"]()["F"]).apply(null,argu
ments)};var
_CropAndResize=Module["_CropAndResize"]=function(){return(_CropAndResize=Module["_CropAndResize"]=
Module["asm"]()["G"]).apply(null,arguments)};var
_Cumsum=Module["_Cumsum"]=function(){return(_Cumsum=Module["_Cumsum"]=Module["asm"]()["H"]).a
pply(null,arguments)};var
_DepthToSpace=Module["_DepthToSpace"]=function(){return(_DepthToSpace=Module["_DepthToSpace"]=M
odule["asm"]()["I"]).apply(null,arguments)};var
_DepthwiseConv2dNative=Module["_DepthwiseConv2dNative"]=function(){return(_DepthwiseConv2dNative=M
odule["_DepthwiseConv2dNative"]=Module["asm"]()["J"]).apply(null,arguments)};var
_Elu=Module["_Elu"]=function(){return(_Elu=Module["_Elu"]=Module["asm"]()["K"]).apply(null,arguments)
};var
_Equal=Module["_Equal"]=function(){return(_Equal=Module["_Equal"]=Module["asm"]()["L"]).apply(null,arg
uments)};var
_Exp=Module["_Exp"]=function(){return(_Exp=Module["_Exp"]=Module["asm"]()["M"]).apply(null,argument
s)};var
_FlipLeftRight=Module["_FlipLeftRight"]=function(){return(_FlipLeftRight=Module["_FlipLeftRight"]=Modu
le["asm"]()["N"]).apply(null,arguments)};var
_Floor=Module["_Floor"]=function(){return(_Floor=Module["_Floor"]=Module["asm"]()["O"]).apply(null,argu
ments)};var
_FloorDiv=Module["_FloorDiv"]=function(){return(_FloorDiv=Module["_FloorDiv"]=Module["asm"]()["P"]).
apply(null,arguments)};var
_FusedBatchNorm=Module["_FusedBatchNorm"]=function(){return(_FusedBatchNorm=Module["_FusedBatchN
orm"]=Module["asm"]()["Q"]).apply(null,arguments)};var
_FusedConv2D=Module["_FusedConv2D"]=function(){return(_FusedConv2D=Module["_FusedConv2D"]=Mod
ule["asm"]()["R"]).apply(null,arguments)};var
_FusedDepthwiseConv2D=Module["_FusedDepthwiseConv2D"]=function(){return(_FusedDepthwiseConv2D=M
odule["_FusedDepthwiseConv2D"]=Module["asm"]()["S"]).apply(null,arguments)};var
_Gather=Module["_Gather"]=function(){return(_Gather=Module["_Gather"]=Module["asm"]()["T"]).apply(null
,arguments)};var
_GatherNd=Module["_GatherNd"]=function(){return(_GatherNd=Module["_GatherNd"]=Module["asm"]()["U"
]).apply(null,arguments)};var

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_Greater=Module["_Greater"]=function(){return(_Greater=Module["_Greater"]=Module["asm"][_"V"]).apply(
null,arguments)};var
_GreaterEqual=Module["_GreaterEqual"]=function(){return(_GreaterEqual=Module["_GreaterEqual"]=Module[
"asm"][_"W"]).apply(null,arguments)};var
_LeakyRelu=Module["_LeakyRelu"]=function(){return(_LeakyRelu=Module["_LeakyRelu"]=Module["asm"][_"
X"]).apply(null,arguments)};var
_Less=Module["_Less"]=function(){return(_Less=Module["_Less"]=Module["asm"][_"Y"]).apply(null,argume
nts)};var
_LessEqual=Module["_LessEqual"]=function(){return(_LessEqual=Module["_LessEqual"]=Module["asm"][_"
Z"]).apply(null,arguments)};var
_Log=Module["_Log"]=function(){return(_Log=Module["_Log"]=Module["asm"][_" _"]).apply(null,arguments
)};var
_LogicalAnd=Module["_LogicalAnd"]=function(){return(_LogicalAnd=Module["_LogicalAnd"]=Module["asm
"][_"$"]).apply(null,arguments)};var
_Max=Module["_Max"]=function(){return(_Max=Module["_Max"]=Module["asm"][_"aa"]).apply(null,argume
nts)};var
_MaxPool=Module["_MaxPool"]=function(){return(_MaxPool=Module["_MaxPool"]=Module["asm"][_"ba"]).
apply(null,arguments)};var
_Maximum=Module["_Maximum"]=function(){return(_Maximum=Module["_Maximum"]=Module["asm"][_"c
a"]).apply(null,arguments)};var
_Mean=Module["_Mean"]=function(){return(_Mean=Module["_Mean"]=Module["asm"][_"da"]).apply(null,ar
guments)};var
_Min=Module["_Min"]=function(){return(_Min=Module["_Min"]=Module["asm"][_"ea"]).apply(null,argumen
ts)};var
_Minimum=Module["_Minimum"]=function(){return(_Minimum=Module["_Minimum"]=Module["asm"][_"fa
"]).apply(null,arguments)};var
_MirrorPad=Module["_MirrorPad"]=function(){return(_MirrorPad=Module["_MirrorPad"]=Module["asm"][_"g
a"]).apply(null,arguments)};var
_Multiply=Module["_Multiply"]=function(){return(_Multiply=Module["_Multiply"]=Module["asm"][_"ha"]).a
pply(null,arguments)};var
_Neg=Module["_Neg"]=function(){return(_Neg=Module["_Neg"]=Module["asm"][_"ia"]).apply(null,argument
s)};var
_NonMaxSuppressionV3=Module["_NonMaxSuppressionV3"]=function(){return(_NonMaxSuppressionV3=Mod
ule["_NonMaxSuppressionV3"]=Module["asm"][_"ja"]).apply(null,arguments)};var
_NonMaxSuppressionV4=Module["_NonMaxSuppressionV4"]=function(){return(_NonMaxSuppressionV4=Mod
ule["_NonMaxSuppressionV4"]=Module["asm"][_"ka"]).apply(null,arguments)};var
_NonMaxSuppressionV5=Module["_NonMaxSuppressionV5"]=function(){return(_NonMaxSuppressionV5=Mod
ule["_NonMaxSuppressionV5"]=Module["asm"][_"la"]).apply(null,arguments)};var
_NotEqual=Module["_NotEqual"]=function(){return(_NotEqual=Module["_NotEqual"]=Module["asm"][_"ma"
]).apply(null,arguments)};var
_OneHot=Module["_OneHot"]=function(){return(_OneHot=Module["_OneHot"]=Module["asm"][_"na"]).appl
y(null,arguments)};var
_PadV2=Module["_PadV2"]=function(){return(_PadV2=Module["_PadV2"]=Module["asm"][_"oa"]).apply(nul
l,arguments)};var
_Pow=Module["_Pow"]=function(){return(_Pow=Module["_Pow"]=Module["asm"][_"pa"]).apply(null,argume
nts)};var
_Prelu=Module["_Prelu"]=function(){return(_Prelu=Module["_Prelu"]=Module["asm"][_"qa"]).apply(null,argu
ments)};var

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_Prod=Module["_Prod"]=function(){return(_Prod=Module["_Prod"]=Module["asm"][_"ra"]).apply(null,arguments)};var
_RealDiv=Module["_RealDiv"]=function(){return(_RealDiv=Module["_RealDiv"]=Module["asm"][_"sa"]).apply(null,arguments)};var
_Relu=Module["_Relu"]=function(){return(_Relu=Module["_Relu"]=Module["asm"][_"ta"]).apply(null,arguments)};var
_Relu6=Module["_Relu6"]=function(){return(_Relu6=Module["_Relu6"]=Module["asm"][_"ua"]).apply(null,arguments)};var
_ResizeBilinear=Module["_ResizeBilinear"]=function(){return(_ResizeBilinear=Module["_ResizeBilinear"]=Module["asm"][_"va"]).apply(null,arguments)};var
_Reverse=Module["_Reverse"]=function(){return(_Reverse=Module["_Reverse"]=Module["asm"][_"wa"]).apply(null,arguments)};var
_RotateWithOffset=Module["_RotateWithOffset"]=function(){return(_RotateWithOffset=Module["_RotateWithOffset"]=Module["asm"][_"xa"]).apply(null,arguments)};var
_Round=Module["_Round"]=function(){return(_Round=Module["_Round"]=Module["asm"][_"ya"]).apply(null,arguments)};var
_Rsqrt=Module["_Rsqrt"]=function(){return(_Rsqrt=Module["_Rsqrt"]=Module["asm"][_"za"]).apply(null,arguments)};var
_ScatterNd=Module["_ScatterNd"]=function(){return(_ScatterNd=Module["_ScatterNd"]=Module["asm"][_"Aa"]).apply(null,arguments)};var
_SelectV2=Module["_SelectV2"]=function(){return(_SelectV2=Module["_SelectV2"]=Module["asm"][_"Ba"]).apply(null,arguments)};var
_Sigmoid=Module["_Sigmoid"]=function(){return(_Sigmoid=Module["_Sigmoid"]=Module["asm"][_"Ca"]).apply(null,arguments)};var
_Sin=Module["_Sin"]=function(){return(_Sin=Module["_Sin"]=Module["asm"][_"Da"]).apply(null,arguments)};var
_Softmax=Module["_Softmax"]=function(){return(_Softmax=Module["_Softmax"]=Module["asm"][_"Ea"]).apply(null,arguments)};var
_Sqrt=Module["_Sqrt"]=function(){return(_Sqrt=Module["_Sqrt"]=Module["asm"][_"Fa"]).apply(null,arguments)};var
_Square=Module["_Square"]=function(){return(_Square=Module["_Square"]=Module["asm"][_"Ga"]).apply(null,arguments)};var
_SquaredDifference=Module["_SquaredDifference"]=function(){return(_SquaredDifference=Module["_SquaredDifference"]=Module["asm"][_"Ha"]).apply(null,arguments)};var
_Step=Module["_Step"]=function(){return(_Step=Module["_Step"]=Module["asm"][_"Ia"]).apply(null,arguments)};var
_StridedSlice=Module["_StridedSlice"]=function(){return(_StridedSlice=Module["_StridedSlice"]=Module["asm"][_"Ja"]).apply(null,arguments)};var
_Sub=Module["_Sub"]=function(){return(_Sub=Module["_Sub"]=Module["asm"][_"Ka"]).apply(null,arguments)};var
_Sum=Module["_Sum"]=function(){return(_Sum=Module["_Sum"]=Module["asm"][_"La"]).apply(null,arguments)};var
_Tan=Module["_Tan"]=function(){return(_Tan=Module["_Tan"]=Module["asm"][_"Ma"]).apply(null,arguments)};var
_Tanh=Module["_Tanh"]=function(){return(_Tanh=Module["_Tanh"]=Module["asm"][_"Na"]).apply(null,arguments)};var
_Tile=Module["_Tile"]=function(){return(_Tile=Module["_Tile"]=Module["asm"][_"Oa"]).apply(null,arguments)};var

```



```

type DataId = object; // object instead of {} to force non-primitive.\n\nexport class BackendWasm extends
KernelBackend {\n // 0 is reserved for null data ids.\n private dataIdNextNumber = 1;\n dataIdMap:
DataStorage<TensorData>;\n\n constructor(public
wasm: BackendWasmModule|BackendWasmThreadedSimdModule) {\n super();\n
this.wasm.tfjs.initWithThreadsCount(threadsCount);\n actualThreadsCount = this.wasm.tfjs.getThreadsCount();\n
this.dataIdMap = new DataStorage(this, engine());\n }\n\n write(values: backend_util.BackendValues, shape:
number[], dtype: DataType):\n DataId {\n const dataId = {id: this.dataIdNextNumber++};\n
this.move(dataId, values, shape, dtype, 1);\n return dataId;\n }\n\n numDataIds(): number {\n return
this.dataIdMap.numDataIds();\n }\n\n async time(f: () => void): Promise<BackendTimingInfo> {\n const start =
util.now();\n f();\n const kernelMs = util.now() - start;\n return {kernelMs};\n }\n\n move(\n dataId:
DataId, values: backend_util.BackendValues, shape: number[],\n dtype: DataType, refCount: number): void {\n
const id = this.dataIdNextNumber++;\n if (dtype === 'string') {\n const stringBytes = values as Uint8Array[];\n
this.dataIdMap.set(\n
dataId,\n {id, stringBytes, shape, dtype, memoryOffset: null, refCount});\n return;\n }\n\n const
size = util.sizeFromShape(shape);\n const numBytes = size * util.bytesPerElement(dtype);\n const
memoryOffset = this.wasm._malloc(numBytes);\n this.dataIdMap.set(dataId, {id, memoryOffset, shape, dtype,
refCount});\n\n this.wasm.tfjs.registerTensor(id, size, memoryOffset);\n if (values != null) {\n
this.wasm.HEAPU8.set(\n new Uint8Array(\n (values as backend_util.TypedArray).buffer,\n
(values as backend_util.TypedArray).byteOffset, numBytes),\n memoryOffset);\n }\n }\n\n async
read(dataId: DataId): Promise<backend_util.BackendValues> {\n return this.readSync(dataId);\n }\n\n
readSync(dataId: DataId): backend_util.BackendValues {\n const {memoryOffset, dtype, shape, stringBytes} =\n
this.dataIdMap.get(dataId);\n if (dtype === 'string') {\n return
stringBytes;\n }\n const bytes = this.wasm.HEAPU8.slice(\n memoryOffset,\n memoryOffset +
util.sizeFromShape(shape) * util.bytesPerElement(dtype));\n return typedArrayFromBuffer(bytes.buffer, dtype);\n
}\n\n /**\n * Dispose the memory if the dataId has 0 refCount. Return true if the memory\n * is released, false
otherwise.\n * @param dataId\n * @oaram force Optional, remove the data regardless of refCount\n */\n
disposeData(dataId: DataId, force = false): boolean {\n if (this.dataIdMap.has(dataId)) {\n const data =
this.dataIdMap.get(dataId);\n data.refCount--;\n if (!force && data.refCount > 0) {\n return false;\n
}\n\n this.wasm._free(data.memoryOffset);\n this.wasm.tfjs.disposeData(data.id);\n
this.dataIdMap.delete(dataId);\n }\n return true;\n }\n\n /** Return refCount of a `TensorData`. */\n
refCount(dataId: DataId): number {\n if (this.dataIdMap.has(dataId)) {\n const tensorData =
this.dataIdMap.get(dataId);\n
return tensorData.refCount;\n }\n return 0;\n }\n\n incRef(dataId: DataId) {\n const data =
this.dataIdMap.get(dataId);\n if (data != null) {\n data.refCount++;\n }\n }\n\n floatPrecision(): 32 {\n
return 32;\n }\n\n // Returns the memory offset of a tensor. Useful for debugging and unit\n // testing.\n
getMemoryOffset(dataId: DataId): number {\n return this.dataIdMap.get(dataId).memoryOffset;\n }\n\n
dispose() {\n this.wasm.tfjs.dispose();\n if ('PThread' in this.wasm) {\n
this.wasm.PThread.terminateAllThreads();\n }\n this.wasm = null;\n }\n\n memory() {\n return {unreliable:
false};\n }\n\n /**\n * Make a tensor info for the output of an op. If `memoryOffset` is not\n * present, this
method allocates memory on the WASM heap. If `memoryOffset`\n * is present, the memory was allocated
elsewhere (in c++) and we just record\n * the pointer where that memory lives.\n */\n makeOutput(shape:
number[], dtype: DataType, memoryOffset?: number):\n TensorInfo {\n let dataId: {};\n if (memoryOffset
== null) {\n dataId = this.write(null /* values */, shape, dtype);\n } else {\n const id =
this.dataIdNextNumber++;\n dataId = {id};\n this.dataIdMap.set(dataId, {id, memoryOffset, shape, dtype,
refCount: 1});\n const size = util.sizeFromShape(shape);\n this.wasm.tfjs.registerTensor(id, size,
memoryOffset);\n }\n return {dataId, shape, dtype};\n }\n\n typedArrayFromHeap({shape, dtype, dataId}:
TensorInfo):\n backend_util.TypedArray {\n const buffer = this.wasm.HEAPU8.buffer;\n const
{memoryOffset} = this.dataIdMap.get(dataId);\n const size = util.sizeFromShape(shape);\n switch (dtype) {\n

```

```

case 'float32':\n    return new Float32Array(buffer, memoryOffset, size);\n    case 'int32':\n        return new
Int32Array(buffer, memoryOffset, size);\n    case 'bool':\n        return new Uint8Array(buffer, memoryOffset,
size);\n    default:\n        throw new Error('Unknown dtype ${dtype}');\n    }\n}\n\nfunction
createInstantiateWasmFunc(path: string) {\n    // this will be replace by rollup plugin patchWechatWebAssembly in\n
// miniprogram's output.\n    // tslint:disable-next-line:no-any\n    return (imports: any, callback: any) => {\n
util.fetch(path, {credentials: 'same-origin'}).then((response) => {\n    if (!response['ok']) {\n
imports.env.a(^failed to load wasm binary file at '${path}');\n    }\n    response.arrayBuffer().then(binary => {\n
    WebAssembly.instantiate(binary, imports).then(output => {\n        callback(output.instance, output.module);\n
    });\n    });\n    });\n    return {};\n    });\n\n    /**\n     * Returns the path of the WASM binary.\n     * @param
simdSupported whether SIMD is supported\n     * @param threadsSupported whether multithreading is supported\n     *
@param wasmModuleFolder the directory containing the WASM binaries.\n     */\n    function getPathToWasmBinary(\n
        simdSupported: boolean, threadsSupported: boolean,\n        wasmModuleFolder: string) {\n        if (wasmPath != null)
{\n            // If wasmPath is defined, the user has supplied a full path to\n            // the vanilla .wasm binary.\n            return
wasmPath;\n        }\n        let path: WasmBinaryName = 'tfjs-backend-wasm.wasm';\n        if (simdSupported &&
threadsSupported) {\n            path = 'tfjs-backend-wasm-threaded-simd.wasm';\n        } else if (simdSupported) {\n            path =
'tfjs-backend-wasm-simd.wasm';\n        }\n        if (wasmFileMap != null) {\n            if (wasmFileMap[path] != null) {\n
return wasmFileMap[path];\n            }\n            return wasmModuleFolder + path;\n        }\n\n        /**\n         * Initializes the wasm
module and creates the js <--> wasm bridge.\n         * NOTE: We wrap the wasm module in a object with property
'wasm' instead of\n         * returning Promise<BackendWasmModule> to avoid freezing Chrome (last tested\n         * in
Chrome 76).\n         */\n        export async function init(): Promise<{wasm: BackendWasmModule}> {\n            const
[simdSupported,
threadsSupported] = await Promise.all([\n                env().getAsync('WASM_HAS_SIMD_SUPPORT'),\n
env().getAsync('WASM_HAS_MULTITHREAD_SUPPORT')\n            ]);\n            return new Promise((resolve, reject) =>
{\n                const factoryConfig: WasmFactoryConfig = {};\n\n                /**\n                 * This function overrides the Emscripten
module locateFile utility.\n                 * @param path The relative path to the file that needs to be loaded.\n                 * @param
prefix The path to the main JavaScript file's directory.\n                 */\n                factoryConfig.locateFile = (path, prefix) => {\n
if (path.endsWith('.worker.js')) {\n                    const response = wasmWorkerContents;\n                    const blob = new
Blob([response], {type: 'application/javascript'});\n                    return URL.createObjectURL(blob);\n                }\n                if
(path.endsWith('.wasm')) {\n                    return getPathToWasmBinary(\n                        simdSupported as boolean,
threadsSupported as boolean,\n                        wasmPathPrefix != null ? wasmPathPrefix : prefix);\n                }\n                return prefix
+ path;\n            };\n\n            // Use the instantiateWasm override when system fetch is not available.\n            // Reference:\n            //
https://github.com/emscripten-
core/emscripten/blob/2bca083cbbd5a4133db61fbd74d04f7feecfa907/tests/manual\_wasm\_instantiate.html#L170\n            if (customFetch) {\n                factoryConfig.instantiateWasm =\n
createInstantiateWasmFunc(getPathToWasmBinary(\n                    simdSupported as boolean, threadsSupported as
boolean,\n                    wasmPathPrefix != null ? wasmPathPrefix : ''));\n            }\n            let initialized = false;\n
factoryConfig.onAbort = () => {\n                if (initialized) {\n                    // Emscripten already called console.warn so no need to
double log.\n                    return;\n                }\n                if (initAborted) {\n                    // Emscripten calls `onAbort` twice, resulting in double
error\n                    // messages.\n                    return;\n                }\n                initAborted = true;\n                const rejectMsg =\n                    'Make sure the
server can serve the `.wasm` file relative to the ' +\n                    'bundled
js file. For more details see https://github.com/tensorflow/tfjs/blob/master/tfjs-backend-wasm/README.md#using-bundlers;\n                reject({message: rejectMsg});\n            };\n            let wasm: Promise<BackendWasmModule>;\n            // If
`wasmPath` has been defined we must initialize the vanilla module.\n            if (threadsSupported && simdSupported
&& wasmPath == null) {\n                factoryConfig.mainScriptUrlOrBlob = new Blob([\n                    var
WasmBackendModuleThreadedSimd = ` +\n                        wasmFactoryThreadedSimd.toString(),\n                    {type:
'text/javascript'}\n                ]);\n                wasm = wasmFactoryThreadedSimd(factoryConfig);\n            } else {\n                // The wasmFactory
works for both vanilla and SIMD binaries.\n                wasm = wasmFactory(factoryConfig);\n            }\n            // The WASM

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module has been successfully created by the factory.\n // Any error will be caught by the onAbort callback defined
above.\n wasm.then((module) => {\n   initialized = true;\n   initAborted = false;\n\n   const voidReturnType:
string
= null;\n   // Using the tfjs namespace to avoid conflict with emscripten's API.\n   module.tfjs = {\n     init:
module.cwrap('init', null, []),\n     initWithThreadsCount:\n       module.cwrap('init_with_threads_count', null,
['number']),\n     getThreadsCount: module.cwrap('get_threads_count', 'number', []),\n     registerTensor:
module.cwrap(\n       'register_tensor', null,\n       [\n         'number', // id\n         'number', // size\n         'number', // memoryOffset\n       ]),\n     disposeData: module.cwrap('dispose_data', voidReturnType,
['number']),\n     dispose: module.cwrap('dispose', voidReturnType, []),\n   };\n\n   resolve({ wasm: module });\n });\n\nfunction typedArrayFromBuffer(\n  buffer: ArrayBuffer, dtype: DataType):
backend_util.TypedArray {\n  switch (dtype) {\n    case 'float32':\n      return new Float32Array(buffer);\n    case
'int32':\n      return new Int32Array(buffer);\n    case 'bool':\n      return new Uint8Array(buffer);\n    default:\n      throw new Error(`Unknown dtype ${dtype}`);\n  }\n}\n\nconst wasmBinaryNames = [\n  'tfjs-backend-wasm.wasm', 'tfjs-backend-wasm-simd.wasm',\n  'tfjs-backend-wasm-threaded-simd.wasm'\n] as const;\n\nexport type WasmBinaryName = typeof
wasmBinaryNames[number];\n\nlet wasmPath: string = null;\nlet wasmPathPrefix: string = null;\nlet wasmFileMap:
{[key in WasmBinaryName]: string} = {};\n\nlet initAborted = false;\nlet customFetch = false;\n\n/**\n *
@deprecated Use `setWasmPaths` instead.\n * Sets the path to the `.wasm` file which will be fetched when the
wasm\n * backend is initialized. See\n * https://github.com/tensorflow/tfjs/blob/master/tfjs-backend-wasm/README.md#using-bundlers\n * for more details.\n * @param path wasm file path or url\n * @param
usePlatformFetch optional boolean to use platform fetch to download\n * the wasm file, default to false.\n *\n *
@doc {heading: 'Environment', namespace: 'wasm'}\n */\n\nexport function setWasmPath(path: string, usePlatformFetch = false): void {\n  deprecationWarn(\n    'setWasmPath has
been deprecated in favor of setWasmPaths and '\n    ' will be removed in a future release.);\n  if (initAborted) {\n    throw new Error(\n      'The WASM backend was already initialized. Make sure you call '\n      ' `setWasmPath`\n      before you call `tf.setBackend()` or `tf.ready()`);\n  }\n  wasmPath = path;\n  customFetch =
usePlatformFetch;\n}\n\n/**\n * Configures the locations of the WASM binaries.\n *\n * ```js\n * setWasmPaths({\n *   'tfjs-backend-wasm.wasm': 'renamed.wasm',\n *   'tfjs-backend-wasm-simd.wasm': 'renamed-simd.wasm',\n *   'tfjs-backend-wasm-threaded-simd.wasm': 'renamed-threaded-simd.wasm'\n * });\n * tf.setBackend('wasm');\n *
```*\n * @param prefixOrFileMap This can be either a string or object:\n * - (string) The path to the directory
where the WASM binaries are located.\n * Note that this prefix will be used to load each binary
(vanilla,\n * SIMD-enabled, threading-enabled, etc.).*\n * - (object) Mapping from names of WASM binaries to
custom\n * full paths specifying the locations of those binaries. This is useful if\n * your WASM binaries are
not all located in the same directory, or if your\n * WASM binaries have been renamed.\n * @param
usePlatformFetch optional boolean to use platform fetch to download\n * the wasm file, default to false.\n *\n *
@doc {heading: 'Environment', namespace: 'wasm'}\n */\n\nexport function setWasmPaths(\n prefixOrFileMap:
string|{[key in WasmBinaryName]: string},\n usePlatformFetch = false): void {\n if (initAborted) {\n throw
new Error(\n 'The WASM backend was already initialized. Make sure you call '\n ' `setWasmPaths`\n before you call `tf.setBackend()` or '\n ' `tf.ready()`);\n }\n\n if (typeof prefixOrFileMap === 'string') {\n wasmPathPrefix = prefixOrFileMap;\n } else {\n wasmFileMap = prefixOrFileMap;\n }\n\n const missingPaths =\n wasmBinaryNames.filter(name => wasmFileMap[name] == null);\n if
(missingPaths.length > 0) {\n throw new Error(\n `There were no entries found for the following binaries: `
+\n `${missingPaths.join(',')}. Please either call setWasmPaths with a `+\n `map providing a path for
each binary, or with a string indicating `+\n `the directory where all the binaries can be found.`);\n }\n}\n\nlet customFetch = usePlatformFetch;\n\n/**\n * Used in unit tests. *\n */\nexport function resetWasmPath(): void {\n wasmPath = null;\n wasmPathPrefix = null;\n wasmFileMap = {};\n customFetch = false;\n initAborted =
false;\n}\n\nlet threadsCount = -1;\nlet actualThreadsCount = -1;\n\n/**\n * Sets the number of threads that will be
used by XNNPACK to create\n * threadpool (default to the number of logical CPU cores).\n *\n * This must be

```

```
called before calling `tf.setBackend('wasm')`.
\n * ^\nexport function setThreadsCount(numThreads:
number) {\n threadsCount = numThreads;\n}\n\n/**\n * Gets the actual threads count that is used by
XNNPACK.\n * It is set after the backend is initialized.\n * ^\nexport function getThreadsCount(): number {\n if
(actualThreadsCount === -1) {\n throw new Error(`WASM backend not initialized.`);\n }\n return
actualThreadsCount;\n}\n\n", "/* @license See the LICENSE file. */\n\n// This code is auto-generated, do not modify
this file!\nconst version = '3.11.0';\nexport {version};\n\n", "/*\n * @license\n * Copyright 2020 Google LLC. All
Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either
express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n */
```



C,QAAQ,EAAE,OAAO,EAAE,QAAQ,CAAC,EAAE,CAAC,CAAC,KAAK,CAAC,CAAC;IACvE,MAAM,KAA  
K,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,GAAG,CAAC,MAAM,CAAC,CAAC,EAAE,CAAC;IAEn  
D,MAAM,WAAW,GAAG,IAAI,UAAU,CAAC,IAAI,UAAU,CAAC,CAAC,CAAC,KAAK,CAAC,CAAC,MAAM  
,CAAC,CAAC;IACnE,MAAM,WAAW,GAAG,IAAI,UAAU,CAAC,IAAI,UAAU,CAAC,CAAC,CAAC,KAAK,C  
AAC,CAAC,MAAM,CAAC,CAAC;IAEnE,eAAe,CACX,GAAG,EAAE,WAAW,EAAE,CAAC,CAAC,KAAK,CA  
AC,MAAM,EAAE,GAAG,EAAE,WAAW,EAAE,CAAC,CAAC,KAAK,CAAC,MAAM,EACIE,UAAU,EAAE,U  
AAU,EAAE,eAAe,EAAE,MAAM,EAAE,wBAAwB,EACzE,cAAc,IAAI,CAAC,EAAE,KAAK,CAAC,CAAC;IAE  
hC,OAAO,GAAG,CAAC;AACb,CAAC;AAEM,MAAM,iBAAiB,GAAiB;IAC7C,UAAU,EAAE,YAAY;IACxB,W  
AAW,EAAE,MAAM;IACnB,SAAS,EAAE,KAAK;IACb,UAAU,EAAE,gBAAoC;CACjD;;AC7GD;;;;;;S  
AuBgB,uBAAuB,CACnC,UAAkB,EAAE,OAAkB;IACxC,IAAI,QAA6D,CAAC;IAEIE,SAAS,SAAS,CAAC,OAA  
oB;QACrC,QAAQ,GAAG,OAAO,CAAC,IAAI,CAAC,KAAK,CAAC,UAAU,EAAE,IAAI,aAAa;YACzD,QAAQ;  
YACR,QAAQ;YACR,QAAQ;SACT,CAAC,CAAC;KACJ;IAED,SAAS,UAAU,CAAC,IAAiD;QAEEnE,MAAM,E  
AAC,OAAO,EAAE,MAAM,EAAE,EAAC,CAAC,EAAC,EAAC,GAAG,IAAI,CAAC;QACpC,MAAM,GAAG,G  
AAG,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,CAAC,CAAC,MAAM,CAAC,CAAC,EAAE,CAAC;QAC/C,M  
AAM,GAAG,GAAG,OAAO,CAAC,UAAU,CAAC,CAAC,CAAC,KAAK,EAAE,OAAO,IAAI,CAAC,CAAC,KA  
AK,CAAC,CAAC;QAC5D,MAAM,KAAK,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,GAAG,CAAC,M  
AAM,CAAC,CAAC,EAAE,CAAC;;QAGnD,IAAI,IAAI,CAAC,aAAa,CAAC,GAAG,CAAC,KAAK,CAAC,KAA  
K,CAAC,EAAE;YACvC,OAAO,GAAG,CAAC;SACZ;QAED,QAAQ,CAAC,GAAG,EAAE,QAAQ,CAAC,CAA  
C,CAAC,KAAK,CAAC,EAAE,KAAK,CAAC,CAAC;QACxC,OAAO,GAAG,CAAC;KACZ;IAED,OAAO,EAAC  
,UAAU,EAAE,WAAW,EAAE,MAAM,EAAE,SAAS,EAAE,UAAU,EAAC,CAAC;AACIE;;ACpDA;;;;;;A  
AoBO,MAAM,SAAS,GAAiB,uBAAuB,CAAC,GAAG,CAAC;;ACpBnE;;;;;;SAuBgB,wBAAwB,CACpC,U  
AAkB,EAAE,qBAA8B,EACID,KAAgB;IACIB,IAAI,QAGQ,CAAC;IAEb,SAAS,SAAS,CAAC,OAAoB;QACrC,  
QAAQ,GAAG,OAAO,CAAC,IAAI,CAAC,KAAK,CAAC,UAAU,EAAE,IAAI,aAAa;YACzD,QAAQ;YACR,OA  
AO;YACP,QAAQ;YACR,QAAQ;YACR,OAAO;YACP,QAAQ;YACR,QAAQ;YACR,QAAQ;SACT,CAAC,CAA  
C;KACJ;IAED,SAAS,UAAU,CAAC,IAAkD;QAEpE,MAAM,EAAC,OAAO,EAAE,MAAM,EAAC,GAAG,IAAI,  
CAAC;QAC/B,MAAM,EAAC,CAAC,EAAE,CAAC,EAAC,GAAG,MAAM,CAAC;QACtB,MAAM,GAAG,GAA  
G,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,CAAC,CAAC,MAAM,CAAC,CAAC,EAAE,CAAC;QAC/C,MAA  
M,GAAG,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,CAAC,CAAC,MAAM,CAAC,CAAC,EAAE,CAA  
C;QAE/C,MAAM,UAAU,GAAG,KAAK,IAAI,IAAI,GAAG,KAAK,GAAG,CAAC,CAAC,KAAK,CAAC;QACnD  
,MAAM,QAAQ,GAAG,YAAY,CAAC,OBAA0B,CAAC,CAAC,CAAC,KAAK,EAAE,CAAC,CAAC,KAAK,CAA  
C,CAAC;QAC3E,MAAM,GAAG,GAAG,OAAO,CAAC,UAAU,CAAC,QAAQ,EAAE,UAAU,CAAC,CAAC;;QA  
GrD,IAAI,IAAI,CAAC,aAAa,CAAC,QAAQ,CAAC,KAAK,CAAC,EAAE;YACtC,OAAO,GAAG,CAAC;SACZ;  
QAED,MAAM,WAAW,GAAG,IAAI,UAAU,CAAC,IAAI,UAAU,CAAC,CAAC,CAAC,KAAK,CAAC,CAAC,M  
AAM,CAAC,CAAC;QACnE,MAAM,WAAW,GAAG,IAAI,UAAU,CAAC,IAAI,UAAU,CAAC,CAAC,CAAC,K  
AAK,CAAC,CAAC,MAAM,CAAC,CAAC;QACnE,MAAM,KAAK,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG,  
CAAC,GAAG,CAAC,MAAM,CAAC,CAAC,EAAE,CAAC;QACnD,MAAM,UAAU,GAAG,MAAM,QAAQ,CAC  
7B,GAAG,EAAE,WAAW,EAAE,CAAC,CAAC,KAAK,CAAC,MAAM,EAAE,GAAG,EAAE,WAAW,EAAE,CA  
AC,CAAC,KAAK,CAAC,MAAM,EACIE,QAAQ,CAAC,CAAC,CAAC,KAAK,CAAC,EAAE,KAAK,CAAC,CA  
AC;;QAG9B,IAAI,qBAAqB,IAAI,CAAC,CAAC,KAAK,KAAK,SAAS,EAAE;YACID,UAAU,EAAE,CAAC;YA  
Cb,OAAO,GAAG,CAAC;SACZ;QAED,MAAM,cAAc,GAAG,YAAY,CAAC,gBAAgB,CAAC,CAAC,CAAC,KA  
AK,EAAE,QAAQ,CAAC,CAAC;QACxE,MAAM,cAAc,GAAG,YAAY,CAAC,gBAAgB,CAAC,CAAC,CAAC,K  
AAK,EAAE,QAAQ,CAAC,CAAC;QACxE,MAAM,eAAe,GAAG,cAAc,CAAC,KAAK,CAAC,CAAC,CAAC,EA  
AE,CAAC,KAAK,CAAC,KAAK,CAAC,CAAC,CAAC;QACHE,MAAM,eAAe,GAAG,cAAc,CAAC,KAAK,CAA  
C,CAAC,CAAC,EAAE,CAAC,KAAK,CAAC,KAAK,CAAC,CAAC,CAAC;QACHE,IAAI,eAAe,IAAI,eAAe,EA  
E;YACtC,UAAU,EAAE,CAAC;YACb,OAAO,GAAG,CAAC;SACZ;aAAM;YACL,MAAM,IAAI,KAAK,CACX,  
2CAA2C;gBAC3C,iBAAiB,CAAC,CAAC,KAAK,IAAI,UAAU,GAAG,CAAC,CAAC;SACHd;KACF;IAED,OAA  
O,EAAC,UAAU,EAAE,WAAW,EAAE,MAAM,EAAE,SAAS,EAAE,UAAU,EAAC,CAAC;AACIE;;ACxFa;;;;;  
;;;;;AAqBA,MAAM,qBAAqB,GAAG,IAAI,CAAC;AAE5B,MAAM,SAAS,GACIB,wBAAwB,CAAC,GAAG,E

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, cAAc, EAAE, EAAE, CAAC; aACrD, CAAC; YAEF, OAAO, CAAC, EAAC, IAAI, EAAE, MAAM, EAAC, CAAC, CAA  
C; SACzB, CAAC, CAAC; KACJ, CAAC, CAAC; AACL, CAAC; AAED, SAAS, oBAAB, CACzB, MAAM, EAAE, K  
AAe; IACtC, QAAQ, KAAK; QACX, KAAK, SAAS; YACZ, OAAO, IAAI, YAAy, CAAC, MAAM, CAAC, CAAC; QAC  
IC, KAAK, OAAO; YACV, OAAO, IAAI, UAAU, CAAC, MAAM, CAAC, CAAC; QACHc, KAAK, MAAM; YACT, OA  
AO, IAAI, UAAU, CAAC, MAAM, CAAC, CAAC; QACHc; YACE, MAAM, IAAI, KAAK, CAAC, iBAAiB, KAAK, EA  
AE, CAAC, CAAC; KAC7C; AACH, CAAC; AAED, MAAM, eAAe, GAAG; IACtB, wBAAwB, EAAE, 6BAA6B; IACv  
D, sCAAsC; CAC9B, CAAC; AAGZ, IAAI, QAAQ, GAAG, IAAI, CAAC; AAC5B, IAAI, cAAc, GAAG, IAAI, CAAC; A  
ACIC, IAAI, WAAW, GAAG, EAAE, CAAC; AACzD, IAAI, WAAW, GAAG, KAAK, CAAC; AACxB, IAAI, WAAW,  
GAAG, KAAK, CAAC; AAExB; ; ; ; ; SAYgB, WAAW, CAAC, IAAy, EAAE, gBAAGb, GAAG, KAAK; IACHe, eA  
Ae, CACX, 8DAA8D; QAC9D, uCAAuC, CAAC, CAAC; IAC7C, IAAI, WAAW, EAAE; QACf, MAAM, IAAI, KAAK, C  
ACX, +DAA+D; YAC/D, mEAAmE, CAAC, CAAC; KAC1E; IACD, QAAQ, GAAG, IAAI, CAAC; IACHb, WAAW, GA  
AG, gBAAGb, CAAC; AACjC, CAAC; AAED; ; ; ; ; ; ; ; ; ; ; SAYBgB, YAAy, CACxB, eAA0D, EAC1D, gBAAGb,  
GAAG, KAAK; IAC1B, IAAI, WAAW, EAAE; QACf, MAAM, IAAI, KAAK, CACX, +DAA+D; YAC/D, wDAAwD; YA  
Cx, cAAc, CAAC, CAAC; KACrB; IAED, IAAI, OAAO, eAAe, KAAK, QAAQ, EAAE; QACvC, cAAc, GAAG, eAAe, C

AAC;KACIC;SAAM;QACL,WAAW,GAAG,eAAe,CAAC;QAC9B,MAAM,YAAY,GACd,eAAe,CAAC,MAAM,CAAC,IAAI,IAAI,WAAW,CAAC,IAAI,CAAC,IAAI,IAAI,CAAC,CAAC;QAC9D,IAAI,YAAY,CAAC,MAAM,GAAG,CAAC,EAAE;YAC3B,MAAM,IAAI,KAAK,CACX,0DAA0D;gBAC1D,GAAG,YAAY,CAAC,IAAI,CAAC,GAAG,CAAC,2CAA2C;gBACpE,oEAAoE;gBACpE,oDAAoD,CAAC,CAAC;SAC3D;KACF;IAED,WAAW,GAAG,gBAAgB,CAAC;AACjC,CAAC;AAWD,IAAI,YAAY,GAAG,CAAC,CAAC,CAAC;AACtB,IAAI,kBAAkB,GAAG,CAAC,CAAC,CAAC;AAE5B;;;;;SAMgB,eAAe,CAAC,UAAkB;IACHd,YAAY,GAAG,UAAU,CAAC;AAC5B,CAAC;AAED;;;;;SAKgB,eAAe;IAC7B,IAAI,kBAAkB,KAAK,CAAC,CAAC,EAAE;QAC7B,MAAM,IAAI,KAAK,CAAC,+BAA+B,CAAC,CAAC;KACID;IACD,OAAO,kBAAkB,CAAC;AAC5B;;ACxfA;AAEA;MACM,OAAO,GAAG;;ACHhB;;;;;AA0BA,MAAM,aAAa,GAAG,CAAC,CAAC;AACxB,eAAe,CAAC,MAAM,EAAE;IACtB,MAAM,EAAC,IAAI,EAAC,GAAG,MAAM,IAAI,EAAE,CAAC;IAC5B,OAAO,IAAI,WAAW,CAAC,IAAI,CAAC,CAAC;AAC/B,CAAC,EAAE,aAAa,CAAC;;;;}

Found

in path(s):

\* /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/tf-backend-wasm.fesm.js.map

No license file was found, but licenses were detected in source scan.

```
{ "version": 3, "file": "tf-backend-wasm.min.js", "sources": ["../src/kernels/types.ts", "../src/kernels/_FusedMatMul.ts", "../src/kernels/unary_kernel.ts", "../src/kernels/Abs.ts", "../src/kernels/binary_kernel.ts", "../src/kernels/Add.ts", "../src/kernels/AddN.ts", "../src/kernels/Identity.ts", "../src/kernels/Transpose.ts", "../src/kernels/All.ts", "../src/kernels/kernel_utils.ts", "../src/kernels/Any.ts", "../src/kernels/ArgMax.ts", "../src/kernels/AvgPool.ts", "../src/kernels/Reshape.ts", "../src/kernels/BatchMatMul.ts", "../node_modules/@tensorflow/tfjs-backend-cpu/dist/kernels/Slice.js", "../src/kernels/Slice.ts", "../src/kernels/BatchToSpaceND.ts", "../src/kernels/Cast.ts", "../src/kernels/ClipByValue.ts", "../src/kernels/Ceil.ts", "../src/kernels/Concat.ts", "../node_modules/@tensorflow/tfjs-backend-cpu/dist/kernels/Concat_impl.js", "../src/kernels/Conv2D.ts", "../src/kernels/Conv2DBackpropInput.ts", "../src/kernels/CropAndResize.ts", "../src/kernels/Cos.ts", "../src/kernels/Cosh.ts", "../src/kernels/Cumsum.ts", "../src/kernels/DepthToSpace.ts", "../src/kernels/DepthwiseConv2dNative.ts", "../src/kernels/Elu.ts", "../src/kernels/Equal.ts", "../src/kernels/Exp.ts", "../src/kernels/ExpandDims.ts", "../src/kernels/Fill.ts", "../src/kernels/FlipLeftRight.ts", "../src/kernels/FusedBatchNorm.ts", "../src/kernels/Floor.ts", "../src/kernels/FloorDiv.ts", "../src/kernels/FusedConv2D.ts", "../src/kernels/FusedDepthwiseConv2D.ts", "../src/kernels/GatherNd.ts", "../src/kernels/GatherV2.ts", "../src/kernels/LeakyRelu.ts", "../src/kernels/Greater.ts", "../src/kernels/GreaterEqual.ts", "../src/kernels/Max.ts", "../src/kernels/Less.ts", "../src/kernels/LessEqual.ts", "../src/kernels/Log.ts", "../src/kernels/LogicalAnd.ts", "../src/kernels/MaxPool.ts", "../src/kernels/Maximum.ts", "../src/kernels/Mean.ts", "../src/kernels/Min.ts", "../src/kernels/MirrorPad.ts", "../src/kernels/Minimum.ts", "../src/kernels/NonMaxSuppressionV3.ts", "../src/kernels/Multiply.ts", "../src/kernels/Neg.ts", "../src/kernels/NonMaxSuppression_util.ts", "../src/kernels/NonMaxSuppressionV4.ts", "../src/kernels/NonMaxSuppressionV5.ts", "../src/kernels/OneHot.ts", "../src/kernels/NotEqual.ts", "../src/kernels/OnesLike.ts", "../src/kernels/Pack.ts", "../src/kernels/PadV2.ts", "../src/kernels/Prelu.ts", "../src/kernels/Pow.ts", "../src/kernels/Prod.ts", "../src/kernels/ResizeBilinear.ts", "../src/kernels/Range.ts", "../node_modules/@tensorflow/tfjs-backend-cpu/dist/kernels/Range_impl.js", "../src/kernels/RealDiv.ts", "../src/kernels/Relu.ts", "../src/kernels/Relu6.ts", "../src/kernels/Reverse.ts", "../src/kernels/RotateWithOffset.ts", "../src/kernels/ScatterNd.ts", "../src/kernels/Round.ts", "../src/kernels/Rsqrt.ts", "../src/kernels/Select.ts", "../src/kernels/Sigmoid.ts", "../src/kernels/Softmax.ts", "../src/kernels/Sin.ts", "../src/kernels/SpaceToBatchND.ts", "../src/kernels/SplitV.ts", "../src/kernels/Step.ts", "../src/kernels/Sqrt.ts", "../src/kernels/Square.ts", "../src/kernels/SquaredDifference.ts", "../src/kernels/StridedSlice.ts", "../src/kernels/Sum.ts", "../src/kernels/Sub.ts", "../src/kernels/Tile.ts", "../src/kernels/Tan.ts", "../src/kernels/Tanh.ts", "../src/kernels/TopK.ts", "../src/kernels/Transform.ts", "../src/kernels/Unpack.ts", "../src/register_all_kernels.ts", "../src/kernels/ZerosLike.ts", "../src/flags_wasm.ts", "../wasm-out/tfjs-backend-wasm-threaded-simd.js", "../wasm-out/tfjs-backend-
```

```

wasm.js", "../src/backend_wasm.ts", "../wasm-out/tfjs-backend-wasm-threaded-
simd.worker.js", "../src/base.ts", "../src/version.ts"], "sourcesContent": ["/**\n
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2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
\n
*/\n\n// This enum must align with the enum defined in cc/backend.h.\nexport enum CppDType {\n float32 = 0,\n
int32 = 1,\n bool = 2,\n string = 3,\n complex64 = 4\n}\n\n// Must match enum in cc/fusable_activations.h.\nexport
enum FusableActivation {\n linear = 0,\n relu = 1,\n relu6 = 2,\n prelu = 3,\n leakyrelu = 4,\n sigmoid = 5,\n elu
= 6\n}\n\n", "/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache
License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You
may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required
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distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR
CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing
permissions and\n * limitations under the License.\n *
=====
\n
*/\n\nimport { _FusedMatMul, _FusedMatMulAttrs, _FusedMatMulInputs, KernelConfig, KernelFunc } from
'@tensorflow/tfjs-core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nimport { FusableActivation } from
'./types';\n\nlet wasmFusedMatMul: (\n aId: number, aShape: Uint8Array, aShapeSize: number, bId: number,\n bShape: Uint8Array, bShapeSize: number, transposeA: boolean,\n transposeB: boolean, activation: number,\n biasId: number,\n preluActivationWeightsId: number, leakyreluAlpha: number, outId: number) =>\n void;\n\nfunction setup(backend: BackendWasm) {\n wasmFusedMatMul = backend.wasm.cwrap(_FusedMatMul,\n null /* void */, [\n 'number',\n // a_id\n 'array', // a_shape\n 'number', // a_shape.length\n 'number', // b_id\n 'array', // b_shape\n 'number', // b_shape.length\n 'number', // transpose_a\n 'number', // transpose_b\n 'number', // activation\n 'number', // biasId\n 'number', // preluActivationWeightsId\n 'number', // leakyreluAlpha\n 'number' // out_id\n]);\n\n function fusedBatchMatMul(args: {\n inputs: _FusedMatMulInputs,\n backend: BackendWasm,\n attrs: _FusedMatMulAttrs\n }) {\n const { inputs, backend, attrs } = args;\n const { a, b, bias, preluActivationWeights } = inputs;\n\n if (a.dtype !== 'float32' || b.dtype !== 'float32') {\n throw new Error(\n `_FusedMatMul for non non-float32 tensors not yet supported.`);\n }\n\n const { transposeA, transposeB, activation, leakyreluAlpha } = attrs;\n const aId = backend.dataIdMap.get(a.dataId).id;\n const bId = backend.dataIdMap.get(b.dataId).id;\n\n let biasId = 0;\n if (bias != null) {\n const biasData = backend.dataIdMap.get(bias.dataId);\n if (biasData.shape.length !== 1) {\n throw new Error(\n `_FusedMatMul only supports rank-1 bias but got ` +\n `rank ${biasData.shape.length}.`);\n }\n biasId = biasData.id;\n }\n\n const preluActivationWeightsId = preluActivationWeights == null ? 0 : backend.dataIdMap.get(preluActivationWeights.dataId).id;\n const fusedActivation =\n FusableActivation[activation as { } as keyof typeof FusableActivation];\n if (fusedActivation == null) {\n throw new Error(\n `${activation} activation not yet supported for FusedConv2D ` +\n `in the wasm backend.`);\n }\n\n const leftDim = transposeA ? a.shape[2] : a.shape[1];\n const rightDim = transposeB ? b.shape[1] : b.shape[2];\n const batchDim = a.shape[0];\n\n const out = backend.makeOutput([batchDim, leftDim, rightDim], a.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n const aShapeBytes = new Uint8Array(new Int32Array(a.shape).buffer);\n const bShapeBytes = new Uint8Array(new Int32Array(b.shape).buffer);\n\n wasmFusedMatMul(\n aId, aShapeBytes, a.shape.length, bId, bShapeBytes, b.shape.length,\n transposeA,

```

```

transposeB, fusedActivation, biasId, preluActivationWeightsId,\n leakyreluAlpha || 0, outId);\n\n return
out;\n}\n\nexport const fusedMatMulConfig: KernelConfig = {\n kernelName: '_FusedMatMul',\n backendName:
'wasm',\n setupFunc: setup,\n kernelFunc: fusedBatchMatMul as { } as KernelFunc\n};\n\n", "/**\n * @license\n *
Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
'License');\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an 'AS IS' BASIS,\n *
WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport { DataType, KernelConfig, TensorInfo, UnaryInputs, util } from '@tensorflow/tfjs-core';\n\nimport
{ BackendWasm } from '../backend_wasm';\n\nimport { CppDType } from './types';\n\nexport function
createUnaryKernelConfig(\n kernelName: string, outType?: DataType): KernelConfig {\n let wasmFunc: (xId:
number, dtype: number, outId: number) => void;\n\n function setupFunc(backend: BackendWasm): void {\n
wasmFunc = backend.wasm.cwrap(kernelName, null /* void */, [\n 'number', // x_id\n 'number', // dtype\n 'number', // out_id\n]);\n }\n\n function kernelFunc(args: { backend: BackendWasm, inputs: UnaryInputs }):\n TensorInfo {\n const { backend, inputs: { x } } = args;\n const xId = backend.dataIdMap.get(x.dataId).id;\n
 const out = backend.makeOutput(x.shape, outType || x.dtype);\n const outId =
backend.dataIdMap.get(out.dataId).id;\n\n // Short-circuit zero-sized tensors.\n if (util.sizeFromShape(out.shape)
=== 0) {\n return out;\n }\n\n wasmFunc(xId, CppDType[x.dtype], outId);\n return out;\n }\n\n return
{ kernelName, backendName: 'wasm', setupFunc, kernelFunc };\n}\n\n", "/**\n * @license\n * Copyright 2019 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the 'License');\n * you may not
use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an 'AS IS' BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n
* limitations under the License.\n *
=====\n
*/\n\nimport { Abs, KernelConfig } from '@tensorflow/tfjs-core';\n\nimport { createUnaryKernelConfig } from
'../unary_kernel';\n\nexport const absConfig: KernelConfig = createUnaryKernelConfig(Abs);\n\n", "/**\n * @license\n *
Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
'License');\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an 'AS IS' BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport { backend_util, BinaryInputs, DataType, KernelConfig, TensorInfo, util } from '@tensorflow/tfjs-
core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nimport { CppDType } from './types';\n\nexport
function createBinaryKernelConfig(\n kernelName: string, supportsFullBroadcast: boolean,\n dtype?:
DataType): KernelConfig {\n let wasmFunc:\n (aId: number, aShape: Uint8Array, aShapeLen: number, bId:
number,\n bShape: Uint8Array, bShapeLen: number, dtype: number, outId: number) =>\n void;\n\n function setupFunc(backend: BackendWasm): void {\n wasmFunc = backend.wasm.cwrap(kernelName, null /*
void */, [\n 'number', // a_id,\n 'array', // a_shape\n 'number', // a_shape.length\n 'number', // b_id\n 'array', // b_shape\n 'number', // b_shape.length\n 'number', // dtype\n 'number' // out_id\n]);\n }\n\n function kernelFunc(args: { backend: BackendWasm, inputs: BinaryInputs }):\n

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TensorInfo {\n const {backend, inputs} = args;\n const {a, b} = inputs;\n const aId =
backend.dataIdMap.get(a.dataId).id;\n const bId = backend.dataIdMap.get(b.dataId).id;\n\n const outputType =
dtype != null ? dtype : a.dtype;\n const newShape = backend_util.assertAndGetBroadcastShape(a.shape,
b.shape);\n const out = backend.makeOutput(newShape, outputType);\n\n // Short-circuit zero-sized tensors.\n if (util.sizeFromShape(newShape) === 0) {\n return out;\n }\n\n const aShapeBytes = new Uint8Array(new
Int32Array(a.shape).buffer);\n const bShapeBytes = new Uint8Array(new Int32Array(b.shape).buffer);\n const
outId = backend.dataIdMap.get(out.dataId).id;\n const kernelFunc = () => wasmFunc(\n aId, aShapeBytes,
a.shape.length, bId, bShapeBytes, b.shape.length,\n CppDType[a.dtype], outId);\n\n // Currently only some
float operations support full broadcast.\n if (supportsFullBroadcast && a.dtype === 'float32')
{\n kernelFunc();\n return out;\n }\n\n const aBroadcastDims = backend_util.getBroadcastDims(a.shape,
newShape);\n const bBroadcastDims = backend_util.getBroadcastDims(b.shape, newShape);\n const
loopsOverAllOfA = aBroadcastDims.every((v, i) => v === i);\n const loopsOverAllOfB =
bBroadcastDims.every((v, i) => v === i);\n if (loopsOverAllOfA && loopsOverAllOfB) {\n kernelFunc();\n
return out;\n } else {\n throw new Error(\n `Broadcasting along outer dims is not yet ` +\n
`supported for ${a.dtype} ${kernelName}.`);\n }\n\n return {kernelName, backendName: 'wasm', setupFunc,
kernelFunc};\n}\n\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required
by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\"
BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the
License for the specific language governing permissions and\n * limitations under the License.\n *
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\n
*/\n\nimport {Add, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createBinaryKernelConfig} from
'./binary_kernel';\n\nconst supportsFullBroadcast = true;\n\nexport const addConfig: KernelConfig = \n
createBinaryKernelConfig(Add, supportsFullBroadcast);\n\n", "/*\n * @license\n * Copyright 2019 Google LLC. All
Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====
\n
*/\n\nimport {AddN, KernelConfig, KernelFunc, TensorInfo, util} from '@tensorflow/tfjs-core';\n\nimport
{BackendWasm} from './backend_wasm';\n\nimport {CppType} from './types';\n\nlet wasmFunc;\n (inputIds:
Uint8Array, inputIdsLen: number, dtype: number, outId: number) =>\n void;\n\nfunction setupFunc(backend:
BackendWasm): void {\n wasmFunc = backend.wasm.cwrap(AddN, null /* void */, [\n 'array', // input_ids\n
'number', // input_ids.length\n 'number', // dtype\n 'number', // out_id\n]);\n\n function addn(args: {inputs:
TensorInfo[], backend: BackendWasm}) {\n const {inputs,
backend} = args;\n const out = backend.makeOutput(inputs[0].shape, inputs[0].dtype);\n\n // Short-circuit zero-
sized tensors.\n if (util.sizeFromShape(out.shape) === 0) {\n return out;\n }\n\n const inputIds = inputs.map(x
=> backend.dataIdMap.get(x.dataId).id);\n const inputIdsBytes = new Uint8Array(new
Int32Array(inputIds).buffer);\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmFunc(inputIdsBytes,
inputIds.length, CCppType[out.dtype], outId);\n\n return out;\n }\n\n export const addNConfig: KernelConfig = {\n
kernelName: AddN,\n backendName: 'wasm',\n setupFunc,\n kernelFunc: addn as {} as KernelFunc,\n};\n\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version
2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable

```

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```
=====\\n
*\\n\\nimport {Identity, IdentityInputs, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';\\nimport
{TensorInfo} from '@tensorflow/tfjs-core';\\n\\nimport {BackendWasm} from '../backend_wasm';\\n\\nexport function
identity(args: {inputs: IdentityInputs, backend: BackendWasm}):\\n TensorInfo {\\n const {inputs: {x}, backend} =
args;\\n const out = backend.makeOutput(x.shape, x.dtype);\\n const inVals = backend.toArrayFromHeap(x);\\n
const outVals = backend.toArrayFromHeap(out);\\n outVals.set(inVals);\\n return out;\\n}\\n\\nexport const
identityConfig: KernelConfig = {\\n kernelName: Identity,\\n backendName: 'wasm',\\n
 kernelFunc: identity as { } as KernelFunc,\\n};\\n\\n,\"/*\\n * @license\\n * Copyright 2019 Google LLC. All Rights
Reserved.\\n * Licensed under the Apache License, Version 2.0 (the \"License\");\\n * you may not use this file
except in compliance with the License.\\n * You may obtain a copy of the License at\\n *\\n *
http://www.apache.org/licenses/LICENSE-2.0\\n *\\n * Unless required by applicable law or agreed to in writing,
software\\n * distributed under the License is distributed on an \"AS IS\" BASIS,\\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\\n * See the License for the specific language
governing permissions and\\n * limitations under the License.\\n *
```

```
=====\\n
*\\n\\nimport {KernelConfig, KernelFunc, TensorInfo, Transpose, TransposeAttrs, TransposeInputs} from
'@tensorflow/tfjs-core';\\nimport {BackendWasm} from '../backend_wasm';\\nimport {identity} from
'./Identity';\\nimport {CppType}
from './types';\\n\\nlet wasmTranspose: (\\n xId: number, xShape: Uint8Array, xShapeLength: number, dtype:
CppType,\\n outId: number, perm: Uint8Array, permLength: number) => void;\\n\\nfunction setup(backend:
BackendWasm) {\\n wasmTranspose = backend.wasm.cwrap(Transpose, null /* void */, [\\n 'number', // xId\\n
'array', // x.shape\\n 'number', // x.shape.length\\n 'number', // dtype\\n 'number', // outId\\n
'array', // perm\\n 'number', // perm.length\\n]);\\n}\\n\\nexport function transpose(\\n args: {\\n {inputs: TransposeInputs, backend:
BackendWasm, attrs: TransposeAttrs}):\\n TensorInfo {\\n const {inputs, backend, attrs} = args;\\n // Reduce any
dimensions with size one. Lower-rank transpose kernel performs\\n // better due to simpler memory access pattern.\\n
const [reducedShape, perm] = removeOneSizeDims(inputs.x.shape, attrs.perm);\\n\\n let permIsNoOp = true;\\n for
(let i = 0; i < perm.length; i++) {\\n if (perm[i] !== i) {\\n permIsNoOp
= false;\\n }\\n }\\n const outShape = computeOutShape(inputs.x.shape, attrs.perm);\\n const x = {\\n dataId:
inputs.x.dataId,\\n shape: reducedShape,\\n dtype: inputs.x.dtype\\n };\\n if (permIsNoOp) {\\n const cloned =
identity({inputs, backend});\\n cloned.shape = outShape;\\n return cloned;\\n }\\n const out =
backend.makeOutput(outShape, x.dtype);\\n const xId = backend.dataIdMap.get(x.dataId).id;\\n const outId =
backend.dataIdMap.get(out.dataId).id;\\n const permBytes = new Uint8Array(new Int32Array(perm).buffer);\\n
const xShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);\\n\\n wasmTranspose(\\n xId,
xShapeBytes, x.shape.length, CCppType[x.dtype], outId, permBytes,\\n perm.length);\\n return
out;\\n}\\n\\nfunction computeOutShape(inShape: number[], perm: number[]): number[] {\\n const outShape = new
Array(inShape.length);\\n for (let i = 0; i < outShape.length; i++) {\\n outShape[i] = inShape[perm[i]];\\n }\\n
return outShape;\\n}\\n\\nfunction
removeOneSizeDims(\\n shape: number[], perm: number[]): [number[], number[]] {\\n const newShape: number[]
= [];\\n const newPerm: number[] = [];\\n for (let i = 0; i < shape.length; ++i) {\\n if (shape[i] !== 1) {\\n
newShape.push(shape[i]);\\n }\\n if (shape[perm[i]] !== 1) {\\n newPerm.push(perm[i]);\\n }\\n }\\n for (let i =
0; i < newPerm.length; ++i) {\\n let minValIdx = -1;\\n for (let j = 0; j < newPerm.length; ++j) {\\n if
(newPerm[j] >= i && (minValIdx === -1 || newPerm[minValIdx] > newPerm[j])) {\\n minValIdx = j;\\n
 }\\n }\\n newPerm[minValIdx] = i;\\n }\\n return [newShape, newPerm];\\n}\\n\\nexport const transposeConfig:
KernelConfig = {\\n kernelName: Transpose,\\n backendName: 'wasm',\\n kernelFunc: transpose as { } as
```

KernelFunc,\n setupFunc: setup,\n};\n", "/\*\n \* @license\n \* Copyright 2021 Google LLC. All Rights Reserved.\n \* Licensed under the Apache License, Version 2.0 (the \"License\");\n \* you may not use this file except in compliance with the License.\n \* You may obtain a copy of the License at\n \* \n \* http://www.apache.org/licenses/LICENSE-2.0\n \* \n \* Unless required by applicable law or agreed to in writing, software\n \* distributed under the License is distributed on an \"AS IS\" BASIS,\n \* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*

```
=====\n*\n\nimport { All, AllAttrs, AllInputs, backend_util, KernelConfig, KernelFunc, TensorInfo, util } from\n '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nimport\n { permuteAxesAndTranspose } from './kernel_utils';\nlet wasmAll: (xId: number, reduceSize: number, outId:\n number) => void;\nfunction setup(backend: BackendWasm): void {\n wasmAll = backend.wasm.cwrap(All, null\n /*void*/, ['number, number, number']);\n}\n\nfunction\n all(args: { backend: BackendWasm, inputs: AllInputs, attrs: AllAttrs }):\n TensorInfo {\n const { backend, inputs,\n attrs } = args;\n const { axis, keepDims } = attrs;\n const { x } = inputs;\n const xId =\n backend.dataIdMap.get(x.dataId).id;\n let inputId = xId;\n let input = x;\n const { transposed, axes, originalAxes,\n inputWasTransposed } =\n permuteAxesAndTranspose(x, axis, backend);\n if (inputWasTransposed) {\n const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n input = transposed;\n inputId =\n transposedId;\n }\n const inputRank = input.shape.length;\n backend_util.assertAxesAreInnerMostDims('all',\n axes, inputRank);\n const [outShape, reduceShape] =\n backend_util.computeOutAndReduceShapes(input.shape, axes);\n const reduceSize =\n util.sizeFromShape(reduceShape);\n const out = backend.makeOutput(outShape, x.dtype);\n if\n (util.sizeFromShape(input.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmAll(inputId,\n reduceSize, outId);\n }\n if (inputWasTransposed) {\n // dispose of the transposed tensor.\n backend.disposeData(transposed.dataId);\n }\n if (keepDims) {\n // reshape\n const newShape =\n backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n out.shape = newShape;\n }\n return\n out;\n}\n\nexport const allConfig: KernelConfig = {\n kernelName: All,\n backendName: 'wasm',\n setupFunc:\n setup,\n kernelFunc: all as { } as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2020 Google Inc. All Rights\n Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file\n except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express\n or implied.\n * See the License for the specific language governing permissions and\n * limitations under the\n License.\n *
```

```
=====\n*\n\nimport { backend_util, TensorInfo, util } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from\n '../backend_wasm';\nimport { transpose } from './Transpose';\n\n/*\n * Compute permutation axes and do a transpose\n if necessary.\n * \n * Used by reduction ops.\n * \n * @param x input TensorInfo\n * \n * @param axis reduction axes\n * \n * @param backend wasm backend instance\n */\nexport function permuteAxesAndTranspose(\n x: TensorInfo,\n axis: number|number[],\n backend: BackendWasm): {\n transposed: TensorInfo|null,\n axes: number[],\n originalAxes: number[],\n inputWasTransposed: boolean\n } {\n const xShape = x.shape;\n const xRank =\n x.shape.length;\n const originalAxes = util.parseAxisParam(axis, xShape);\n let axes = originalAxes;\n const\n permutedAxes = backend_util.getAxesPermutation(axes,\n xRank);\n let xTransposed = null;\n let inputWasTransposed = false;\n if (permutedAxes !== null) {\n const\n newShape: number[] = new Array(xRank);\n for (let i = 0; i < newShape.length; i++) {\n newShape[i] =\n xShape[permutedAxes[i]];\n }\n axes = backend_util.getInnerMostAxes(axes.length, xRank);\n xTransposed =\n
```



```

=\\n transpose({inputs: {x}, attrs: {perm: permutedAxes}, backend});\\n\\n const xId =
backend.dataIdMap.get(x.dataId).id;\\n const transposedId = backend.dataIdMap.get(xTransposed.dataId).id;\\n if
(transposedId !== xId) {\\n inputWasTransposed = true;\\n }\\n }\\n\\n return {transposed: xTransposed,
originalAxes, axes, inputWasTransposed};\\n}\\n\\n", "/*\\n * @license\\n * Copyright 2021 Google LLC. All Rights
Reserved.\\n * Licensed under the Apache License, Version 2.0 (the \\\"License\\\");\\n * you may not use this file
except in compliance with the License.\\n * You may obtain a copy of the License at\\n *\\n *
http://www.apache.org/licenses/LICENSE-2.0\\n
*\\n * Unless required by applicable law or agreed to in writing, software\\n * distributed under the License is
distributed on an \\\"AS IS\\\" BASIS,\\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
express or implied.\\n * See the License for the specific language governing permissions and\\n * limitations under
the License.\\n *
=====\\n
*\\n\\nimport {Any, AnyAttrs, AnyInputs, backend_util, KernelConfig, KernelFunc, TensorInfo, util} from
'@tensorflow/tfjs-core';\\n\\nimport {BackendWasm} from '../backend_wasm';\\n\\nimport
{permuteAxesAndTranspose} from './kernel_utils';\\n\\nlet wasmAny: (xId: number, reduceSize: number, outId:
number) => void;\\n\\nfunction setup(backend: BackendWasm): void {\\n wasmAny = backend.wasm.cwrap(Any,
null /*void*/, ['number, number, number']);\\n}\\n\\nfunction any(args: {backend: BackendWasm, inputs: AnyInputs,
attrs: AnyAttrs}):\\n TensorInfo {\\n const {backend, inputs,
attrs} = args;\\n const {axis, keepDims} = attrs;\\n const {x} = inputs;\\n const xId =
backend.dataIdMap.get(x.dataId).id;\\n let inputId = xId;\\n let input = x;\\n\\n const {transposed, axes, originalAxes,
inputWasTransposed} =\\n permuteAxesAndTranspose(x, axis, backend);\\n\\n if (inputWasTransposed) {\\n
const transposedId = backend.dataIdMap.get(transposed.dataId).id;\\n input = transposed;\\n inputId =
transposedId;\\n }\\n\\n const inputRank = input.shape.length;\\n backend_util.assertAxesAreInnerMostDims('any',
axes, inputRank);\\n const [outShape, reduceShape] =\\n
backend_util.computeOutAndReduceShapes(input.shape, axes);\\n const reduceSize =
util.sizeFromShape(reduceShape);\\n\\n const out = backend.makeOutput(outShape, x.dtype);\\n if
(util.sizeFromShape(input.shape) !== 0) {\\n const outId = backend.dataIdMap.get(out.dataId).id;\\n
wasmAny(inputId, reduceSize, outId);\\n }\\n\\n if (inputWasTransposed) {\\n // dispose of the transposed tensor.\\n
backend.disposeData(transposed.dataId);\\n
 }\\n\\n if (keepDims) {\\n // reshape\\n const newShape = backend_util.expandShapeToKeepDim(out.shape,
originalAxes);\\n out.shape = newShape;\\n }\\n\\n return out;\\n}\\n\\nexport const anyConfig: KernelConfig = {\\n
kernelName: Any,\\n backendName: 'wasm',\\n setupFunc: setup,\\n kernelFunc: any as {} as
KernelFunc\\n};\\n", "/*\\n * @license\\n * Copyright 2019 Google LLC. All Rights Reserved.\\n * Licensed under the
Apache License, Version 2.0 (the \\\"License\\\");\\n * you may not use this file except in compliance with the
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Unless required by applicable law or agreed to in writing, software\\n * distributed under the License is distributed
on an \\\"AS IS\\\" BASIS,\\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\\n * See the License for the specific language governing permissions and\\n * limitations under the
License.\\n
*
=====\\n
*\\n\\nimport {ArgMax, ArgMaxAttrs, ArgMaxInputs, KernelConfig, KernelFunc, util} from '@tensorflow/tfjs-
core';\\n\\nimport {BackendWasm} from '../backend_wasm';\\n\\nimport {permuteAxesAndTranspose} from
'./kernel_utils';\\n\\nimport {CppType} from './types';\\n\\nlet wasmFunc: (\\n xId: number, dtype: number, outerSize:
number, innerSize: number,\\n outId: number) => void;\\n\\nfunction setup(backend: BackendWasm) {\\n
wasmFunc = backend.wasm.cwrap(ArgMax, null /* void */, [\\n 'number', // x_id\\n 'number', // dtype\\n
'number', // outer_size\\n 'number', // inner_size\\n 'number' // out_id\\n]);\\n}\\n\\nfunction argmax(\\n args:
{inputs: ArgMaxInputs, backend: BackendWasm, attrs: ArgMaxAttrs}) {\\n const {backend, inputs, attrs} = args;\\n
const {axis} = attrs as {} as ArgMaxAttrs;\\n const {x} = inputs as {} as ArgMaxInputs;\\n const xId =

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backend.dataIdMap.get(x.dataId).id;\n let inputId
= xId;\n let input = x;\n\n const {transposed, axes, inputWasTransposed} =\n permuteAxesAndTranspose(x,
axis, backend);\n\n if (inputWasTransposed) {\n const transposedId =
backend.dataIdMap.get(transposed.dataId).id;\n if (transposedId !== xId) {\n // transpose was not a no-op. We
will need to dispose of this\n // once we are done.\n input = transposed;\n inputId = transposedId;\n }\n }\n\n const outShape = input.shape.slice(0, -1);\n const out = backend.makeOutput(outShape, 'int32');\n const
outId = backend.dataIdMap.get(out.dataId).id;\n const outerSize = util.sizeFromShape(out.shape);\n const
innerSize = input.shape[axes[0]];\n wasmFunc(inputId, CppDType[input.dtype], outerSize, innerSize, outId);\n\n if
(inputWasTransposed) {\n // dispose of the transposed tensor.\n backend.disposeData(transposed.dataId);\n }\n\n return out;\n}\n\nexport const argMaxConfig: KernelConfig = {\n kernelName: ArgMax,\n backendName:
'wasm',\n
kernelFunc: argmax as { } as KernelFunc,\n setupFunc: setup\n};\n\n", "/*\n * @license\n * Copyright 2019 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not
use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *\n
=====*\n\nimport {AvgPool, AvgPoolAttrs, AvgPoolInputs, backend_util, KernelConfig, KernelFunc, Tensor4D} from
'@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nlet wasmAvgPool: (\n xId:
number, batchSize: number, inputHeight: number, inputWidth: number,\n filterHeight: number, filterWidth:
number, padTop: number, padRight: number,\n padBottom: number, padLeft: number, strideHeight: number,\n
strideWidth: number, channels: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n
wasmAvgPool = backend.wasm.cwrap(AvgPool, null /* void */, [\n 'number', // xId\n 'number', // batchSize\n
'number', // inputHeight\n 'number', // inputWidth\n 'number', // filterHeight\n 'number', // filterWidth\n
'number', // padTop\n 'number', // padRight\n 'number', // padBottom\n 'number', // padLeft\n 'number', //
strideHeight\n 'number', // strideWidth\n 'number', // channels\n 'number', // outId\n]);\n\nfunction
avgPool(\n args: {inputs: AvgPoolInputs, backend: BackendWasm, attrs: AvgPoolAttrs}) {\n const {inputs, attrs,
backend} = args;\n\n const x = inputs.x as Tensor4D;\n const xId = backend.dataIdMap.get(x.dataId).id;\n\n
const {filterSize, strides, pad, dimRoundingMode} = attrs;\n const convInfo =
backend_util.computePool2DInfo(\n x.shape, filterSize, strides, 1 /* dilations */, pad, dimRoundingMode);\n\n
const filterHeight = convInfo.filterHeight;\n const filterWidth = convInfo.filterWidth;\n const padTop =
convInfo.padInfo.top;\n const padRight = convInfo.padInfo.right;\n const padBottom = convInfo.padInfo.bottom;\n
const padLeft = convInfo.padInfo.left;\n const strideHeight = convInfo.strideHeight;\n const strideWidth =
convInfo.strideWidth;\n const channels = convInfo.inChannels;\n\n if (convInfo.dataFormat !== 'channelsLast') {\n
throw new Error(\n `wasm backend does not support dataFormat:~` +\n ` ${convInfo.dataFormat}'. Please
use 'channelsLast'.`);\n }\n\n if (convInfo.dilationWidth !== 1 || convInfo.dilationHeight !== 1) {\n throw new
Error(\n `was backend only supports average pooling with dilation = [1, 1], ` +\n
`got [${convInfo.dilationHeight}, ${convInfo.dilationWidth}].`);\n }\n\n const out =
backend.makeOutput(convInfo.outShape, 'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n
wasmAvgPool(\n xId, x.shape[0], x.shape[1], x.shape[2], filterHeight, filterWidth,\n padTop, padRight,
padBottom, padLeft, strideHeight, strideWidth, channels,\n outId);\n return out;\n}\n\nexport const
avgPoolConfig: KernelConfig = {\n kernelName: AvgPool,\n backendName: 'wasm',\n setupFunc: setup,\n
kernelFunc: avgPool as { } as KernelFunc\n};\n\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,

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on an \"AS IS\" BASIS,\n \* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*

```
=====
*\n\nimport { KernelConfig, KernelFunc, Reshape, ReshapeAttrs, ReshapeInputs, util } from '@tensorflow/tfjs-core';
\n\nimport { BackendWasm } from './backend_wasm';
\n\nexport function reshape(\n args: { inputs: ReshapeInputs, attrs: ReshapeAttrs, backend: BackendWasm }) {\n const { inputs, attrs } = args;\n const { x } = inputs;\n const { shape } = attrs;\n const xSize = util.sizeFromShape(x.shape);\n const $shape = util.inferFromImplicitShape(shape, xSize);\n util.assert(\n xSize === util.sizeFromShape($shape),\n () => `new shape: ${$shape}, old shape: ${x.shape}. New shape and old\n `shape must have the same number of elements.`);\n // Backend needs to track refCount\n for the dataId for reshape op\n args.backend.incRef(x.dataId);\n return { dataId: x.dataId, shape: $shape, dtype: x.dtype };\n}\n\nexport const reshapeConfig: KernelConfig = {\n kernelName: Reshape,\n backendName: 'wasm',\n kernelFunc: reshape as { } as KernelFunc\n};
\n\n", /*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====
*\n\nimport { BatchMatMul, BatchMatMulAttrs, BatchMatMulInputs, KernelConfig, KernelFunc, util } from '@tensorflow/tfjs-core';
\n\nimport { BackendWasm } from './backend_wasm';
\n\nimport { reshape } from './Reshape';
\n\nlet wasmBatchMatMul: (\n aId: number, aShape: Uint8Array, aShapeSize: number, bId: number, bShape: Uint8Array, bShapeSize: number, transposeA: boolean, transposeB: boolean, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmBatchMatMul = backend.wasm.cwrap(BatchMatMul, null /* void */, [\n 'number', // a_id\n 'array', // a_shape\n 'number', // a_shape.length\n 'number', // b_id\n 'array', // b_shape\n 'number', // b_shape.length\n 'number', // transpose_a\n 'number', // transpose_b\n 'number' // out_id\n]);\n\n function batchMatMul(args: {\n inputs: BatchMatMulInputs,\n backend: BackendWasm,\n attrs: BatchMatMulAttrs\n }) {\n const { inputs, backend, attrs } = args;\n const { a, b } = inputs;\n const { transposeA, transposeB } = attrs;\n\n if (a.dtype !== 'float32' || b.dtype !== 'float32') {\n throw new Error(`BatchMatMul for non non-float32 tensors not yet supported.`);\n }\n\n const aRank = a.shape.length;\n const bRank = b.shape.length;\n const innerShapeA = transposeA ? a.shape[aRank - 2] : a.shape[aRank - 1];\n const innerShapeB = transposeB ? b.shape[bRank - 1] : b.shape[bRank - 2];\n const outerShapeA = transposeA ? a.shape[aRank - 1] : a.shape[aRank - 2];\n const outerShapeB = transposeB ? b.shape[bRank - 2] : b.shape[bRank - 1];\n const outerDimsA = a.shape.slice(0, -2);\n const outerDimsB = b.shape.slice(0, -2);\n const batchDimA = util.sizeFromShape(outerDimsA);\n const batchDimB = util.sizeFromShape(outerDimsB);\n const batchDimsCompatible = batchDimA === batchDimB || batchDimA === 1 || batchDimB === 1;\n util.assert(\n aRank >= 2 && bRank >= 2 && batchDimsCompatible,\n () => `Error in matMul: the input batch dimensions\n must either be the\n `same or at least one input batch dimension must be 1. Got input\n `batch dimensions of (${outerDimsA}) and (${outerDimsB}).`);\n const outShapeOuterDims = batchDimA > batchDimB ? a.shape.slice(0, -2) : b.shape.slice(0, -2);\n const outShape = outShapeOuterDims.concat([outerShapeA, outerShapeB]);\n util.assert(\n innerShapeA === innerShapeB,\n () => `Error in matMul: inner shapes (${innerShapeA}) and\n `${innerShapeB}) of Tensors with shapes
```

[illegible]



ycmF5LCB1dGlsfSBmcm9tICdAdGVuc29yZmxvdy90ZmpzLWNvcnUnO1xuXG5pbXBvcnQge01hdGhCYWNr  
ZW5kQ1BVfSBmcm9tICCuLi9iYWNRZW5kX2NwdSc7XG5pbXBvcnQge2Fzc2VydE5vdENvbXBsZXh9IGZyb2  
0gJy4uL2NwdV91dGlsJztcblxuZXhwb3J0IGZ1bmN0aW9uIHNSaWNISW1wbChcbiAgICB2YWxzOiBCYWNrZ  
W5kVmFsdWVzLCBiZWdpbjogbnVtYmVyW10sIHNPemU6IG51bWJlcldLCBzaGFwZTogbnVtYmVyW10sXG  
4gICAgZHR5cGU6IERhdGFUeXB1KTogQmFja2VuZGFzZHVlcYB7XG4gIGNvbnN0IGlzQ29udGlub3VzID0gc2  
xpY2VfdXRpbC5pc1NsaWNIQ29udGlub3VzKHNoYXBILCBiZWdpbiwgc2l6ZSk7XG4gIGNvbnN0IGxlbmd0aC  
A9IHV0aWwuc2l6ZUZYb21TaGFwZShzaXplKTtcbiAgY29uc3QgeFN0cmklZXMgPSB1dGlsLmNvbXB1dGVtd  
HJpZGVzKHNoYXB1KTtcbiAgICBpZiAoaXNDb250aW5vdXMPHtcbiAgICBjb25zdCBmbGF0T2Zmc2V0ID0gc  
2xpY2VfdXRpbC5jb21wdXRIRmxhdE9mZnNldChiZWdpbiwgcFN0cmklZXMpO1xuXG4gICAgYWYgKGR0eX  
BIID09PSAnc3RyaW5nJykge1xuICAgICAgcmV0dXJuICh2YWxzIGFzIFVpbnQ4QXJyYXlbXSkuC2xpY2UoZmx  
hdE9mZnNldCwgZmxhdE9mZnNldCArIGxlbmd0aCk7XG4gICAgfVxuXG4gICAgcmV0dXJuICh2YWxzIGFzIF  
R5cGVkQXJyYXkpLnN1YmFycmF5KGZsYXRPZmZzZXQsIGZsYXRPZmZzZXQgKyBsZW5ndGpO1xuICB9  
XG5cbiAgY29uc3QgZGVjb2RIZERhdGEgPSBkdHlwZSA9PT0gJ3N0cmLuZycgP1xuICAgICAgYmFja2VuZGF91d  
GlsLmZyb21VaW50OFRvU3RyaW5nQXJyYXkodmFscYBhcyBVAW50OEFycmF5W10pIDpobiAgICAgIHZhbH  
MgYXMGVHlwZWRBcnJheTtcbiAgICBjb25zdCBpbk1JiA9IGJ1ZmZlcihzaGFwZSwgZHR5cGU6IGRlY29kZW  
REYXRhKTtcbiAgY29uc3Qgb3V0QnVmID0gYnVmZmVyKHNPemUsIGR0eXB1KTtcbiAgZm9yIChsZXQgaSA  
9IDA7IGkgPCBvdXRcdWYuc2l6ZTsKypKSB7XG4gICAgY29uc3Qgb3V0TG9jID0gb3V0QnVmLmluZGV4V  
G9Mb2MoaSk7XG4gICAgY29uc3QgaW5Mb2MgPSBvdXRmb2MubWFWKChpZHG6IG51bWJlcwgaikgPT4ga  
WR4ICsgYmVnaW5bal0pO1xuICAgIG91dEJ1Zi5zZXQoaW5CdWYuZ2V0KC4uLmluTG9jKSwgLi4ub3V0TG9j  
KTtcbiAgfVxuXG4gIGlmIChkdHlwZSA9PT0gJ3N0cmLuZycpIHtcbiAgICBzXR1cm4gYmFja2VuZGF91dGlsLm  
Zyb21TdHJpbmdBcnJheVRvVWludDob3V0QnVmLnZhbnVlcYBhcyBzdHJpbmdBXSsk7XG4gIH1cbiAgcmV0d  
XJuIG91dEJ1Zi52YWx1ZXMgYXMGVHlwZWRBcnJheTtcbn1cbiAgZXhwb3J0IGZ1bmN0aW9uIHNSaWNlKFxu  
ICAgIGFyZ3M6IHtpbnB1dHM6IFNSaWNISW5wdXRzLCBiYWNRZW5kOiBNYXR0cmFja2VuZENQVSwgYX  
R0cnM6IFNSaWNlQXR0cnN9KTpobiAgICBUZW5zb3JjbmZvIHtcbiAgY29uc3Qge2lucHV0cywgYmFja2VuZC  
wgYXR0cnN9ID0gYXJncztcbiAgY29uc3Qge3h9ID0gaW5wdXRzO1xuICBjb25zdCB7YmVnaW4sIHNPemV9ID  
0gYXR0cnM7XG5cbiAgYXNzZXJ0Tm90Q29tcGxleCh4LCAnc2xpY2UnKTtcbiAgICBjb25zdCBbJGJlZ2luLCAk  
c2l6ZV0gPSBzbGljZV91dGlsLnBhcnNIU2xpY2VQYXJhbXMOeCwgYmVnaW4sIHNPemUpO1xuICBzbGljZV9  
1dGlsLmFzc2VydFBhcmFtc1ZhbnGlkKHGsICRiZWdpbiwJHNpemUpO1xuXG4gIGNvbnN0IHZhbHMgPSBiYW  
NRZW5kLmRhdGEuZ2V0KHguZGF0YUlKKS52YWx1ZXM7XG4gIGNvbnN0IG91dFZhbHMgPSBzbGljZUlcG  
wodmFscYwgJGJlZ2luLCAk2l6ZSwgeC5zaGFwZSwgeC5kdHlwZSk7XG4gIHJldHVybiBiYWNRZW5kLm1ha2  
VUZW5zb3JjbmZvKCRzaXplLCB4LmR0eXB1LCBvdXRWYWxzKTtcbn1cbiAgZXhwb3J0IGNvbnN0IHNSaWN  
lQ29uZmlnOiBlZXJlZmZzZXQgaW5hbWU6IFNSaWNlFxcuICBiYWNRZW5kTmFtZ  
TogJ2NwdScsXG4gIGtlcm5lEZ1bmM6IHNSaWNlIGFzIHt9IGFzIEtlcm5lEZ1bmNcbn07XG4iXX0=","/\*\n

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=====\n
*\n\nimport {backend_util, KernelConfig, KernelFunc, Slice, slice_util, SliceAttrs, SliceInputs, TypedArray, util}
from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport {sliceImplCPU} from
'../kernel_utils/shared';\n\nexport function slice(\n args: {inputs: SliceInputs, attrs: SliceAttrs, backend:
BackendWasm}) {\n const {inputs: {x}, attrs: {begin, size}, backend} = args;\n\n const [begin_, size_] =
slice_util.parseSliceParams(x, begin, size);\n\n const isContinuous
= slice_util.isSliceContinuous(x.shape, begin_, size_);\n\n const xVals = backend.readSync(x.dataId);\n\n const out =
backend.makeOutput(size_, x.dtype);\n\n const xStrides = util.computeStrides(x.shape);\n\n const outData =
backend.dataIdMap.get(out.dataId);\n\n if (isContinuous) {\n const flatOffset =
```

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slice_util.computeFlatOffset(begin_, xStrides);\n\n if (x.dtype === 'string') {\n outData.stringBytes =\n (xVals as Uint8Array[]).\n slice(flatOffset, flatOffset + util.sizeFromShape(size_));\n } else {\n const\n outVals = backend.typedArrayFromHeap(out);\n outVals.set(\n (xVals as TypedArray).\n subarray(flatOffset, flatOffset + util.sizeFromShape(size_));\n);\n return out;\n }\n\n if (x.dtype ===\n 'string') {\n const res = sliceImplCPU(xVals, begin_, size_, x.shape, x.dtype);\n outData.stringBytes = res as\n Uint8Array[];\n return out;\n }\n\n const outVals = backend.typedArrayFromHeap(out);\n const rank\n = x.shape.length;\n if (rank === 2) {\n slice2d(\n xVals as TypedArray, xStrides[0], outVals, begin_ as\n [number, number],\n size_ as [number, number]);\n } else if (rank === 3) {\n slice3d(\n xVals as\n TypedArray, xStrides[0], xStrides[1], outVals,\n begin_ as [number, number, number], size_ as [number,\n number, number]);\n } else if (rank === 4) {\n slice4d(\n xVals as TypedArray, xStrides[0], xStrides[1],\n xStrides[2], outVals,\n begin_ as [number, number, number, number],\n size_ as [number, number, number,\n number]);\n } else {\n const res =\n sliceImplCPU(xVals, begin_, size_, x.shape, x.dtype) as TypedArray;\n outVals.set(res);\n }\n\n return out;\n }\n\nfunction slice2d(\n xVals: backend_util.TypedArray, xStride:\n number,\n outVals: backend_util.TypedArray, begin: [number, number],\n size: [number, number]): void {\n let\n outOffset = 0;\n const beginI = begin[0];\n const beginJ = begin[1];\n const\n endI = beginI + size[0];\n for (let i = beginI; i < endI; i++) {\n const xOffset = i * xStride + beginJ;\n outVals.set(xVals.subarray(xOffset, xOffset + size[1]), outOffset);\n outOffset += size[1];\n }\n}\n\nfunction\nslice3d(\n xVals: backend_util.TypedArray, xStride1: number, xStride2: number,\n outVals:\n backend_util.TypedArray, begin: [number, number, number],\n size: [number, number, number]): void {\n let\n outOffset = 0;\n const beginI = begin[0];\n const beginJ = begin[1];\n const beginK = begin[2];\n const endI =\n beginI + size[0];\n const endJ = beginJ + size[1];\n for (let i = beginI; i < endI; i++) {\n for (let j = beginJ; j <\n endJ; j++) {\n const xOffset = i * xStride1 + j * xStride2 + beginK;\n outVals.set(xVals.subarray(xOffset,\n xOffset + size[2]), outOffset);\n outOffset += size[2];\n }\n }\n}\n\nfunction slice4d(\n xVals:\n backend_util.TypedArray, xStride1: number, xStride2: number,\n xStride3: number, outVals:\n backend_util.TypedArray,\n begin: [number, number, number, number],\n size: [number, number, number, number]): void {\n let outOffset\n = 0;\n const beginI = begin[0];\n const beginJ = begin[1];\n const beginK = begin[2];\n const beginL = begin[3];\n for (let i\n = beginI; i < endI; i++) {\n for (let j = beginJ; j < endJ; j++) {\n for (let k = beginK; k < endK; k++) {\n const xOffset = i * xStride1 + j * xStride2 + k * xStride3 + beginL;\n outVals.set(xVals.subarray(xOffset,\n xOffset + size[3]), outOffset);\n outOffset += size[3];\n }\n }\n }\n}\n\nexport const sliceConfig:\n KernelConfig = {\n kernelName: 'Slice',\n backendName: 'wasm',\n kernelFunc: slice as {\n }\n }\n\nKernelFunc,\n };\n\n"/**\n * @license\n * Copyright 2021 Google LLC. All Rights Reserved.\n * Licensed under the\n Apache License, Version 2.0 (the "License");\n * you may not use this\n file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *\n http://www.apache.org/licenses/LICENSE-2.0\n * \n *\n Unless required by applicable law or agreed to in writing,\n software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES\n OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n governing permissions and\n * limitations under the License.\n *\n =====\n *\n \nimport {backend_util, BatchToSpaceND, BatchToSpaceNDAttrs, BatchToSpaceNDInputs, KernelConfig,\n KernelFunc} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nimport\n {reshape} from './Reshape';\nimport {slice} from './Slice';\nimport {transpose} from './Transpose';\n\nfunction\n batchToSpaceND(args: {\n inputs: BatchToSpaceNDInputs,\n backend: BackendWasm,\n attrs:\n BatchToSpaceNDAttrs\n }) {\n const {inputs,\n backend, attrs} = args;\n const {x} = inputs;\n const {blockShape, crops} = attrs;\n\n const prod =\n blockShape.reduce((a, b) => a * b);\n\n const reshaped = backend_util.getReshaped(x.shape, blockShape, prod);\n const permuted = backend_util.getPermuted(reshaped.length, blockShape.length);\n const reshapedPermuted =\n
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backend_util.getReshapedPermuted(x.shape, blockShape, prod);\n const sliceBeginCoords =\n
backend_util.getSliceBeginCoords(crops, blockShape.length);\n const sliceSize =\n
backend_util.getSliceSize(reshapedPermuted, crops, blockShape.length);\n\n const xReshaped = reshape({inputs:
{x}, backend, attrs: {shape: reshaped}});\n const xTransposed =\n transpose({inputs: {x: xReshaped}, backend,
attrs: {perm: permuted}});\n const xTransposedReshaped = reshape(\n {inputs: {x: xTransposed}, backend,
attrs: {shape: reshapedPermuted}});\n const result = slice({\n inputs: {x: xTransposedReshaped},\n backend,\n attrs: {begin: sliceBeginCoords,
size: sliceSize}});\n\n\n backend.disposeData(xReshaped.dataId);\n backend.disposeData(xTransposed.dataId);\n
backend.disposeData(xReshaped.dataId);\n\n return result;\n}\n\n\nexport const batchToSpaceNDConfig:
KernelConfig = {\n kernelName: BatchToSpaceND,\n backendName: 'wasm',\n kernelFunc: batchToSpaceND as
{ } as KernelFunc\n};\n\n","/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed
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on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
=====
\n
*/\n\nimport {Cast, CastAttrs, CastInputs, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';\nimport
{TensorInfo} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nexport function
cast(\n args: {inputs: CastInputs, attrs: CastAttrs, backend: BackendWasm});\n TensorInfo {\n const {inputs:
{x}, attrs: {dtype}, backend} = args;\n const out = backend.makeOutput(x.shape, dtype);\n const inVals =
backend.typedArrayFromHeap(x);\n const outVals = backend.typedArrayFromHeap(out);\n outVals.set(inVals);\n
return out;\n}\n\n\nexport const castConfig: KernelConfig = {\n kernelName: Cast,\n backendName: 'wasm',\n
kernelFunc: cast as { } as KernelFunc,\n};\n\n","/*\n * @license\n * Copyright 2019 Google LLC. All Rights
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BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the
License for the specific language governing permissions and\n * limitations under the License.\n *
=====
\n
*/\n\nimport {ClipByValue, ClipByValueAttrs, ClipByValueInputs, KernelConfig, KernelFunc} from
'@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\n\nlet wasmClip: (xId: number, min:
number, max: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmClip =
backend.wasm.cwrap(ClipByValue, null /* void */, [\n 'number', // x_id\n 'number', // min\n 'number', //
max\n 'number' // out_id\n]);\n\n function clip(args: {\n inputs: ClipByValueInputs,\n
backend: BackendWasm,\n attrs: ClipByValueAttrs\n}) {\n const {inputs, backend, attrs} = args;\n const {x} =
inputs;\n const {clipValueMin, clipValueMax} = attrs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const
out = backend.makeOutput(x.shape, x.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n
wasmClip(xId, clipValueMin, clipValueMax, outId);\n return out;\n}\n\n\nexport const clipByValueConfig:
KernelConfig = {\n kernelName: ClipByValue,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: clip
as { } as KernelFunc\n};\n\n","/*\n * @license\n * Copyright 2021 Google LLC. All Rights Reserved.\n * Licensed
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express or implied.\n * See the License for the specific language governing permissions and\n * limitations under

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the License.\n \*

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=====\\n
*\\nimport {KernelConfig, Ceil} from '@tensorflow/tfjs-core';\\nimport {createUnaryKernelConfig} from
'./unary_kernel';\\n\\nexport const ceilConfig: KernelConfig = createUnaryKernelConfig(Ceil);\\n", "/*\\n *
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2.0 (the \"License\");\\n * you may not use this file except in compliance with the License.\\n * You may obtain a
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND,
either express or implied.\\n * See the License for the specific language governing permissions and\\n * limitations
under the License.\\n *
=====\\n
*\\n\\nimport {backend_util, Concat, ConcatAttrs, ConcatInputs, KernelConfig, KernelFunc, util} from
'@tensorflow/tfjs-core';\\nimport {BackendWasm} from '../backend_wasm';\\nimport {concatImplCPU} from
'./kernel_utils/shared';\\nimport {identity} from './Identity';\\nimport {reshape} from './Reshape';\\n\\nexport function
concat(\\n args: {inputs: ConcatInputs, backend: BackendWasm, attrs: ConcatAttrs}) {\\n const {inputs, backend}
= args;\\n const axis = util.parseAxisParam(args.attrs.axis, inputs[0].shape)[0];\\n let outShape =
backend_util.computeOutShape(inputs.map(t => t.shape), axis);\\n // Keep only non-empty tensors (ignore tensors
with 0 in their shape).\\n const $inputs = inputs.filter(t => util.sizeFromShape(t.shape) > 0);\\n if ($inputs.length ===
1)
 {\\n return identity({inputs: {x: $inputs[0]}, backend});\\n }\\n const out = backend.makeOutput(outShape,
inputs[0].dtype);\\n if (util.sizeFromShape(outShape) === 0) {\\n return out;\\n }\\n const shapes =
$inputs.map(t => t.shape);\\n backend_util.assertParamsConsistent(shapes, axis);\\n if ($inputs[0].dtype ===
'string') {\\n // Any concat of n-dimensional tensors across any axis can be reduced to\\n // a concatenation of two-
dimensional tensors across the axis 1 by first\\n // partitioning the axes of the original tensors into those less than
the\\n // axis to be concatenated and the rest. Then reshape the tensors\\n // into a two-dimensional tensor by
collapsing these two sets of axes and\\n // concatenate the resulting matrices across the axis 1, finally reshaping\\n
// the result to have the proper shape.\\n const inputs2D = $inputs.map(t => {\\n const innerSize =
util.sizeFromShape(t.shape.slice(axis));\\n const shape = [-1, innerSize];\\n
 return reshape({inputs: {x: t}, backend, attrs: {shape}});\\n });\\n const inputsValShapes = inputs2D.map(t
=> {\\n return {vals: backend.readSync(t.dataId), shape: t.shape};\\n });\\n // Concat 2d tensors along
axis=1.\\n outShape =\\n backend_util.computeOutShape(inputs2D.map(t => t.shape), 1 /* axis */);\\n const
simplyConcat = inputs2D[0].shape[0] === 1;\\n const outVals = concatImplCPU(\\n
inputsValShapes, outShape, inputs[0].dtype,\\n simplyConcat) as string[];\\n const finalOutShape
=\\n backend_util.computeOutShape($inputs.map(t => t.shape), axis);\\n out.shape = finalOutShape;\\n
const outData = backend.dataIdMap.get(out.dataId);\\n outData.stringBytes =
backend_util.fromStringArrayToUint8(outVals);\\n inputs2D.forEach(t => backend.disposeData(t.dataId));\\n\\n
return out;\\n }\\n const batchDim = util.sizeFromShape($inputs[0].shape.slice(0, axis));\\n let sumInnerDims =
0;\\n
 const innerDims = $inputs.map(input => {\\n const innerDim = util.sizeFromShape(input.shape.slice(axis));\\n
sumInnerDims += innerDim;\\n return innerDim;\\n });\\n const inVals = $inputs.map(input =>
backend.toArrayFromHeap(input));\\n const outVals = backend.toArrayFromHeap(out);\\n for (let b = 0; b <
batchDim; b++) {\\n let outOffset = b * sumInnerDims;\\n for (let i = 0; i < inVals.length; i++) {\\n const
innerDim = innerDims[i];\\n const inOffset = b * innerDim;\\n const vals = inVals[i].subarray(inOffset,
inOffset + innerDim);\\n outVals.set(vals, outOffset);\\n outOffset += innerDim;\\n }\\n }\\n return
out;\\n}\\n\\nexport const concatConfig: KernelConfig = {\\n kernelName: Concat,\\n backendName: 'wasm',\\n
kernelFunc: concat as {} as KernelFunc,\\n};\\n", "/*\\n * @license\\n * Copyright 2020 Google LLC. All Rights
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## Open Source Used In Cisco Meeting Server (formerly Acano Server) 3.7 4583

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Conv2DAttrs)) {\n const {inputs, attrs, backend} = args;\n\n const {x, filter} = inputs;\n const xId =
backend.dataIdMap.get(x.dataId).id;\n const filterId = backend.dataIdMap.get(filter.dataId).id;\n\n const {strides,
dilations, pad, dimRoundingMode, dataFormat} = attrs;\n const $dataFormat =
backend_util.convertConv2DDDataFormat(dataFormat);\n const convInfo = backend_util.computeConv2DInfo(\n
(x as Tensor4D).shape, (filter as Tensor4D).shape, strides, dilations,\n pad, dimRoundingMode, false,
$dataFormat);\n\n const filterHeight = convInfo.filterHeight;\n const filterWidth = convInfo.filterWidth;\n const
padTop = convInfo.padInfo.top;\n
 const padRight = convInfo.padInfo.right;\n const padBottom = convInfo.padInfo.bottom;\n const padLeft =
convInfo.padInfo.left;\n const dilationHeight = convInfo.dilationHeight;\n const dilationWidth =
convInfo.dilationWidth;\n const strideHeight = convInfo.strideHeight;\n const strideWidth =
convInfo.strideWidth;\n const inputChannels = convInfo.inChannels;\n const outputChannels =
convInfo.outChannels;\n const isSamePad = convInfo.padInfo.type === 'SAME' ? 1 : 0;\n\n if
(convInfo.dataFormat !== 'channelsLast') {\n throw new Error(\n `wasm backend Conv2D does not support
dataFormat:` +\n `${convInfo.dataFormat}`. Please use 'channelsLast'.`);\n };\n\n const out =
backend.makeOutput(convInfo.outShape, 'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n
wasmConv2d(\n xId, x.shape[0], x.shape[1], x.shape[2], filterId, filterHeight,\n filterWidth, padTop,
padRight, padBottom, padLeft, isSamePad,\n dilationHeight, dilationWidth,
strideHeight, strideWidth, inputChannels,\n outputChannels, outId);\n return out;\n}\n\nexport const
conv2DConfig: KernelConfig = {\n kernelName: Conv2D,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: conv2d as { } as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights
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http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *\n
=====*\n\nimport
 {backend_util, Conv2DBackpropInput, Conv2DBackpropInputAttrs, Conv2DBackpropInputInputs, KernelConfig,
 KernelFunc, TensorInfo, util} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from
'./backend_wasm';\n\nlet wasmConv2DBackpropInput: (\n dyId: number, filterId: number, batchSize: number,
filterHeight: number,\n filterWidth: number, inHeight: number, inWidth: number, inChannels: number,\n
outHeight: number, outWidth: number, outChannels: number,\n strideHeight: number, strideWidth: number,
topPad: number, leftPad: number,\n fltS0: number, fltS1: number, fltS2: number, xBatchStride: number,\n
xRowStride: number, xColStride: number, xChannelStride: number,\n yBatchStride: number, yRowStride:
number, yColStride: number,\n yChannelStride: number, outId: number) => void;\n\nfunction setup(backend:
BackendWasm): void {\n wasmConv2DBackpropInput = backend.wasm.cwrap(Conv2DBackpropInput, null, [\n
'number', // dyId\n 'number', // filterId\n 'number', // batchSize\n 'number', // filterHeight\n 'number', // filterWidth\n 'number', // inHeight\n 'number', // inWidth\n 'number', // inChannels\n 'number', // outHeight\n 'number', // outWidth\n 'number', // outChannels\n 'number', // strideHeight\n 'number', // strideWidth\n 'number', // topPad\n 'number', // leftPad\n 'number', // fltS0\n 'number', // fltS1\n 'number', // fltS2\n 'number', // xBatchStride\n 'number', // xRowStride\n 'number', // xColStride\n 'number', // xChannelStride\n 'number', // yBatchStride\n 'number', // yRowStride\n 'number', // yColStride\n 'number', // yChannelStride\n 'number', // outId\n]);\n\nfunction conv2DBackpropInput(args: {\n backend: BackendWasm,\n inputs:
Conv2DBackpropInputInputs,\n attrs: Conv2DBackpropInputAttrs\n}): TensorInfo {\n const {backend, inputs,
attrs} = args;\n const {dy, filter} = inputs;\n const {strides, pad, dataFormat, dimRoundingMode,

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inputShape} = attrs;\n\n const dilations = 1;\n\n const $dataFormat =
backend_util.convertConv2DDataFormat(dataFormat);\n\n const convInfo = backend_util.computeConv2DInfo(\n
inputShape, filter.shape as [number, number, number, number], strides,\n\n dilations, pad, dimRoundingMode,
false /* depthwise */, $dataFormat);\n\n const {\n\n batchSize,\n\n filterHeight,\n\n filterWidth,\n\n inChannels,\n\n
inHeight,\n\n inWidth,\n\n outChannels,\n\n outHeight,\n\n outWidth,\n\n strideHeight,\n\n strideWidth\n } =
convInfo;\n\n\n const topPad = filterHeight - 1 - convInfo.padInfo.top;\n\n const leftPad = filterWidth - 1 -
convInfo.padInfo.left;\n\n\n const isChannelsLast = convInfo.dataFormat === 'channelsLast';\n\n const dxStrides =
util.computeStrides(convInfo.inShape);\n\n const dyStrides = util.computeStrides(dy.shape);\n\n const [fltS0, fltS1,
fltS2] = util.computeStrides(filter.shape);\n\n const xBatchStride = dxStrides[0];\n\n const xRowStride =
isChannelsLast ?
dxStrides[1] : dxStrides[2];\n\n const xColStride = isChannelsLast ? dxStrides[2] : 1;\n\n const xChannelStride =
isChannelsLast ? 1 : dxStrides[1];\n\n const yBatchStride = dyStrides[0];\n\n const yRowStride = isChannelsLast ?
dyStrides[1] : dyStrides[2];\n\n const yColStride = isChannelsLast ? dyStrides[2] : 1;\n\n const yChannelStride =
isChannelsLast ? 1 : dyStrides[1];\n\n\n const out = backend.makeOutput(convInfo.inShape, 'float32');\n\n const outId
= backend.dataIdMap.get(out.dataId).id;\n\n const dyId = backend.dataIdMap.get(dy.dataId).id;\n\n const filterId =
backend.dataIdMap.get(filter.dataId).id;\n\n\n wasmConv2DBackpropInput(\n\n dyId, filterId, batchSize,
filterHeight, filterWidth, inHeight, inWidth,\n\n inChannels, outHeight, outWidth, outChannels, strideHeight,
strideWidth,\n\n topPad, leftPad, fltS0, fltS1, fltS2, xBatchStride, xRowStride,\n\n xColStride, xChannelStride,
yBatchStride, yRowStride, yColStride,\n\n yChannelStride, outId);\n\n return out;\n}\n\n\nexport
const conv2DBackpropInputConfig: KernelConfig = {\n\n kernelName: Conv2DBackpropInput,\n\n backendName:
'wasm',\n\n setupFunc: setup,\n\n kernelFunc: conv2DBackpropInput as {} as KernelFunc\n};\n\n", "/*\n\n * @license\n\n *
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n\n * See the License for
the specific language governing permissions and\n\n * limitations under the License.\n\n *
=====\\n
*\n\nimport {CropAndResize, CropAndResizeAttrs, CropAndResizeInputs, KernelConfig, KernelFunc,
TensorInfo} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport {cast}
from './Cast';\n\n\n// Must match enum in CropAndResize.cc\nenum InterpolationMethod {\n\n bilinear = 0,\n\n nearest
= 1\n}\n\n\nlet wasmCropAndResize: (\n\n imagesId: number, boxesId: number, boxIndId: number, numBoxes:
number,\n\n imagesShape: Uint8Array, cropHeight: number, cropWidth: number,\n\n method: number,
extrapolationValue: number, outId: number) => void;\n\n\nfunction setup(backend: BackendWasm): void {\n\n
wasmCropAndResize = backend.wasm.cwrap(CropAndResize, null /*void*/, [\n\n 'number', // imagesId\n\n
'number', // boxesId\n\n 'number', // boxIndId\n\n 'number', // numBoxes\n\n 'array', // images shape\n\n
'number', // cropHeight\n\n 'number', // cropWidth\n\n 'number', // method\n\n 'number', // extrapolation value\n\n
'number' // out id\n\n]);\n\n\nfunction cropAndResize(args: {\n\n backend: BackendWasm,\n\n inputs: CropAndResizeInputs,\n\n
attrs: CropAndResizeAttrs\n}): TensorInfo {\n\n const {backend, inputs, attrs} = args;\n\n const {method,
extrapolationValue, cropSize} = attrs;\n\n const {image, boxes, boxInd} = inputs;\n\n\n const numBoxes =
boxes.shape[0];\n\n\n const [cropHeight, cropWidth] = cropSize as [number, number];\n\n const outShape =
[numBoxes, cropHeight, cropWidth, image.shape[3]];\n\n\n let imagesData =
backend.dataIdMap.get(image.dataId);\n\n let castedData;\n\n if (image.dtype !== 'float32') {\n\n castedData =
cast({backend, inputs: {x: image}, attrs: {dtype: 'float32'}});\n\n imagesData =
backend.dataIdMap.get(castedData.dataId);\n\n }\n\n\n const imagesId = imagesData.id;\n\n const boxesId =
backend.dataIdMap.get(boxes.dataId).id;\n\n const boxIndId = backend.dataIdMap.get(boxInd.dataId).id;\n\n\n const
out = backend.makeOutput(outShape, 'float32');\n\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n\n const
imagesShapeBytes = new Uint8Array(new Int32Array(image.shape).buffer);\n\n\n wasmCropAndResize(\n
```

```
imagesId, boxesId, numBoxes, imagesShapeBytes, cropHeight,\n cropWidth,\nInterpolationMethod[method as {}] as keyof typeof InterpolationMethod],\n extrapolationValue, outId);\n\n if\n(castedData != null) {\n backend.disposeData(castedData.dataId);\n }\n\n return out;\n}\n\nexport const\ncropAndResizeConfig: KernelConfig = {\n kernelName: CropAndResize,\n backendName: 'wasm',\n setupFunc:\nsetup,\n kernelFunc: cropAndResize as {}] as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2019 Google\nLLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not\nuse this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,\nsoftware\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\nOR CONDITIONS OF ANY KIND, either\nexpress or implied.\n * See the License for the specific language governing permissions and\n * limitations under\nthe License.\n */\n\n=====\n\n*/\n\nimport {Cos, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from\n'./unary_kernel';\n\nexport const cosConfig: KernelConfig = createUnaryKernelConfig(Cos);\n\n"/**\n * @license\n * Copyright 2021 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n\"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\nLicense at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or\nagreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\nthe specific language governing permissions\nand\n * limitations under the License.\n */\n\n=====\n\n*/\n\nimport {Cosh, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from\n'./unary_kernel';\n\nexport const coshConfig: KernelConfig = createUnaryKernelConfig(Cosh);\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version\n2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a\ncopy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable\nlaw or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\nthe specific language governing permissions and\n * limitations under the License.\n */\n\n=====\n\n*/\n\nimport {backend_util, KernelConfig, KernelFunc, Cumsum, CumsumAttrs, CumsumInputs, TensorInfo, util}\nfrom '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nimport {CppType} from\n'./types';\nimport {transpose} from './Transpose';\n\nlet wasmCumsum: (xId: number, exclusive: number, reverse:\nnumber,\n finalDim: number, outId: number, dtype: CppDType) => void;\n\nfunction setup(backend:\nBackendWasm) {\n wasmCumsum = backend.wasm.cwrap(Cumsum, null /* void */, [\n 'number', // x_id\n 'number', // exclusive\n 'number', // reverse\n 'number', // final_dim\n 'number', // out_id\n 'number' //\ndtype\n]);\n\n export function cumsum(\n args: {inputs: CumsumInputs, backend: BackendWasm, attrs:\nCumsumAttrs}): TensorInfo {\n const {inputs, backend, attrs} = args;\n const {x} = inputs;\n const {axis,\nexclusive, reverse} = attrs;\n const xRank = x.shape.length;\n\n util.assert(x.dtype\n=== 'float32' || x.dtype === 'int32',\n () => `cumsum does not support ${x.dtype} tensors in the WASM\nbackend`);\n // permute required axis to inner most axis\n const permutation =\nbackend_util.getAxesPermutation([axis], xRank);\n let permutedX = x;\n if (permutation !== null) {\n permutedX = transpose({inputs: {x}, attrs: {perm: permutation}, backend});\n }\n\n const permutedAxis =\nbackend_util.getInnerMostAxes(1, xRank)[0];\n backend_util.assertAxesAreInnerMostDims('cumsum',\n[permutedAxis, xRank]);\n\n const permutedOut = backend.makeOutput(permutedX.shape, permutedX.dtype);\n const finalDim = permutedX.shape[permutedAxis];\n const permutedXId =
```



```

=====\\n
*\\n\\nimport {backend_util, DepthwiseConv2dNative, DepthwiseConv2dNativeAttrs,
DepthwiseConv2dNativeInputs, KernelConfig, KernelFunc, Tensor4D} from '@tensorflow/tfjs-core';\\n\\nimport
{BackendWasm} from './backend_wasm';\\n\\nlet wasmDepthwiseConv2d: (\\n xId: number, batchSize: number,
inputHeight: number, inputWidth: number,\\n filterId: number, filterHeight: number, filterWidth: number, padTop:
number,\\n padRight: number, padBottom: number, padLeft: number, isSamePad: number,\\n dilationHeight:
number, dilationWidth: number,
 strideHeight: number,\\n strideWidth: number, inputChannels: number, outputChannels: number,\\n outId:
number) => void;\\n\\nfunction setup(backend: BackendWasm) {\\n wasmDepthwiseConv2d =\\n
backend.wasm.cwrap(DepthwiseConv2dNative, null /* void */, [\\n 'number', // xId\\n 'number', //
batchSize\\n 'number', // inputHeight\\n 'number', // inputWidth\\n 'number', // filterId\\n 'number', //
filterHeight\\n 'number', // filterWidth\\n 'number', // padTop\\n 'number', // padRight\\n 'number', //
padBottom\\n 'number', // padLeft\\n 'number', // isSamePad\\n 'number', // dilationHeight\\n
'number', // dilationWidth\\n 'number', // strideHeight\\n 'number', // strideWidth\\n 'number', //
inputChannels\\n 'number', // outputChannels\\n 'number', // outId\\n]);\\n}\\n\\nfunction
depthwiseConv2d(args: {\\n inputs: DepthwiseConv2dNativeInputs,\\n
 backend: BackendWasm,\\n attrs: DepthwiseConv2dNativeAttrs\\n}) {\\n const {inputs, attrs, backend} = args;\\n\\n
const {x, filter} = inputs;\\n const xId = backend.dataIdMap.get(x.dataId).id;\\n const filterId =
backend.dataIdMap.get(filter.dataId).id;\\n\\n const {strides, dilations, pad, dimRoundingMode} = attrs;\\n\\n const
$dilations = dilations == null ? [1, 1] : dilations;\\n\\n const convInfo = backend_util.computeConv2DInfo(\\n (x as
Tensor4D).shape, (filter as Tensor4D).shape, strides,\\n ($dilations as number | [number, number]), pad,
dimRoundingMode,\\n true /* depthwise */);\\n\\n const filterHeight = convInfo.filterHeight;\\n const filterWidth =
convInfo.filterWidth;\\n const padTop = convInfo.padInfo.top;\\n const padRight = convInfo.padInfo.right;\\n const
padBottom = convInfo.padInfo.bottom;\\n const padLeft = convInfo.padInfo.left;\\n const dilationHeight =
convInfo.dilationHeight;\\n const dilationWidth = convInfo.dilationWidth;\\n const strideHeight =
convInfo.strideHeight;\\n
 const strideWidth = convInfo.strideWidth;\\n const inputChannels = convInfo.inChannels;\\n const outputChannels
= convInfo.outChannels;\\n const isSamePad = convInfo.padInfo.type === 'SAME' ? 1 : 0;\\n\\n if
(convInfo.dataFormat !== 'channelsLast') {\\n throw new Error(\\n `wasm backend DepthwiseConv2dNative
does not support dataFormat:` +\\n `${convInfo.dataFormat}`. Please use 'channelsLast'.`);\\n }\\n\\n const out =
backend.makeOutput(convInfo.outShape, 'float32');\\n const outId = backend.dataIdMap.get(out.dataId).id;\\n
wasmDepthwiseConv2d(\\n xId, x.shape[0], x.shape[1], x.shape[2], filterId, filterHeight,\\n filterWidth,
padTop, padRight, padBottom, padLeft, isSamePad,\\n dilationHeight, dilationWidth, strideHeight, strideWidth,
inputChannels,\\n outputChannels, outId);\\n return out;\\n}\\n\\nexport const depthwiseConv2dNativeConfig:
KernelConfig = {\\n kernelName: DepthwiseConv2dNative,\\n backendName: 'wasm',\\n setupFunc: setup,\\n
 kernelFunc: depthwiseConv2d as { } as KernelFunc\\n};\\n", "/*\\n * @license\\n * Copyright 2021 Google LLC. All
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file except in compliance with the License.\\n * You may obtain a copy of the License at\\n *\\n *
http://www.apache.org/licenses/LICENSE-2.0\\n *\\n * Unless required by applicable law or agreed to in writing,
software\\n * distributed under the License is distributed on an \"AS IS\" BASIS,\\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\\n * See the License for the specific language
governing permissions and\\n * limitations under the License.\\n *
=====\\n
*\\n\\nimport {Elu, KernelConfig} from '@tensorflow/tfjs-core';\\n\\nimport {createUnaryKernelConfig} from
'./unary_kernel';\\n\\nexport const eluConfig: KernelConfig = createUnaryKernelConfig(Elu);\\n", "/*\\n * @license\\n
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```



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```
=====
*\\nimport {Equal, KernelConfig} from '@tensorflow/tfjs-core';\\n\\nimport {createBinaryKernelConfig} from
'./binary_kernel';\\n\\nconst supportsFullBroadcast = false;\\nexport const equalConfig: KernelConfig =\\n
createBinaryKernelConfig(Equal, supportsFullBroadcast, 'bool');\\n"/**\\n * @license\\n * Copyright
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you may not use this file except in compliance with the License.\\n * You may obtain a copy of the License at\\n *\\n *
http://www.apache.org/licenses/LICENSE-2.0\\n * Unless required by applicable law or agreed to in writing,
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OR CONDITIONS OF ANY KIND, either express or implied.\\n * See the License for the specific language
governing permissions and\\n * limitations under the License.\\n *
```

```
=====\\n
*\\nimport {Exp, KernelConfig} from '@tensorflow/tfjs-core';\\n\\nimport {createUnaryKernelConfig} from
'./unary_kernel';\\n\\nexport const expConfig: KernelConfig = createUnaryKernelConfig(Exp, 'float32');\\n"/**\\n *
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Version 2.0 (the "License");\\n * you may not use this file except in compliance with the License.\\n * You may
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BASIS,\\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\\n * See the
License for the specific language governing permissions and\\n * limitations under the License.\\n *
```

```
=====\\n
*\\n\\nimport {ExpandDims, ExpandDimsAttrs, ExpandDimsInputs, KernelConfig, KernelFunc, util} from
'@tensorflow/tfjs-core';\\n\\nimport {BackendWasm} from '../backend_wasm';\\nimport {reshape} from
'./Reshape';\\n\\nexport function expandDims(args: {\\n inputs: ExpandDimsInputs,\\n attrs: ExpandDimsAttrs,\\n
backend: BackendWasm\\n}) {\\n const {inputs, attrs, backend} = args;\\n const {input}
= inputs;\\n const {dim} = attrs;\\n\\n const inputRank = input.shape.length;\\n const newShape =
input.shape.slice();\\n let $dim = dim;\\n if (dim < 0) {\\n // Negative value is counted from the tail of rank.\\n
util.assert(\\n -(inputRank + 1) <= dim,\\n () => `Axis must be in the interval [${-(inputRank + 1)}, ${\\n
 inputRank}]`);\\n $dim = inputRank + dim + 1;\\n }\\n newShape.splice($dim, 0, 1);\\n\\n return reshape({inputs:
{x: input}, backend, attrs: {shape: newShape}});\\n}\\n\\nexport const expandDimsConfig: KernelConfig = {\\n
kernelName: ExpandDims,\\n backendName: 'wasm',\\n kernelFunc: expandDims as {} as KernelFunc,\\n};\\n"/**\\n
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BASIS,\\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\\n * See the
License for the specific language governing permissions and\\n * limitations under the License.\\n *
```

```
=====\\n
*\\n\\nimport {KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';\\nimport {Fill, FillAttrs} from
'@tensorflow/tfjs-core';\\n\\nimport {BackendWasm} from '../backend_wasm';\\n\\nexport function fill(args: {attrs:
FillAttrs, backend: BackendWasm}) {\\n const {attrs: {shape, value, dtype}, backend} = args;\\n const out =
backend.makeOutput(shape, dtype);\\n const outVals = backend.typedArrayFromHeap(out);\\n outVals.fill(value as
number);\\n return out;\\n}\\n\\nexport const fillConfig: KernelConfig = {\\n kernelName: Fill,\\n backendName:
'wasm',\\n kernelFunc: fill as {} as KernelFunc,\\n};\\n"/**\\n *
```

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```
=====
*\n\nimport {FlipLeftRight, FlipLeftRightInputs, KernelConfig, KernelFunc, TensorInfo} from '@tensorflow/tfjs-core';
\n\nimport {BackendWasm} from '../backend_wasm';
\n\nlet wasmFlipLeftRight: (\n xId: number, batch: number, imageHeight: number, imageWidth: number,\n numChannels: number, outId: number) => void;
\n\nfunction setup(backend: BackendWasm) {\n wasmFlipLeftRight = backend.wasm.cwrap(FlipLeftRight, null /* void */, [\n 'number', // xId\n 'number', // batch\n 'number', // imageHeight\n 'number', // imageWidth\n 'number', // numChannels\n 'number', // outId\n]);\n}\n\nexport function flipLeftRight(\n args: {inputs: FlipLeftRightInputs, backend: BackendWasm}): TensorInfo {\n const {inputs, backend} = args;\n const {image} = inputs;\n const out = backend.makeOutput(image.shape, image.dtype);\n const imageId = backend.dataIdMap.get(image.dataId).id;\n const outId = backend.dataIdMap.get(out.dataId).id;\n const [batch, imageHeight, imageWidth, numChannels] = image.shape;\n wasmFlipLeftRight(\n imageId, batch, imageHeight, imageWidth, numChannels, outId);\n return out;\n}\n\nexport const flipLeftRightConfig: KernelConfig = {\n kernelName: FlipLeftRight,\n backendName: 'wasm',\n kernelFunc: flipLeftRight as {\n as KernelFunc,\n setupFunc: setup\n };
\n}, \"/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====
*\n\nimport {FusedBatchNorm, FusedBatchNormAttrs, FusedBatchNormInputs, KernelConfig, KernelFunc, TensorInfo, util} from '@tensorflow/tfjs-core';
\n\nimport {BackendWasm} from '../backend_wasm';
\n\nlet wasmBatchNorm: (\n xId: number, meanId: number, varianceId: number, offsetId: number,\n scaleId: number, varianceEpsilon: number, outId: number) => void;
\n\nfunction setup(backend: BackendWasm): void {\n wasmBatchNorm = backend.wasm.cwrap(\n FusedBatchNorm, null /* void */, [\n 'number', 'number', 'number', 'number', 'number', 'number',\n 'number'\n]);\n}\n\nfunction fusedBatchNorm(args: {\n backend: BackendWasm,\n inputs: FusedBatchNormInputs,\n attrs: FusedBatchNormAttrs\n}): TensorInfo {\n const {backend, inputs, attrs} = args;\n const {varianceEpsilon} = attrs;\n const {x, mean, variance, offset, scale} = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const meanId = backend.dataIdMap.get(mean.dataId).id;\n const varianceId = backend.dataIdMap.get(variance.dataId).id;\n const offsetId = offset != null ? backend.dataIdMap.get(offset.dataId).id : 0;\n const scaleId = scale != null ? backend.dataIdMap.get(scale.dataId).id : 0;\n const out = backend.makeOutput(x.shape, x.dtype);\n // Short-circuit zero-sized tensors.\n if (util.sizeFromShape(x.shape) === 0) {\n return out;\n }\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmBatchNorm(\n xId, meanId, varianceId, offsetId, scaleId, varianceEpsilon, outId);\n return out;\n}\n\nexport const fusedBatchNormConfig: KernelConfig = {\n kernelName: FusedBatchNorm,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: fusedBatchNorm as {\n as KernelFunc\n };
\n}, \"/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *

```

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```
=====
*import {Floor, KernelConfig} from '@tensorflow/tfjs-core';
import {createUnaryKernelConfig} from
'./unary_kernel';
export const floorConfig: KernelConfig = createUnaryKernelConfig(Floor);
"/**
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the License.
```

```
=====
*import {FloorDiv, KernelConfig} from '@tensorflow/tfjs-core';
import {createBinaryKernelConfig} from
'./binary_kernel';
const supportsFullBroadcast = false;
export const floorDivConfig: KernelConfig =
createBinaryKernelConfig(FloorDiv, supportsFullBroadcast);
"/**
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OR CONDITIONS OF ANY KIND, either express or implied.
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the License.
```

```
=====
*import {backend_util, FusedConv2D, FusedConv2DAttrs, FusedConv2DInputs, KernelConfig, KernelFunc,
Tensor4D} from '@tensorflow/tfjs-core';
import {BackendWasm} from './backend_wasm';
import
{FusableActivation} from './types';
let wasmFusedConv2d:
(xId: number, batchSize: number, inputHeight:
number, inputWidth: number,
filterId: number, filterHeight: number, filterWidth: number,
biasId: number,
padTop: number, padRight: number, padBottom: number,
padLeft: number, isSamePad: number,
dilationHeight: number,
dilationWidth: number, strideHeight: number, strideWidth: number,
inputChannels: number, outputChannels: number, activation: number,
preluActivationWeightsId: number,
leakyreluAlpha: number, outId: number) =>
void;
function setup(backend: BackendWasm) {
wasmFusedConv2d = backend.wasm.cwrap(FusedConv2D, null /* void
*/, [
number, // xId
number, // batchSize
number, // inputHeight
number, // inputWidth
number, // filterId
number, // filterHeight
number, // filterWidth
number, // biasId
number, // padTop
number, // padRight
number, // padBottom
number, // padLeft
number, // isSamePad
number, // dilationHeight
number, // dilationWidth
number, // strideHeight
number, // strideWidth
number, // inputChannels
number, // outputChannels
number, // activation
number, // preluActivationWeightsId
number, // leakyreluAlpha
number, // outId
]);
function
fusedConv2d(args: {
inputs: FusedConv2DInputs,
backend: BackendWasm,
attrs: FusedConv2DAttrs
})
{
const {inputs, attrs, backend} = args;
const {x, filter, bias, preluActivationWeights} = inputs;
const {
strides,
pad,
dilations,
dataFormat,
dimRoundingMode,
activation,
leakyreluAlpha
} = attrs;
const convInfo =
backend_util.computeConv2DInfo(
(x as Tensor4D).shape, (filter as Tensor4D).shape, strides, dilations,
pad, dimRoundingMode);
const fusedActivation =
FusableActivation[activation as {} as keyof typeof
FusableActivation];
if (fusedActivation == null) {
throw new Error(
`${activation} activation not yet
```

```

supported for FusedConv2D `+` in the wasm backend.`);
}

const xId =
backend.dataIdMap.get(x.dataId).id;
const filterId = backend.dataIdMap.get(filter.dataId).id;
const
outputChannels = convInfo.outChannels;
let biasId = 0;
if (bias != null) {
const biasData =
backend.dataIdMap.get(bias.dataId);
if (biasData.shape.length !== 1) {
throw new Error(
`FusedConv2D only supports rank-1 bias but got ` +
rank ${biasData.shape.length}.`);
}
if
(biasData.shape[0] !== outputChannels)
{
throw new Error(
`FusedConv2D bias shape (${biasData.shape}) does not ` +
match the
number of output channels (${outputChannels}).`);
}
biasId = biasData.id;
}

const filterHeight =
convInfo.filterHeight;
const filterWidth = convInfo.filterWidth;
const padTop = convInfo.padInfo.top;
const
padRight = convInfo.padInfo.right;
const padBottom = convInfo.padInfo.bottom;
const padLeft =
convInfo.padInfo.left;
const dilationHeight = convInfo.dilationHeight;
const dilationWidth =
convInfo.dilationWidth;
const strideHeight = convInfo.strideHeight;
const strideWidth =
convInfo.strideWidth;
const inputChannels = convInfo.inChannels;
const isSamePad = convInfo.padInfo.type
=== 'SAME' ? 1 : 0;
const batchSize = convInfo.batchSize;
const inHeight = convInfo.inHeight;
const
inWidth = convInfo.inWidth;
if (dataFormat !== 'NHWC') {
throw new Error(
`wasm backend
FusedConv2D does not support
dataFormat: ` +
`${dataFormat}'. Please use 'NHWC'.`);
}

const out =
backend.makeOutput(convInfo.outShape, 'float32');
const outId = backend.dataIdMap.get(out.dataId).id;
const
preluActivationWeightsId = preluActivationWeights == null ? 0 :
backend.dataIdMap.get(preluActivationWeights.dataId).id;

wasmFusedConv2d(xId, batchSize, inHeight,
inWidth, filterId, filterHeight, filterWidth,
biasId, padTop, padRight, padBottom, padLeft, isSamePad,
dilationHeight,
dilationWidth, strideHeight, strideWidth, inputChannels, outputChannels,
fusedActivation,
preluActivationWeightsId, leakyreluAlpha || 0, outId);
return out;
}

export const fusedConv2DConfig:
KernelConfig = {
kernelName: FusedConv2D,
backendName: 'wasm',
setupFunc: setup,
kernelFunc:
fusedConv2d as {} as KernelFunc
};

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 * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.
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 * limitations under the License.
 */
=====
*/
import {backend_util, FusedDepthwiseConv2D, FusedDepthwiseConv2DAttrs,
FusedDepthwiseConv2DInputs, KernelConfig, KernelFunc, Tensor4D} from '@tensorflow/tfjs-core';
import
{BackendWasm} from '../backend_wasm';
import {FusableActivation} from './types';
let
wasmFusedDepthwiseConv2d:
(xId: number, batchSize: number, inputHeight: number, inputWidth: number,
filterId: number, filterHeight:
number, filterWidth: number,
biasId: number, padTop: number, padRight: number, padBottom: number,
padLeft: number, isSamePad: number, dilationHeight: number,
dilationWidth: number, strideHeight: number,
strideWidth: number,
inputChannels: number, outputChannels: number, activation: number,
preluActivationWeightsId: number, leakyreluAlpha: number, outId: number) =>
void;

function
setup(backend: BackendWasm) {
wasmFusedDepthwiseConv2d =
backend.wasm.cwrap(FusedDepthwiseConv2D, null /* void */, [
number, // xId
number, //
batchSize
number, // inputHeight
number, // inputWidth
number, // filterId
number, //
filterHeight
number, // filterWidth
number, // biasId
number, // padTop
number, //
padRight
number, // padBottom
number, // padLeft
number, // isSamePad
number, //
dilationHeight
number, // dilationWidth
number, // strideHeight
number, // strideWidth
number, // inputChannels
number, // outputChannels
number, // activation
number, //

```

```

preluActivationWeightsId\n 'number', // leakyreluAlpha\n 'number', // outId\n]);\n}\n\nfunction
fusedDepthwiseConv2d(args: {\n inputs: FusedDepthwiseConv2DInputs,\n backend: BackendWasm,\n attrs:
FusedDepthwiseConv2DAttrs\n}) {\n const {inputs, attrs, backend} = args;\n const {x, filter, bias,
preluActivationWeights} = inputs;\n const {\n strides,\n pad,\n dilations,\n dataFormat,\n dimRoundingMode,\n activation,\n leakyreluAlpha\n } = attrs;\n const convInfo =
backend_util.computeConv2DInfo(\n (x as Tensor4D).shape, (filter as Tensor4D).shape, strides, dilations,\n pad, dimRoundingMode, true /* depthwise */);\n const fusedActivation =\n FusableActivation[activation
as {} as keyof typeof FusableActivation];\n if (fusedActivation == null) {\n throw new Error(\n
`${activation} activation not yet supported for FusedDepthwiseConv2D` +\n `in the wasm backend.`);\n }\n const xId = backend.dataIdMap.get(x.dataId).id;\n const filterId = backend.dataIdMap.get(filter.dataId).id;\n const
outputChannels = convInfo.outChannels;\n let biasId = 0;\n if (bias != null) {\n const biasData =
backend.dataIdMap.get(bias.dataId);\n if (biasData.shape.length !== 1) {\n throw new Error(\n
`FusedDepthwiseConv2D only supports rank-1 bias but got` +\n `rank ${biasData.shape.length}.`);\n }\n if (biasData.shape[0] !== outputChannels) {\n throw new Error(\n
`FusedDepthwiseConv2D bias shape
(${biasData.shape}) does not` +\n `match the number of output channels (${outputChannels})`);\n }\n biasId = biasData.id;\n }\n const filterHeight = convInfo.filterHeight;\n const
filterWidth = convInfo.filterWidth;\n const padTop = convInfo.padInfo.top;\n const padRight =
convInfo.padInfo.right;\n const padBottom = convInfo.padInfo.bottom;\n const padLeft = convInfo.padInfo.left;\n const dilationHeight = convInfo.dilationHeight;\n const dilationWidth = convInfo.dilationWidth;\n const
strideHeight = convInfo.strideHeight;\n const strideWidth = convInfo.strideWidth;\n const inputChannels =
convInfo.inChannels;\n const isSamePad = convInfo.padInfo.type === 'SAME' ? 1 : 0;\n const batchSize =
convInfo.batchSize;\n const inHeight = convInfo.inHeight;\n const inWidth = convInfo.inWidth;\n if
(dataFormat !== 'NHWC') {\n throw new Error(\n `wasm backend FusedDepthwiseConv2D does not support
dataFormat:` +\n `${dataFormat}`. Please use 'NHWC'.`);\n }\n const out =
backend.makeOutput(convInfo.outShape, 'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n const
preluActivationWeightsId = preluActivationWeights == null
? 0 :\n backend.dataIdMap.get(preluActivationWeights.dataId).id;\n const wasmFusedDepthwiseConv2d(\n
xId, batchSize, inHeight, inWidth, filterId, filterHeight, filterWidth,\n biasId, padTop, padRight, padBottom,
padLeft, isSamePad, dilationHeight,\n dilationWidth, strideHeight, strideWidth, inputChannels,
outputChannels,\n fusedActivation, preluActivationWeightsId, leakyreluAlpha || 0, outId);\n return
out;\n}\n\nexport const fusedDepthwiseConv2DConfig: KernelConfig = {\n kernelName:
FusedDepthwiseConv2D,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: fusedDepthwiseConv2d as
{} as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {gather_util, GatherNd, GatherNdInputs, KernelConfig, TensorInfo} from '@tensorflow/tfjs-
core';\nimport {BackendWasm} from '../backend_wasm';\nimport {CppDType} from './types';\n\nlet
wasmGatherNd: (\n xId: number, dtype: CppDType, indicesId: number, numSlices: number,\n sliceRank:
number, sliceSize: number, strides: Uint8Array, outId: number) =>\n void;\n\nfunction setup(backend:
BackendWasm): void {\n const wasmGatherNd = backend.wasm.cwrap(GatherNd, null /*void*/, [\n 'number', // xId\n 'number', // dtype\n 'number', // indicesId\n 'number', // numSlices\n 'number', // sliceRank\n 'number', // sliceSize\n 'array', // strides\n 'number' // outId\n]);\n const gatherNd(args: {backend:
BackendWasm, inputs: GatherNdInputs}): TensorInfo {\n const {backend, inputs} = args;\n const {params,

```

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indices} = inputs;\n\n const [resultShape, numSlices, sliceSize, strides] =\ngather_util.prepareAndValidate(params, indices);\n\n const out = backend.makeOutput(resultShape,\nparams.dtype);\n\n if (numSlices === 0) {\n return out;\n }\n\n const indicesShape = indices.shape;\n\n const sliceRank = indicesShape[indicesShape.length - 1];\n\n const xData = backend.dataIdMap.get(params.dataId);\n\n const xId = xData.id;\n\n const indicesData = backend.dataIdMap.get(indices.dataId);\n\n const indicesId =\nindicesData.id;\n\n const stridesBytes = new Uint8Array(new Int32Array(strides).buffer);\n\n const outId =\nbackend.dataIdMap.get(out.dataId).id;\n\n wasmGatherNd(\n xId, CppDType[params.dtype], indicesId,\nnumSlices, sliceRank, sliceSize,\n\n stridesBytes, outId);\n\n return out;\n}\n\nexport const gatherNdConfig: KernelConfig = {\n kernelName:\nGatherNd,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: gatherNd\n};\n","/*\n * @license\n *\nCopyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n\"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\nLicense at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or\nagreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *\nWITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\nthe specific language governing permissions and\n * limitations under the License.\n */\n\n=====\n*/\n\nimport {backend_util, GatherV2, GatherV2Attrs, GatherV2Inputs, KernelConfig, KernelFunc,\nTensor, TensorInfo, TypedArray, util} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from\n'./backend_wasm';\n\nimport {reshape} from './Reshape';\n\nimport {CppType} from './types';\n\nlet wasmGather:\n(\n xId: number, dtype: CppDType, xStrides: Uint8Array, stridesSize: number,\n indicesId: number, batchSize:\nnumber, outStrides: Uint8Array,\n outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n wasmGather = backend.wasm.cwrap('Gather', null /*void*/, [\n 'number', // xId\n 'number', // dtype\n 'array',\n // xStrides\n 'number', // stridesSize\n 'number', // indicesId\n 'number', // batchSize\n 'array', //\noutStrides\n 'number' // outId\n]);\n\n function gatherV2(\n args: {backend: BackendWasm, inputs:\nGatherV2Inputs, attrs: GatherV2Attrs}): \nTensorInfo {\n const {backend, inputs, attrs} = args;\n const {x,\nindices} = inputs;\n const {axis, batchDims} = attrs;\n\n // Throw error when any index\nis out of bound.\n const parsedAxis = util.parseAxisParam(axis, x.shape)[0];\n const indicesVals =\nbackend.readSync(indices.dataId) as TypedArray;\n const axisDim = x.shape[parsedAxis];\n for (let i = 0; i <\nindicesVals.length; ++i) {\n const index = indicesVals[i];\n util.assert(\n index <= axisDim - 1 && index >=\n0,\n () =>`\n `GatherV2: the index value ${index} is not in [0, ${axisDim - 1}]`);\n }\n\n const\nshapeInfo = backend_util.segment_util.collectGatherOpShapeInfo(\n x as Tensor, indices as Tensor, parsedAxis,\nbatchDims);\n\n const flattenX = reshape({\n inputs: {x},\n attrs: {\n shape: [\n shapeInfo.batchSize,\n shapeInfo.outerSize, shapeInfo.dimSize,\n shapeInfo.sliceSize\n],\n backend\n });\n const\nindicesSize = util.sizeFromShape(indices.shape);\n const flattenIndex = reshape({\n inputs: {x: indices},\n attrs:\n{\n shape: [shapeInfo.batchSize, indicesSize / shapeInfo.batchSize],\n backend\n }\n });\n const flattenOutputShape = [\n shapeInfo.batchSize, shapeInfo.outerSize, indicesSize /\nshapeInfo.batchSize,\n shapeInfo.sliceSize\n];\n\n const out = backend.makeOutput(flattenOutputShape,\nx.dtype);\n\n if (util.sizeFromShape(x.shape) === 0) {\n return out;\n }\n\n const stridesSize = flattenX.shape.length\n- 1;\n\n const xData = backend.dataIdMap.get(flattenX.dataId);\n const xId = xData.id;\n\n const indicesData =\nbackend.dataIdMap.get(flattenIndex.dataId);\n const indicesId = indicesData.id;\n\n const outId =\nbackend.dataIdMap.get(out.dataId).id;\n\n const xStridesBytes = new Uint8Array(\n new\nInt32Array(util.computeStrides(flattenX.shape)).buffer);\n const outStridesBytes = new Uint8Array(\n new\nInt32Array(util.computeStrides(flattenOutputShape)).buffer);\n\n wasmGather(\n xId, CppDType[x.dtype],\nxStridesBytes, stridesSize, indicesId,\n shapeInfo.batchSize, outStridesBytes, outId);\n\n backend.disposeData(flattenX.dataId);\n backend.disposeData(flattenIndex.dataId);\n\n // reshape\n out.shape = shapeInfo.outputShape;\n return out;\n}\n\nexport const gatherV2Config: KernelConfig =\n{\n kernelName: GatherV2,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: gatherV2 as {} as
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KernelFunc\n};\n", "/\*\n \* @license\n \* Copyright 2019 Google LLC. All Rights Reserved.\n \* Licensed under the Apache License, Version 2.0 (the \"License\");\n \* you may not use this file except in compliance with the License.\n \* You may obtain a copy of the License at\n \* http://www.apache.org/licenses/LICENSE-2.0\n \* Unless required by applicable law or agreed to in writing, software\n \* distributed under the License is distributed on an \"AS IS\" BASIS,\n \* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*/

```
=====\n\n/*\n\nimport { KernelConfig, KernelFunc, LeakyRelu, LeakyReluAttrs, LeakyReluInputs, TensorInfo, util } from\n '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nimport { CppDType } from\n './types';\n\nlet wasmFunc: (\n xId: number, dtype: number, leakyreluAlpha: number, outId: number) =>\n void;\n\nfunction setupFunc(backend: BackendWasm): void {\n wasmFunc = backend.wasm.cwrap(LeakyRelu,\n null /* void */, [\n 'number', // x_id\n 'number', // dtype\n 'number', // leakyrelu_alpha\n 'number', //\n out_id\n]);\n\n \nexport function leakyRelu(\n args: {\n inputs: LeakyReluInputs, attrs: LeakyReluAttrs,\n backend: BackendWasm\n }): TensorInfo {\n const { inputs: { x }, attrs: { alpha }, backend } = args;\n const xId =\n backend.dataIdMap.get(x.dataId).id;\n // According to TF API, LeakyRelu returns float32 when input is either\n float32\n // or int32.\n const out = backend.makeOutput(x.shape, 'float32');\n if (util.sizeFromShape(x.shape)\n !== 0)\n {\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmFunc(xId, CppDType[x.dtype], alpha, outId);\n }\n return out;\n }\n\n \nexport const leakyReluConfig: KernelConfig = {\n kernelName: LeakyRelu,\n backendName: 'wasm',\n setupFunc,\n kernelFunc: leakyRelu as {} as KernelFunc\n };\n\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\n * License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or\n * agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n * the specific language governing permissions and\n * limitations under the License.\n */
```

```
=====\n\n/*\n\nimport { Greater, KernelConfig } from '@tensorflow/tfjs-core';\nimport { createBinaryKernelConfig } from\n './binary_kernel';\n\nconst supportsFullBroadcast = false;\n\nexport const greaterConfig: KernelConfig =\n createBinaryKernelConfig(Greater, supportsFullBroadcast, 'bool');\n\n", "/*\n * @license\n * Copyright 2019 Google\n * LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not\n * use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\n * OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n * governing permissions and\n * limitations under the License.\n */
```

```
=====\n\n/*\n\nimport { GreaterEqual, KernelConfig } from '@tensorflow/tfjs-core';\nimport { createBinaryKernelConfig } from\n './binary_kernel';\n\nconst supportsFullBroadcast = false;\n\nexport const greaterEqualConfig: KernelConfig =\n createBinaryKernelConfig(GreaterEqual, supportsFullBroadcast, 'bool');\n\n", "/*\n * @license\n * Copyright 2019\n * Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you\n * may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\n * OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n * governing permissions and\n * limitations under the License.\n */
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=====\n\n
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```
=====\n\n*\nimport {KernelConfig, Log} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from\n './unary_kernel';\nexport\n\nconst logConfig: KernelConfig = createUnaryKernelConfig(Log);\n"/**\n * @license\n * Copyright 2019 Google\n LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not\n use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,\n software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\n OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n governing permissions and\n * limitations under the License.\n *\n
```

```
=====\n\n*\nimport {KernelConfig, LogicalAnd} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from\n './binary_kernel';\nconst supportsFullBroadcast = false;\nexport const logicalAndConfig: KernelConfig\n =\n createBinaryKernelConfig(LogicalAnd, supportsFullBroadcast, 'bool');\n"/**\n * @license\n * Copyright\n 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,\n software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\n OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n governing permissions and\n * limitations under the License.\n *\n
```

```
=====\n\n*\nimport {backend_util, KernelConfig, KernelFunc, MaxPool, MaxPoolAttrs, MaxPoolInputs, Tensor4D, util}\n from '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nlet\n\nwasmMaxPool: (\n xId: number, batchSize: number, inputHeight: number, inputWidth: number,\n filterHeight:\n number, filterWidth: number, padTop: number, padRight: number,\n padBottom: number, padLeft: number,\n dilationHeight: number,\n dilationWidth: number, strideHeight: number, strideWidth: number,\n inputChannels:\n number, outputChannels: number, outId: number) => void;\nfunction setup(backend: BackendWasm) {\n\nwasmMaxPool = backend.wasm.cwrap(MaxPool, null /* void */, [\n 'number', // xId\n 'number', // batchSize\n 'number', // inputHeight\n 'number', // inputWidth\n 'number', // filterHeight\n 'number', // filterWidth\n 'number', // padTop\n 'number', // padRight\n 'number', // padBottom\n 'number', // padLeft\n 'number', //\n dilationHeight\n 'number', // dilationWidth\n 'number', // strideHeight\n 'number', // strideWidth\n 'number',\n // inputChannels\n 'number', // outputChannels\n 'number', // outId\n\n]);\n\nfunction maxPool(\n args: {inputs: MaxPoolInputs, backend: BackendWasm, attrs: MaxPoolAttrs}) {\n\nconst {inputs, attrs, backend} = args;\nconst x = inputs.x as Tensor4D;\nconst xId =\n backend.dataIdMap.get(x.dataId).id;\n// TF API supports int32 input. CPU and WebGL backend also support\n int32\n // input. WASM backend doesn't support it because it uses xnnpack which only\n // supports float32.\n // Add the following assert only for the WASM backend instead of at core op\n // level.\n // TODO: add\n support for int32 input.\n util.assert(\n x.dtype === 'float32',\n () =>\n `Error in MaxPool: only float32\n input is supported. Got ${x.dtype}.`);\nconst {filterSize, strides, pad, dimRoundingMode} = attrs;\nconst\n convInfo = backend_util.computePool2DInfo(\n x.shape, filterSize, strides, 1 /* dilations */, pad,\n dimRoundingMode);\nconst filterHeight = convInfo.filterHeight;\nconst filterWidth = convInfo.filterWidth;\nconst padTop = convInfo.padInfo.top;\nconst padRight = convInfo.padInfo.right;\nconst padBottom =\n convInfo.padInfo.bottom;\nconst padLeft = convInfo.padInfo.left;\nconst dilationHeight =\n convInfo.dilationHeight;\nconst dilationWidth = convInfo.dilationWidth;\nconst strideHeight =\n convInfo.strideHeight;\nconst strideWidth = convInfo.strideWidth;\nconst inputChannels =\n convInfo.inChannels;\nconst outputChannels = convInfo.outChannels;\nif (convInfo.dataFormat !==
```

```

'channelsLast') {\n throw new Error(\n `wasm backend does not support dataFormat:~` +\n
`${convInfo.dataFormat}'. Please use 'channelsLast'.`);\n }\n\n const out =
backend.makeOutput(convInfo.outShape, 'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n
wasmMaxPool(\n xId, x.shape[0], x.shape[1], x.shape[2], filterHeight, filterWidth,\n padTop, padRight,
padBottom, padLeft, dilationHeight, dilationWidth,\n strideHeight, strideWidth, inputChannels, outputChannels,
outId);\n return out;\n);\n\nexport const maxPoolConfig: KernelConfig = {\n kernelName: MaxPool,\n
backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: maxPool as { } as KernelFunc\n};\n"/**\n *
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====
*\nimport {KernelConfig, Maximum} from '@tensorflow/tfjs-core';\nimport
{createBinaryKernelConfig} from './binary_kernel';\nconst supportsFullBroadcast = false;\nexport const
maximumConfig: KernelConfig =\n createBinaryKernelConfig(Maximum, supportsFullBroadcast);\n"/**\n *
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {backend_util, KernelConfig, KernelFunc, Mean, MeanAttrs, MeanInputs,
TensorInfo, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nimport {cast}
from './Cast';\nimport {permuteAxesAndTranspose} from './kernel_utils';\n\nlet wasmMean: (xId: number,
reduceSize: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n wasmMean =\n backend.wasm.cwrap(Mean, null /*void*/, ['number, number, number']);\n}\n\nexport function mean(\n args:
{backend: BackendWasm, inputs: MeanInputs, attrs: MeanAttrs});\n TensorInfo {\n const {backend, inputs,
attrs} = args;\n const {axis, keepDims} = attrs;\n const {x} = inputs;\n const xId =
backend.dataIdMap.get(x.dataId).id;\n let inputId = xId;\n let input = x;\n\n const {transposed, axes, originalAxes,
inputWasTransposed} =\n permuteAxesAndTranspose(x, axis, backend);\n\n let reductionAxes = axes;\n if
(inputWasTransposed) {\n const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n if (transposedId
!== xId) {\n //
 transpose was not a no-op. We will need to dispose of this\n // once we are done.\n input = transposed;\n
inputId = transposedId;\n reductionAxes = backend_util.getInnerMostAxes(\n reductionAxes.length,
input.shape.length);\n }\n }\n\n backend_util.assertAxesAreInnerMostDims(\n 'mean', reductionAxes,
input.shape.length);\n const [outShape, reduceShape] =\n backend_util.computeOutAndReduceShapes(input.shape, reductionAxes);\n const reduceSize =
util.sizeFromShape(reduceShape);\n let castedInput = input;\n if (input.dtype !== 'float32') {\n castedInput =\n cast({backend, inputs: {x: input}, attrs: {dtype: 'float32'}});\n inputId =
backend.dataIdMap.get(castedInput.dataId).id;\n }\n\n const out = backend.makeOutput(outShape, 'float32');\n if
(util.sizeFromShape(input.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmMean(inputId, reduceSize, outId);\n }\n\n if (inputWasTransposed) {\n //
 dispose of the transposed tensor.\n backend.disposeData(transposed.dataId);\n }\n\n if (keepDims) {\n //
 reshape\n const newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n out.shape =
newShape;\n }\n\n if (input.dtype !== 'float32') {\n backend.disposeData(castedInput.dataId);\n }\n\n return

```

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out;\n\nexport const meanConfig: KernelConfig = {\n kernelName: Mean,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: mean as {} as KernelFunc\n};\n","/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND,\n * either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n\n=====\n\n*/\n\nimport {backend_util, KernelConfig, KernelFunc, Min, MinAttrs, MinInputs, TensorInfo, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nimport {permuteAxesAndTranspose} from './kernel_utils';\nimport {CppType} from './types';\nlet wasmMin: (xId: number, dtype: number, reduceSize: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n wasmMin = backend.wasm.cwrap(Min, null /*void*/, [\n 'number', // x_id\n 'number', // dtype\n 'number', // reduce_size\n 'number', // out_id\n]);\n\n function min(args: {backend: BackendWasm, inputs: MinInputs, attrs: MinAttrs}): TensorInfo {\n const {backend, inputs, attrs} = args;\n const {axis, keepDims} = attrs;\n const {x} = inputs;\n\n const xId = backend.dataIdMap.get(x.dataId).id;\n let inputId = xId;\n let input = x;\n\n const {transposed, axes, originalAxes, inputWasTransposed} = permuteAxesAndTranspose(x, axis, backend);\n\n if (inputWasTransposed) {\n const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n if (transposedId !== xId) {\n // transpose was not a no-op. We will need to dispose of this\n // once we are done.\n input = transposed;\n inputId = transposedId;\n }\n }\n\n const inputRank = input.shape.length;\n\n backend_util.assertAxesAreInnerMostDims('min', axes, inputRank);\n const [outShape, reduceShape] = backend_util.computeOutAndReduceShapes(input.shape, axes);\n const reduceSize = util.sizeFromShape(reduceShape);\n const out = backend.makeOutput(outShape, input.dtype);\n\n if (util.sizeFromShape(input.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmMin(inputId, CCppType[x.dtype], reduceSize, outId);\n }\n\n if (inputWasTransposed) {\n // dispose of the transposed tensor.\n backend.disposeData(transposed.dataId);\n }\n\n if (keepDims) {\n // reshape\n const newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n out.shape = newShape;\n }\n\n return out;\n }\n\n export const minConfig: KernelConfig = {\n kernelName: Min,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: min as {} as KernelFunc\n};\n","/**\n * @license\n * Copyright 2021 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND,\n * either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n\n=====\n\n*/\n\nimport {KernelConfig, KernelFunc, MirrorPad, MirrorPadAttrs, MirrorPadInputs} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nimport {CppType} from './types';\n// Must match enum in MirrorPad.cc\nenum MirrorPaddingMode {\n reflect = 0,\n symmetric = 1\n}\n\nlet wasmMirrorPad: (\n xId: number, xShapeBytes: Uint8Array, xShapeLength: number, xDtype: number,\n prePaddingsBytes: Uint8Array, postPaddingsBytes: Uint8Array, mode: number,\n outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmMirrorPad = backend.wasm.cwrap(MirrorPad, null /*void*/, [\n 'number', // xId\n 'array', // x.shape\n 'number', // x.shape.length\n 'number', // x.dtype\n 'array', // pre-paddings\n 'array', // post-paddings\n 'number', //\n])
```

```

mode\n 'number', // outId\n]);\n\nfunction mirrorPad(args: {\n inputs: MirrorPadInputs,\n backend:
BackendWasm,\n attrs: MirrorPadAttrs\n}) {\n const {inputs: {x}, backend, attrs: {paddings, mode}} = args;\n\n
const outShape = paddings.map(\n (p, i) => p[0] /* beforePad */ + x.shape[i] + p[1] /* afterPad */);\n const xId =
backend.dataIdMap.get(x.dataId).id;\n const out = backend.makeOutput(outShape, x.dtype);\n const outId =
backend.dataIdMap.get(out.dataId).id;\n const xShapeBytes = new Uint8Array(new
Int32Array(x.shape).buffer);\n\n const prePaddingsFlat = paddings.map(padTuple => padTuple[0]);\n const
postPaddingsFlat = paddings.map(padTuple => padTuple[1]);\n const prePaddingsBytes =\n new
Uint8Array(new Int32Array(prePaddingsFlat).buffer);\n const postPaddingsBytes =\n new Uint8Array(new
Int32Array(postPaddingsFlat).buffer);\n\n wasmMirrorPad(\n xId, xShapeBytes, x.shape.length,
CppType[x.dtype], prePaddingsBytes,\n postPaddingsBytes,
MirrorPaddingMode[mode], outId);\n return out;\n}\n\nexport const mirrorPadConfig: KernelConfig = {\n
kernelName: MirrorPad,\n backendName: 'wasm',\n kernelFunc: mirrorPad as { } as KernelFunc,\n setupFunc:
setup\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the
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on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n */
=====
\n
*/\nimport {KernelConfig, Minimum} from '@tensorflow/tfjs-core';\n\nimport
{createBinaryKernelConfig} from './binary_kernel';\n\nconst supportsFullBroadcast = false;\n\nexport const
minimumConfig: KernelConfig =\n createBinaryKernelConfig(Minimum, supportsFullBroadcast);\n\n"/**\n *
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2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the
specific language governing permissions and\n * limitations under the License.\n */
=====
\n
*/\n\nimport {KernelConfig, KernelFunc, NonMaxSuppressionV3,
NonMaxSuppressionV3Attrs, NonMaxSuppressionV3Inputs, TensorInfo} from '@tensorflow/tfjs-core';\n\nimport
{BackendWasm} from './backend_wasm';\n\nimport {parseResultStruct} from './NonMaxSuppression_util';\n\nlet
wasmFunc: (\n boxesId: number, scoresId: number, maxOutputSize: number,\n iouThreshold: number,
scoreThreshold: number) => number;\n\nfunction setup(backend: BackendWasm): void {\n wasmFunc =
backend.wasm.cwrap(\n NonMaxSuppressionV3,\n 'number', // Result*\n [\n 'number', // boxesId\n
'number', // scoresId\n 'number', // maxOutputSize\n 'number', // iouThreshold\n 'number', //
scoreThreshold\n]);\n\nfunction kernelFunc(args: {\n backend: BackendWasm,\n inputs:
NonMaxSuppressionV3Inputs,\n attrs: NonMaxSuppressionV3Attrs\n}): TensorInfo {\n const {backend, inputs,
attrs} = args;\n const {iouThreshold, maxOutputSize, scoreThreshold} = attrs;\n const {boxes, scores} =
inputs;\n\n const boxesId =
backend.dataIdMap.get(boxes.dataId).id;\n const scoresId = backend.dataIdMap.get(scores.dataId).id;\n\n const
resOffset =\n wasmFunc(boxesId, scoresId, maxOutputSize, iouThreshold, scoreThreshold);\n\n const
{pSelectedIndices, selectedSize, pSelectedScores, pValidOutputs} =\n parseResultStruct(backend, resOffset);\n\n
// Since we are not using scores for V3, we have to delete it from the heap.\n
backend.wasm._free(pSelectedScores);\n backend.wasm._free(pValidOutputs);\n\n const selectedIndicesTensor
=\n backend.makeOutput([selectedSize, 'int32', pSelectedIndices);\n\n return
selectedIndicesTensor;\n}\n\nexport const nonMaxSuppressionV3Config: KernelConfig = {\n kernelName:

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NonMaxSuppressionV3,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: kernelFunc as { } as  
KernelFunc,\n};\n", "/\*\n \* @license\n \* Copyright 2019 Google LLC. All Rights Reserved.\n \* Licensed under the  
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OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language  
governing permissions and\n \* limitations under the License.\n \*

=====\n\n\*\n\nimport { KernelConfig, Multiply } from '@tensorflow/tfjs-core';\n\nimport { createBinaryKernelConfig } from  
 './binary\_kernel';\n\nconst supportsFullBroadcast = true;\n\nexport const multiplyConfig: KernelConfig =\n\ncreateBinaryKernelConfig(Multiply, supportsFullBroadcast);\n\n", "/\*\n \* @license\n \* Copyright 2020 Google  
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OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language  
governing permissions and\n \* limitations under the License.\n \*

=====\n\n\*\n\nimport { KernelConfig, Neg } from '@tensorflow/tfjs-core';\n\nimport { createUnaryKernelConfig } from  
 './unary\_kernel';\n\nexport const negConfig: KernelConfig = createUnaryKernelConfig(Neg);\n\n", "/\*\n \* @license\n \* Copyright 2019 Google LLC. All Rights Reserved.\n \* Licensed under the Apache License, Version 2.0 (the  
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=====\n\n\*\n\nimport { BackendWasm } from '../backend\_wasm';\n\n// Analogous to `struct Result` in  
`non\_max\_suppression\_impl.h`\n\ninterface Result {\n\n pSelectedIndices: number;\n\n selectedSize: number;\n\n pSelectedScores: number;\n\n pValidOutputs: number;\n\n}\n\n/\*\n \* Parse the result of the c++ method, which has the  
shape equivalent to\n \* `Result`\n \*/\n\nexport function parseResultStruct(\n\n backend: BackendWasm, resOffset:  
number): Result {\n\n const result = new Int32Array(backend.wasm.HEAPU8.buffer, resOffset, 4);\n\n const  
pSelectedIndices  
= result[0];\n\n const selectedSize = result[1];\n\n const pSelectedScores = result[2];\n\n const pValidOutputs =  
result[3];\n\n // Since the result was allocated on the heap, we have to delete it.\n\n backend.wasm.\_free(resOffset);\n\n return { pSelectedIndices, selectedSize, pSelectedScores, pValidOutputs };\n\n}\n\n", "/\*\n \* @license\n \* Copyright  
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OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language  
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=====\n\n\*\n\nimport { KernelConfig, KernelFunc, NonMaxSuppressionV4, NonMaxSuppressionV4Attrs,  
NonMaxSuppressionV4Inputs, TensorInfo } from '@tensorflow/tfjs-core';\n\nimport { BackendWasm } from

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../backend_wasm';\n\nimport {parseResultStruct} from './NonMaxSuppression_util';\n\nlet wasmFunc: (\nboxesId: number, scoresId: number, maxOutputSize: number,\n iouThreshold: number, scoreThreshold: number,\npadToMaxOutputSize: boolean) => number;\n\nfunction setup(backend: BackendWasm): void {\n wasmFunc = backend.wasm.cwrap(\n NonMaxSuppressionV4,\n 'number', // Result*\n [\n 'number', // boxesId\n 'number', // scoresId\n 'number', // maxOutputSize\n 'number', // iouThreshold\n 'number', // scoreThreshold\n 'bool', // padToMaxOutputSize\n]);\n}\n\nfunction nonMaxSuppressionV4(args: {\n backend: BackendWasm,\n inputs: NonMaxSuppressionV4Inputs,\n attrs: NonMaxSuppressionV4Attrs\n}): TensorInfo[]{\n const {backend, inputs, attrs} = args;\n const {iouThreshold, maxOutputSize, scoreThreshold, padToMaxOutputSize} =\n attrs;\n const {boxes, scores} = inputs;\n const boxesId = backend.dataIdMap.get(boxes.dataId).id;\n const scoresId = backend.dataIdMap.get(scores.dataId).id;\n const resOffset = wasmFunc(\n boxesId, scoresId, maxOutputSize, iouThreshold, scoreThreshold,\npadToMaxOutputSize);\n const {pSelectedIndices, selectedSize, pSelectedScores, pValidOutputs} =\n parseResultStruct(backend, resOffset);\n // Since we are not using scores for V4, we have to delete it from the heap.\n backend.wasm._free(pSelectedScores);\n const selectedIndicesTensor =\n backend.makeOutput([selectedSize], 'int32', pSelectedIndices);\n const validOutputsTensor =\n backend.makeOutput([], 'int32', pValidOutputs);\n return [selectedIndicesTensor, validOutputsTensor];\n}\n\nexport const nonMaxSuppressionV4Config: KernelConfig = {\n kernelName: NonMaxSuppressionV4,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: nonMaxSuppressionV4 as\n {} as KernelFunc,\n};\n","/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS"\n * BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n\n=====\n\n*/\n\nimport {KernelConfig, KernelFunc, NonMaxSuppressionV5, NonMaxSuppressionV5Attrs,\n NonMaxSuppressionV5Inputs, TensorInfo} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport {parseResultStruct} from './NonMaxSuppression_util';\n\nlet wasmFunc:\n (boxesId: number, scoresId: number, maxOutputSize: number,\n iouThreshold: number, scoreThreshold: number, softNmsSigma: number)\n => number;\n\nfunction setup(backend: BackendWasm):\n void {\n wasmFunc = backend.wasm.cwrap(\n NonMaxSuppressionV5,\n 'number', // Result*\n [\n 'number', // boxesId\n 'number', // scoresId\n 'number', // maxOutputSize\n 'number', // iouThreshold\n 'number', // scoreThreshold\n 'number', // softNmsSigma\n]);\n }\n\nfunction\n kernelFunc(args: {\n backend: BackendWasm,\n inputs: NonMaxSuppressionV5Inputs,\n attrs: NonMaxSuppressionV5Attrs\n }): TensorInfo[] {\n const {backend, inputs, attrs} = args;\n const {iouThreshold, maxOutputSize, scoreThreshold, softNmsSigma} =\n attrs;\n const {boxes, scores} = inputs;\n const boxesId = backend.dataIdMap.get(boxes.dataId).id;\n const scoresId = backend.dataIdMap.get(scores.dataId).id;\n const resOffset = wasmFunc(\n boxesId, scoresId, maxOutputSize, iouThreshold, scoreThreshold,\n softNmsSigma);\n const {pSelectedIndices, selectedSize, pSelectedScores, pValidOutputs} =\n parseResultStruct(backend, resOffset);\n // Since we are not using validOutputs for V5, we have to delete it from the heap.\n backend.wasm._free(pValidOutputs);\n const selectedIndicesTensor =\n backend.makeOutput([selectedSize], 'int32', pSelectedIndices);\n const selectedScoresTensor =\n backend.makeOutput([selectedSize], 'float32', pSelectedScores);\n return [selectedIndicesTensor, selectedScoresTensor];\n }\n\nexport const nonMaxSuppressionV5Config: KernelConfig =\n {\n kernelName: NonMaxSuppressionV5,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: kernelFunc as\n {} as KernelFunc,\n };\n","/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n
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* limitations under the License.
=====
\n
*\n\nimport { KernelConfig, KernelFunc, OneHot, OneHotAttrs, OneHotInputs } from '@tensorflow/tfjs-core';
\n\nimport { BackendWasm } from '../backend_wasm';
\n\nlet wasmOneHot: (\n indicesId: number, depth: number, onValue: number, offValue: number,\n outId: number) => void;
\n\nfunction setup(backend: BackendWasm) {\n wasmOneHot = backend.wasm.cwrap(OneHot, null /* void */, [\n 'number', // indices_id\n 'number', // depth,\n 'number', // onValue\n 'number', // offValue\n 'number' // out_id\n]);\n\n function oneHot(\n args: { inputs: OneHotInputs, attrs: OneHotAttrs, backend: BackendWasm }) {\n const { inputs, backend, attrs } = args;\n const { indices } = inputs;\n const { depth, onValue, offValue } = attrs;\n\n const out = backend.makeOutput([...indices.shape, depth], 'int32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n const indicesData = backend.dataIdMap.get(indices.dataId);\n const indicesId = indicesData.id;\n\n wasmOneHot(indicesId, depth, onValue, offValue, outId);\n\n return out;\n }\n\n export const oneHotConfig: KernelConfig = {\n kernelName: OneHot,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: oneHot as {} as KernelFunc,\n };
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\n =====\n\n *\n\n import { KernelConfig, NotEqual } from '@tensorflow/tfjs-core';
 import { createBinaryKernelConfig } from '../binary_kernel';
 const supportsFullBroadcast = false;
 export const notEqualConfig: KernelConfig =\n createBinaryKernelConfig(NotEqual, supportsFullBroadcast, 'bool');
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\n =====\n\n *\n\n import { KernelConfig, KernelFunc, OnesLike, OnesLikeInputs } from '@tensorflow/tfjs-core';
 import { BackendWasm } from '../backend_wasm';
 function onesLike(args: { inputs: OnesLikeInputs, backend: BackendWasm }) {\n const { inputs: { x }, backend } = args;\n const out = backend.makeOutput(x.shape, x.dtype);\n const outVals = backend.typedArrayFromHeap(out);\n outVals.fill(1);\n return out;\n }\n\n export const onesLikeConfig: KernelConfig = {\n kernelName: OnesLike,\n backendName: 'wasm',\n kernelFunc: onesLike as {} as KernelFunc,\n };
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=====\\n
*\\n\\nimport {KernelConfig, KernelFunc, Pack, PackAttrs, PackInputs, TensorInfo, util} from '@tensorflow/tfjs-
core';\\nimport {BackendWasm}
from './backend_wasm';\\n\\nimport {concat} from './Concat';\\nimport {expandDims} from
'./ExpandDims';\\n\\nexport function pack(\\n args: {inputs: PackInputs, backend: BackendWasm, attrs:
PackAttrs}):\\n TensorInfo {\\n const {inputs, backend, attrs} = args;\\n const {axis} = attrs;\\n\\n if (inputs.length
=== 1) {\\n return expandDims(\\n {inputs: {input: inputs[0]}, backend, attrs: {dim: axis}});\\n }\\n\\n const
shape = inputs[0].shape;\\n const dtype = inputs[0].dtype;\\n\\n inputs.forEach(t => {\\n util.assertShapesMatch(\\n
 shape, t.shape,\\n 'All tensors passed to stack must have matching shapes');\\n util.assert(\\n dtype ===
t.dtype,\\n () => 'All tensors passed to stack must have matching dtypes');\\n });\\n\\n const
intermediateTensorInfos: TensorInfo[] = [];\\n const expandedTensors = inputs.map(t => {\\n const expandedT =\\n
 expandDims({inputs: {input: t}, backend, attrs: {dim: axis}});\\n intermediateTensorInfos.push(expandedT);\\n
 return expandedT;\\n });\\n\\n const result = concat({inputs: expandedTensors, backend, attrs: {axis}});\\n\\n
intermediateTensorInfos.forEach(t => backend.disposeData(t.dataId));\\n\\n return result;\\n}\\n\\nexport const
packConfig: KernelConfig = {\\n kernelName: Pack,\\n backendName: 'wasm',\\n kernelFunc: pack as {} as
KernelFunc\\n};\\n\\n","/*\\n * @license\\n * Copyright 2019 Google LLC. All Rights Reserved.\\n * Licensed under the
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implied.\\n * See the License for the specific language governing permissions and\\n * limitations under the
License.\\n *
=====\\n
*\\n\\nimport {KernelConfig, KernelFunc, PadV2, PadV2Attrs, PadV2Inputs, util} from '@tensorflow/tfjs-
core';\\nimport {BackendWasm} from './backend_wasm';\\n\\nimport {fill} from './Fill';\\n\\nimport {CppType}
from './types';\\n\\nlet wasmPadV2: (\\n xId: number, xShapeBytes: Uint8Array, xShapeLength: number, xDtype:
number,\\n prePaddingsBytes: Uint8Array, postPaddingsBytes: Uint8Array,\\n constantValue: number, outId:
number) => void;\\n\\nfunction setup(backend: BackendWasm) {\\n wasmPadV2 = backend.wasm.cwrap(PadV2, null
/* void */, [\\n 'number', // xId\\n 'array', // x.shape\\n 'number', // x.shape.length\\n 'number', // x.dtype\\n
'array', // pre-paddings\\n 'array', // post-paddings\\n 'number', // constantValue\\n 'number', // outId\\n
]);\\n}\\n\\nfunction pad(\\n args: {inputs: PadV2Inputs, backend: BackendWasm, attrs: PadV2Attrs}) {\\n const
{inputs: {x}, backend, attrs:
{paddings, constantValue}} = args;\\n\\n const outShape = paddings.map(\\n (p, i) => p[0] /* beforePad */ +
x.shape[i] + p[1] /* afterPad */);\\n\\n if (util.sizeFromShape(x.shape) === 0) {\\n // Short-circuit the computation,
since x doesn't have value, only\\n // the shape is used to compute output shape to pad.\\n return fill({\\n
 backend,\\n attrs: {shape: outShape, value: constantValue, dtype: x.dtype}\\n });\\n }\\n\\n const xId =
backend.dataIdMap.get(x.dataId).id;\\n const out = backend.makeOutput(outShape, x.dtype);\\n const
outTensorData = backend.dataIdMap.get(out.dataId);\\n const outId = outTensorData.id;\\n\\n const xShapeBytes =
new Uint8Array(new Int32Array(x.shape).buffer);\\n\\n const prePaddingsFlat = paddings.map(padTuple =>
padTuple[0]);\\n const postPaddingsFlat = paddings.map(padTuple => padTuple[1]);\\n const prePaddingsBytes =\\n
 new Uint8Array(new Int32Array(prePaddingsFlat).buffer);\\n const postPaddingsBytes =\\n new
Uint8Array(new Int32Array(postPaddingsFlat).buffer);\\n\\n
 wasmPadV2(\\n xId, xShapeBytes, x.shape.length, CppDType[x.dtype], prePaddingsBytes,\\n
 postPaddingsBytes, constantValue, outId);\\n return out;\\n}\\n\\nexport const padV2Config: KernelConfig = {\\n
 kernelName: PadV2,\\n backendName: 'wasm',\\n kernelFunc: pad as {} as KernelFunc,\\n setupFunc:
setup\\n};\\n\\n","/*\\n * @license\\n * Copyright 2019 Google LLC. All Rights Reserved.\\n * Licensed under the
Apache License, Version 2.0 (the "License");\\n * you may not use this file except in compliance with the
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```



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```
=====
\n\nimport {KernelConfig, KernelFunc, Prelu, PreluInputs} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport {cast} from './Cast';\n\nlet wasmPrelu: (xId: number, weightsId: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmPrelu = backend.wasm.cwrap(Prelu, null / void */, [\n 'number', // x_id\n 'number', // weights_id\n 'number' // out_id\n]);\n\n function prelu(args: {inputs: PreluInputs, backend: BackendWasm}) {\n const {inputs, backend} = args;\n const {x, alpha} = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const weightsId = backend.dataIdMap.get(alpha.dataId).id;\n\n let inputId = xId;\n const input = x;\n let castedInput = input;\n if (input.dtype !== 'float32') {\n castedInput = cast({backend, inputs: {x}, attrs: {dtype: 'float32'}});\n inputId = backend.dataIdMap.get(castedInput.dataId).id;\n }\n\n const out = backend.makeOutput(x.shape, 'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmPrelu(inputId, weightsId, outId);\n\n if (input.dtype !== 'float32') {\n backend.disposeData(castedInput.dataId);\n }\n\n return out;\n }\n\n export const preluConfig: KernelConfig = {\n kernelName: Prelu,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: prelu as {} as KernelFunc\n };\n \"/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n\n=====
```

```
\n\nimport {KernelConfig, Pow} from '@tensorflow/tfjs-core';\n\nimport {createBinaryKernelConfig} from './binary_kernel';\n\nconst supportsFullBroadcast = false;\n\nexport const powConfig: KernelConfig = {\n createBinaryKernelConfig(Pow, supportsFullBroadcast);\n \"/\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n\n=====
```

```
\n\nimport {backend_util, KernelConfig, KernelFunc, Prod, ProdAttrs, ProdInputs, TensorInfo, util} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport {permuteAxesAndTranspose} from './kernel_utils';\n\nimport {CppType} from './types';\n\nlet wasmProd: (\n xId: number, reduceSize: number,\n dtype: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n wasmProd = backend.wasm.cwrap(Prod, null / void */, [\n 'number',\n 'number',\n 'number',\n 'number'\n]);\n\n function prod(args: {\n backend: BackendWasm,\n inputs: ProdInputs,\n attrs: ProdAttrs\n }): TensorInfo {\n const {backend, inputs, attrs} = args;\n const {axis, keepDims} = attrs;\n const {x} = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n let inputId = xId;\n let input = x;\n\n const {transposed, axes, originalAxes, inputWasTransposed} =\n permuteAxesAndTranspose(x, axis, backend);\n\n let reductionAxes = axes;\n if (inputWasTransposed) {\n const transposedId =
```

```

=====
*/\n\nimport { KernelConfig, KernelFunc, ResizeBilinear, ResizeBilinearAttrs, ResizeBilinearInputs, TensorInfo,
util } from '@tensorflow/tfjs-core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nimport { cast } from
'./Cast';\n\nlet wasmResizeBilinear: (\n xId: number, batch: number, oldHeight: number, oldWidth: number,\n numChannels: number, newHeight: number, newWidth: number,\n alignCorners: number, halfPixelCenters:
number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n wasmResizeBilinear =
backend.wasm.cwrap(ResizeBilinear, null /*void*/, [\n 'number', // xId\n 'number', // batch\n 'number', //
oldHeight\n 'number', // oldWidth\n 'number', // numChannels\n 'number', // newHeight\n 'number', //
newWidth\n 'number',
\n // alignCorners\n 'number', // halfPixelCenters\n 'number' // outId\n]);\n\n function resizeBilinear(args: {\n
backend: BackendWasm,\n inputs: ResizeBilinearInputs,\n attrs: ResizeBilinearAttrs\n}): TensorInfo {\n const
{ backend, inputs, attrs } = args;\n\n const { images } = inputs;\n const { alignCorners, halfPixelCenters, size } =
attrs;\n\n const [newHeight, newWidth] = size;\n\n const [batch, oldHeight, oldWidth, numChannels] =
images.shape;\n\n const outShape = [batch, newHeight, newWidth, numChannels];\n\n let xData =
backend.dataIdMap.get(images.dataId);\n\n let castedData;\n\n if (xData.dtype !== 'float32') {\n castedData =\n
cast({ backend, inputs: { x: images }, attrs: { dtype: 'float32' }});\n\n xData =
backend.dataIdMap.get(castedData.dataId);\n\n }\n\n const xId = xData.id;\n\n const out =
backend.makeOutput(outShape, 'float32');\n\n if (util.sizeFromShape(images.shape) === 0) {\n return out;\n }\n
\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n wasmResizeBilinear(\n xId, batch, oldHeight, oldWidth, numChannels, newHeight, newWidth,\n alignCorners ? 1 : 0, halfPixelCenters ? 1 : 0, outId);\n\n if (castedData != null) {\n
backend.disposeData(castedData.dataId);\n }\n\n return out;\n }\n\n export const resizeBilinearConfig:
KernelConfig = {\n kernelName: ResizeBilinear,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc:
resizeBilinear as {} as KernelFunc\n };
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software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express
or implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n */
}
}
=====

```



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```

*\nimport
{ KernelConfig, Relu } from '@tensorflow/tfjs-core';\n\nimport { createUnaryKernelConfig } from
'./unary_kernel';\n\nexport const reluConfig: KernelConfig = createUnaryKernelConfig(Relu);\n\n/*\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
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the specific language governing permissions and\n \* limitations under the License.\n \*

```
=====\n\n*\n\nimport {KernelConfig, Relu6} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig}\nfrom './unary_kernel';\nexport const relu6Config: KernelConfig = createUnaryKernelConfig(Relu6);\n", "/*\n *\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version\n * 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a\n * copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable\n * law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n\n*\n\nimport {KernelConfig, KernelFunc, Reverse, ReverseAttrs, ReverseInputs, TensorInfo, util} from\n '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nimport\n {identity} from './Identity';\nimport {reshape} from './Reshape';\nlet wasmReverse: (\n xId: number, axes:\n Uint8Array, axesLength: number, outShape: Uint8Array,\n outShapeLength: number, outId: number) =>\nvoid;\n\nfunction setup(backend: BackendWasm) {\n wasmReverse = backend.wasm.cwrap(Reverse, null, [\n 'number', // x_id\n 'array', // axes\n 'number', // axes_length\n 'array', // out_shape\n 'number', //\n out_shape_length\n 'number' // out_id\n]);\n\n export function reverse(\n args: {inputs: ReverseInputs,\n backend: BackendWasm, attrs: ReverseAttrs}): \n TensorInfo {\n const {inputs, backend, attrs} = args;\n const\n {x} = inputs;\n const {dims} = attrs;\n\n const axes = util.parseAxisParam(dims, x.shape);\n\n if (x.shape.length\n === 0) {\n return identity({inputs: {x}, backend});\n }\n\n const out = backend.makeOutput(x.shape, x.dtype);\n\n const xId = backend.dataIdMap.get(x.dataId).id;\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n const axesBytes = new Uint8Array(new Int32Array(axes).buffer);\n const outShapeBytes = new Uint8Array(new\n Int32Array(x.shape).buffer);\n\n wasmReverse(\n xId, axesBytes, axes.length, outShapeBytes, x.shape.length,\n outId);\n\n const reshaped =\n reshape({inputs: {x: out}, attrs: {shape: x.shape}, backend});\n\n backend.disposeData(out.dataId);\n return reshaped;\n }\n\n export const reverseConfig: KernelConfig = {\n kernelName: Reverse,\n backendName: 'wasm',\n kernelFunc: reverse as { } as KernelFunc,\n setupFunc:\n setup\n }; \n", "/*\n *\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the\n * Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the\n * License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed\n * on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or\n * implied.\n * See the License for the specific language governing permissions and\n * limitations under the\n * License.\n *
```

```
=====\n\n*\n\nimport {KernelConfig, KernelFunc, RotateWithOffset, RotateWithOffsetAttrs, RotateWithOffsetInputs,\n TensorInfo} from '@tensorflow/tfjs-core';\nimport {backend_util} from '@tensorflow/tfjs-core';\nimport\n {BackendWasm} from '../backend_wasm';\nlet wasmRotate: (\n xId: number, batch: number, imageHeight:\n number, imageWidth: number,\n numChannels: number, radians: number, centerX: number, centerY: number,\n fillBytes: Uint8Array, fillLength: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmRotate = backend.wasm.cwrap(RotateWithOffset, null /* void */, [\n 'number', // xId\n 'number', //\n batch\n 'number', // imageHeight\n 'number', // imageWidth\n\n 'number', // numChannels\n 'number', // radians\n 'number', // centerX\n 'number', // centerY\n 'array', //\n fillBytes\n 'number', // fillLength\n 'number', // outId\n]);\n\n export function rotateWithOffset(args: {\n inputs: RotateWithOffsetInputs,\n backend: BackendWasm,\n attrs: RotateWithOffsetAttrs\n }): TensorInfo {\n
```

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const {inputs, backend, attrs} = args;\n const {image} = inputs;\n const {radians, fillValue, center} = attrs;\n\n const out = backend.makeOutput(image.shape, image.dtype);\n const imageId =\n backend.dataIdMap.get(image.dataId).id;\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n const [batch,\n imageHeight, imageWidth, numChannels] = image.shape;\n\n const [centerX, centerY] =\n backend_util.getImageCenter(center, imageHeight, imageWidth);\n\n const fillIsBlack = fillValue === 0;\n const\n fullOpacityValue = 255;\n\n const fillValues = typeof fillValue === 'number' ?\n [fillValue, fillValue, fillValue,\n fillIsBlack ? 0 : fullOpacityValue] :\n [...fillValue, fullOpacityValue];\n\n const fillBytes = new Uint8Array(new\n Int32Array(fillValues).buffer);\n\n wasmRotate(\n imageId, batch, imageHeight, imageWidth, numChannels,\n radians, centerX,\n centerY, fillBytes, fillValues.length, outId);\n return out;\n\n\nexport const\n rotateWithOffsetConfig: KernelConfig = {\n kernelName: RotateWithOffset,\n backendName: 'wasm',\n kernelFunc: rotateWithOffset as {} as KernelFunc,\n setupFunc: setup\n};\n\n"/**\n * @license\n * Copyright 2019\n Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you\n may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
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=====
\n\n\nimport {KernelConfig, KernelFunc, scatter_util, ScatterNd, ScatterNdAttrs, ScatterNdInputs, TensorInfo, util}\n from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport {CppType} from\n './types';\n\nlet wasmScatterNd: (\n indicesId: number, updatesId: number, dtype: CCppType, sliceRank:\n number,\n numUpdates: number, sliceSize: number, strides: Uint8Array,\n outputSize: number, outId: number)\n => void;\n\nfunction setup(backend: BackendWasm): void {\n wasmScatterNd = backend.wasm.cwrap(ScatterNd,\n null /*void*/, [\n 'number', // indicesId\n 'number', // updatesId\n 'number', // dtype\n 'number', //\n sliceRank\n 'number', // numUpdates\n 'number', // sliceSize\n 'array', // strides\n 'number', // outputSize\n 'number' // outId\n]);\n\n\nfunction scatterNd(\n args: {\n backend:\n BackendWasm, inputs: ScatterNdInputs, attrs: ScatterNdAttrs});\n\n TensorInfo {\n const {backend, inputs, attrs} =\n args;\n const {indices, updates} = inputs;\n const {shape} = attrs;\n\n const out = backend.makeOutput(shape,\n updates.dtype);\n\n if (util.sizeFromShape(shape) === 0) {\n return out;\n }\n\n const {sliceRank, numUpdates,\n sliceSize, strides, outputSize} =\n scatter_util.calculateShapes(updates, indices, shape);\n\n const indicesData =\n backend.dataIdMap.get(indices.dataId);\n const indicesId = indicesData.id;\n\n const updatesData =\n backend.dataIdMap.get(updates.dataId);\n const updatesId = updatesData.id;\n\n const stridesBytes = new\n Uint8Array(new Int32Array(strides).buffer);\n\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n wasmScatterNd(\n indicesId, updatesId, CCppType[updates.dtype], sliceRank, numUpdates,\n stridesBytes, outputSize, outId);\n\n return out;\n\n\n\nexport const scatterNdConfig: KernelConfig = {\n kernelName: ScatterNd,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: scatterNd as {} as\n KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2021 Google LLC. All Rights Reserved.\n * Licensed under the\n Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the\n License.\n * You may obtain a copy of the License at\n *
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=====
\n\n\nimport {KernelConfig, Round} from '@tensorflow/tfjs-core';\n\nimport\n {createUnaryKernelConfig} from '../unary_kernel';\n\nexport const roundConfig: KernelConfig =\n createUnaryKernelConfig(Round);\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n */

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=====
*\\nimport {KernelConfig, Rsqrt} from '@tensorflow/tfjs-core';\\nimport {createUnaryKernelConfig} from
'./unary_kernel';\\nexport
const rsqrtConfig: KernelConfig = createUnaryKernelConfig(Rsqrt);\\n"/**\\n * @license\\n * Copyright 2020
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http://www.apache.org/licenses/LICENSE-2.0\\n * Unless required by applicable law or agreed to in writing,
software\\n * distributed under the License is distributed on an "AS IS" BASIS,\\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\\n * See the License for the specific language
governing permissions and\\n * limitations under the License.\\n *
=====
*\\n\\nimport {KernelConfig, KernelFunc, Select, SelectInputs, util} from '@tensorflow/tfjs-core';\\n\\nimport
{BackendWasm} from './backend_wasm';\\n\\nlet wasmSelect: (\\n conditionId: number, tId: number, eId:
number, offset: number,\\n outId: number) => void;\\n\\nfunction setup(backend: BackendWasm) {\\n wasmSelect
= backend.wasm.cwrap('SelectV2', null, [\\n 'number', // conditionId\\n 'number', // tId\\n 'number', // eId\\n
'number', // offset\\n 'number', // outId\\n]);\\n\\nfunction select(args: {inputs: SelectInputs, backend:
BackendWasm}) {\\n const {inputs, backend} = args;\\n const {condition, t, e} = inputs;\\n\\n const conditionId =
backend.dataIdMap.get(condition.dataId).id;\\n const tId = backend.dataIdMap.get(t.dataId).id;\\n const eId =
backend.dataIdMap.get(e.dataId).id;\\n const out = backend.makeOutput(t.shape, t.dtype);\\n const outId =
backend.dataIdMap.get(out.dataId).id;\\n\\n const cRank = condition.shape.length;\\n const tRank =
t.shape.length;\\n\\n const offset = cRank === 0 || cRank > 1 || tRank === 1 ? 1 :\\n
util.sizeFromShape(t.shape.slice(1));\\n\\n wasmSelect(conditionId, tId, eId, offset, outId);\\n return out;\\n}\\n\\nexport
const selectConfig:
 KernelConfig = {\\n kernelName: 'Select',\\n backendName: 'wasm',\\n kernelFunc: select as {} as KernelFunc,\\n
 setupFunc: setup\\n };\\n"/**\\n * @license\\n * Copyright 2019 Google LLC. All Rights Reserved.\\n * Licensed
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on an "AS IS" BASIS,\\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\\n * See the License for the specific language governing permissions and\\n * limitations under the
License.\\n *
=====
*\\n\\nimport {KernelConfig, KernelFunc, Sigmoid, SigmoidInputs, TensorInfo, util} from '@tensorflow/tfjs-
core';\\n\\nimport {BackendWasm} from
'./backend_wasm';\\n\\nlet wasmFunc: (xId: number, outId: number) => void;\\n\\nfunction setup(backend:
BackendWasm): void {\\n wasmFunc = backend.wasm.cwrap('Sigmoid', null /* void */, ['number',
'number']);\\n}\\n\\nfunction sigmoid(args: {backend: BackendWasm, inputs: SigmoidInputs}):\\n TensorInfo {\\n
const {backend, inputs: {x}} = args;\\n const xId = backend.dataIdMap.get(x.dataId).id;\\n const out =
backend.makeOutput(x.shape, x.dtype);\\n const outId = backend.dataIdMap.get(out.dataId).id;\\n\\n // Short-circuit
zero-sized tensors.\\n if (util.sizeFromShape(out.shape) === 0) {\\n return out;\\n }\\n\\n wasmFunc(xId, outId);\\n
return out;\\n}\\n\\nexport const sigmoidConfig: KernelConfig = {\\n kernelName: 'Sigmoid',\\n backendName:
'wasm',\\n setupFunc: setup,\\n kernelFunc: sigmoid as {} as KernelFunc\\n};\\n"/**\\n * @license\\n * Copyright
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```
=====\n\n*\n\nimport { KernelConfig, KernelFunc, Softmax, SoftmaxAttrs, SoftmaxInputs, TensorInfo, util } from\n '@tensorflow/tfjs-core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nlet wasmFunc: (xId: number, outId:\n number, channels: number, batch: number) =>\n void;\n\nfunction setup(backend: BackendWasm): void {\n wasmFunc = backend.wasm.cwrap(Softmax, null /* void */, [\n 'number', // xId\n 'number', // outId\n 'number', // channels\n 'number' // batch\n]);\n\n function softmax(\n args: { backend: BackendWasm, inputs: SoftmaxInputs, attrs:\n SoftmaxAttrs }):\n TensorInfo {\n const { backend, inputs: { logits }, attrs: { dim } } = args;\n const xId =\n backend.dataIdMap.get(logits.dataId).id;\n const out = backend.makeOutput(logits.shape, logits.dtype);\n const\n outId = backend.dataIdMap.get(out.dataId).id;\n\n const channels = logits.shape[dim];\n const batch =\n util.sizeFromShape(logits.shape) / channels;\n\n // Short-circuit zero-sized tensors.\n if\n (util.sizeFromShape(out.shape) === 0) {\n return out;\n }\n\n wasmFunc(xId, outId, channels, batch);\n return\n out;\n }\n\n export const softmaxConfig: KernelConfig = {\n kernelName: Softmax,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: softmax as { } as KernelFunc\n };,\n /**\n * @license\n * Copyright 2019 Google\n * LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not\n * use this file except
in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *\n */\n}
```

```
=====\n\n*\n\nimport { KernelConfig, Sin } from '@tensorflow/tfjs-core';\n\nimport { createUnaryKernelConfig } from\n '../unary_kernel';\n\nexport const sinConfig: KernelConfig = createUnaryKernelConfig(Sin);\n\n/**\n * @license\n * Copyright 2021 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\n * License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *\n */
```

```
=====\n\n*\n\nimport { backend_util, KernelConfig, KernelFunc, ReshapeAttrs, ReshapeInputs, SpaceToBatchND,\n SpaceToBatchNDAttrs, SpaceToBatchNDInputs, TensorInfo, TransposeAttrs, TransposeInputs, util } from\n '@tensorflow/tfjs-core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nimport { padV2Config } from\n '../PadV2';\n\nimport { reshape } from './Reshape';\n\nimport { transpose } from './Transpose';\n\nfunction\n spaceToBatchND(args: {\n inputs: SpaceToBatchNDInputs,\n backend: BackendWasm,\n attrs:\n SpaceToBatchNDAttrs\n }) {\n const { inputs, backend,\n attrs } = args;\n const { x } = inputs;\n const { blockShape, paddings } = attrs;\n\n const prod =\n util.sizeFromShape(blockShape);\n\n const completePaddings: Array<number, number> = [[0, 0]];\n completePaddings.push(...(paddings as Array<number, number>));\n\n for (let i = 1 + blockShape.length; i <
```



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x.shape.length; ++i) {\n completePaddings.push([0, 0]);\n}\n\n const paddedX = padV2Config.kernelFunc({\ninputs: {x},\n backend,\n attrs: {paddings: completePaddings, constantValue: 0}) as TensorInfo;\n\n const reshapedPaddedShape = \n backend_util.getReshaped(paddedX.shape, blockSize, prod, false);\n\n const permutedReshapedPaddedPermutation = backend_util.getPermuted(\n reshapedPaddedShape.length,\nblockSize.length, false);\n\n const flattenShape = \n backend_util.getReshapedPermuted(paddedX.shape,blockSize, prod, false);\n\n const reshapeInputs: ReshapeInputs = {x: paddedX};\n const reshapeAttrs:\nReshapeAttrs = {shape: reshapedPaddedShape};\n\n const paddedXReshaped = \n reshape({inputs: reshapeInputs, backend, attrs: reshapeAttrs});\n\n const transposeInputs: TransposeInputs = {x: paddedXReshaped};\n const transposeAttrs:\nTransposeAttrs = {perm:\npermutedReshapedPaddedPermutation};\n const paddedXT = \n transpose({inputs: transposeInputs, backend,\natrs: transposeAttrs});\n\n const resultReshapeInputs: ReshapeInputs = {x: paddedXT};\n const resultReshapeAttrs: ReshapeAttrs = {shape: flattenShape};\n const result = reshape(\n {inputs:resultReshapeInputs, backend, attrs: resultReshapeAttrs});\n\n backend.disposeData(paddedX.dataId);\nbackend.disposeData(paddedXReshaped.dataId);\n backend.disposeData(paddedXT.dataId);\n\n return result;\n}\n\nexport const spaceToBatchNDConfig: KernelConfig = {\n kernelName: SpaceToBatchND,\nbackendName: 'wasm',\n kernelFunc: spaceToBatchND as {} as KernelFunc\n};\n","/*\n * @license\n *\nCopyright 2020 Google LLC. All Rights Reserved.\n *\nLicensed under\nthe Apache License, Version 2.0 (the "License");\n *\nyou may not use this file except in compliance with the\nLicense.\n *\nYou may obtain a copy of the License at\n *\nh\n *\nUnless required by applicable law or agreed to in writing, software\n *\ndistributed under the License is distributed\non an "AS IS" BASIS,\n *\nWITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or\nimplied.\n *\nSee the License for the specific language governing permissions and\n *\nlimitations under the\nLicense.\n */\n\n=====\n*\nimport {KernelConfig, KernelFunc, SplitV, SplitVAttr, SplitVInput, util} from '@tensorflow/tfjs-core';\nimport {BackendUtil} from '@tensorflow/tfjs-backend-wasm';\nimport {BackendWasm} from '../backend_wasm';\nimport {slice} from './Slice';\n\nexport function splitV(\n args: {inputs: SplitVInput[], attr: SplitVAttr, backend: BackendWasm}) {\nconst {inputs,\natrs, backend} = args;\nconst {x} = inputs;\nconst {numOrSizeSplits, axis} = atr;\n\nconst $axis =\nutil.parseAxisParam(axis, x.shape)[0];\n\nconst splitSizes = backend_util.prepareSplitSize(x, numOrSizeSplits,$axis);\nconst begin = new Array(x.shape.length).fill(0);\nconst size = x.shape.slice();\nreturn splitSizes.map(s=>{\nconst xSliceSize = [...size];\nxSliceSize[$axis] = s;\nconst xSlice =\nslice({inputs: {x}, attr:{begin, size: xSliceSize}, backend});\nbegin[$axis] += s;\nreturn xSlice;\n});\n}\n\nexport const\nsplitVConfig: KernelConfig = {\nkernelName: SplitV,\nbackendName: 'wasm',\n kernelFunc: splitV as {} as\nKernelFunc\n};\n","/*\n * @license\n *\nCopyright 2020 Google LLC. All Rights Reserved.\n *\nLicensed under the\nApache License, Version 2.0 (the "License");\n *\nyou may not use this file except in compliance with the\nLicense.\n *\nYou may obtain a copy of the License at\n *\nh\n *\nUnless required by applicable law or agreed to in writing, software\n *\ndistributed under the License is\ndistributed on an "AS IS" BASIS,\n *\nWITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either\nexpress or implied.\n *\nSee the License for the specific language governing permissions and\n *\nlimitations under\nthe License.\n */\n\n=====\n*\nimport {KernelConfig, KernelFunc, Step, StepAttr, StepInput, TensorInfo} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nimport {CppType} from './types';\nlet wasmStep:(xId: number, alpha: number, dtype: number, outId: number) =>\nvoid;\n\nfunction setup(backend:\nBackendWasm): void {\nwasms= backend.wasm.cwrap(Step, null /*void*/, [\n'number', // x_id\n'number', // alpha\n'number', // dtype\n'number', // out_id\n]);\n\nfunction step(\n args: {backend:\nBackendWasm, inputs: StepInput[], attr:
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StepsAttrs});\n TensorInfo {\n const {backend, inputs, attrs} = args;\n const {alpha} = attrs;\n const {x} = \ninputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const out = backend.makeOutput(x.shape,\nx.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmStep(xId, alpha, CppDType[x.dtype],\noutId);\n return out;\n}\n\nexport const stepConfig: KernelConfig = {\n kernelName: Step,\n backendName:\n'wasm',\n setupFunc: setup,\n kernelFunc: step as { } as KernelFunc\n};\n"},"/**\n * @license\n * Copyright 2020\nGoogle LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you\nmay not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,\nsoftware\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES\nOR CONDITIONS\nOF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions\nand\n * limitations under the License.\n */\n\n=====\n*\nimport {KernelConfig, Sqrt} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from\n'/unary_kernel';\nexport const sqrtConfig: KernelConfig = createUnaryKernelConfig(Sqrt);\n"},"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n\"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\nLicense at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or\nagreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\nthe specific language\n * governing permissions and\n * limitations under the License.\n */\n\n=====\n*\nimport {KernelConfig, Square} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from\n'/unary_kernel';\nexport const squareConfig: KernelConfig = createUnaryKernelConfig(Square);\n"},"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version\n2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a\ncopy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable\nlaw or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\nthe specific language governing permissions and\n * limitations under the License.\n */\n\n=====\n*\nimport {KernelConfig, SquaredDifference} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig}\nfrom '/binary_kernel';\nconst supportsFullBroadcast = true;\nexport const squaredDifferenceConfig: KernelConfig\n=\n createBinaryKernelConfig(SquaredDifference, supportsFullBroadcast);\n"},"/**\n * @license\n * Copyright\n2021 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you\nmay not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,\nsoftware\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\nOR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n * governing permissions and\n * limitations under the License.\n */\n\n* =====\n*\nimport {KernelConfig, KernelFunc, slice_util, StridedSlice, StridedSliceAttrs, StridedSliceInputs, TensorInfo,\nutil} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nimport {reshape} from\n './Reshape';\nimport {slice} from './Slice';\n\nlet wasmStridedSlice: (\n xId: number, xStridesBytes: Uint8Array,\nxRank: number,\n beginBytes: Uint8Array, endBytes: Uint8Array, stridesBytes: Uint8Array,\n outShapeBytes:\nUint8Array, outStridesBytes: Uint8Array,\n outShapeLength: number, outId: number) => void;\n\nfunction\nsetup(backend: BackendWasm): void {\n wasmStridedSlice = backend.wasm.cwrap(StridedSlice, null /*void*/, [\n
```

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'number', // xId\n 'array', // xStrides\n 'number', // xRank\n 'array', // beginBytes\n 'array', // endBytes\n
'array', // stridesBytes\n 'array', // outShapeBytes\n 'array', // outStridesBytes\n 'number',
// outShapeLength\n 'number', // outId\n]);\n\n\nexport function stridedSlice(args: {\n backend:
BackendWasm,\n inputs: StridedSliceInputs,\n attrs: StridedSliceAttrs\n}): TensorInfo {\n const {backend, inputs,
attrs} = args;\n const {x} = inputs;\n\n const {\n begin,\n end,\n strides,\n beginMask,\n endMask,\n
ellipsisMask,\n newAxisMask,\n shrinkAxisMask\n } = attrs;\n\n const {\n finalShapeSparse,\n
finalShape,\n isIdentity,\n sliceDim0,\n isSimpleSlice,\n begin: $begin,\n end: $end,\n strides: $strides\n
} =\n slice_util.sliceInfo(\n x.shape, begin, end, strides, beginMask, endMask, ellipsisMask,\n
newAxisMask, shrinkAxisMask);\n\n let result;\n\n if (isIdentity) {\n // Optimization #1, slice is a no-op plus
reshape\n result = reshape({inputs: {x}, backend, attrs: {shape: finalShape}});\n } else if (sliceDim0 ||
isSimpleSlice) {\n // Optimization #2, slice is memory contiguous
(only occurs in dim 0)\n util.assert(\n x.shape.length >= 1,\n () => `Input must have rank at least 1, got:
${x.shape.length}`);\n\n const size = slice_util.computeOutShape($begin, $end, $strides);\n // To tolerate
begin[0] > end[0] (a 0-output slice), we min(begin, end).\n\n const sliced = slice({inputs: {x}, backend, attrs:
{begin: $begin, size}});\n\n result =\n reshape({inputs: {x: sliced}, backend, attrs: {shape: finalShape}});\n
backend.disposeData(sliced.dataId);\n } else {\n const out = backend.makeOutput(finalShapeSparse,
'float32');\n\n const xId = backend.dataIdMap.get(x.dataId).id;\n const xStridesBytes =\n new
Uint8Array(new Int32Array(util.computeStrides(x.shape)).buffer);\n const beginBytes = new Uint8Array(new
Int32Array($begin).buffer);\n const endBytes = new Uint8Array(new Int32Array($end).buffer);\n const
stridesBytes = new Uint8Array(new Int32Array($strides).buffer);\n\n const outputShapeBytes =\n
new Uint8Array(new Int32Array(finalShapeSparse).buffer);\n const outStridesBytes = new Uint8Array(\n
new Int32Array(util.computeStrides(finalShapeSparse)).buffer);\n const outId =
backend.dataIdMap.get(out.dataId).id;\n\n wasmStridedSlice(\n xId, xStridesBytes, x.shape.length,
beginBytes, endBytes, stridesBytes,\n outputShapeBytes, outStridesBytes, finalShapeSparse.length, outId);\n\n
result = reshape({inputs: {x: out}, backend, attrs: {shape: finalShape}});\n\n backend.disposeData(out.dataId);\n
}\n\n return result;\n}\n\n\nexport const stridedSliceConfig: KernelConfig = {\n kernelName: StridedSlice,\n
backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: stridedSlice as { } as KernelFunc\n};\n\n"/**\n *
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2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License
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writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT
WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific
language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {backend_util, KernelConfig, KernelFunc, Sum, SumAttrs, SumInputs, TensorInfo, util} from
'@tensorflow/tfjs-core';\n\nimport {BackendWasm} from './backend_wasm';\n\nimport
{permuteAxesAndTranspose} from './kernel_utils';\n\nimport {CppType} from './types';\n\nlet wasmSum: (xId:
number, reduceSize: number, dtype: number, outId: number) =>\n void;\n\nfunction setup(backend:
BackendWasm): void {\n wasmSum = backend.wasm.cwrap(Sum, null /*void*/, [\n 'number', // input_id\n
'number', // reduce_size\n
'number', // dtype\n 'number', // out_id\n]);\n\n\nfunction sum(args: {backend: BackendWasm, inputs:
SumInputs, attrs: SumAttrs}): TensorInfo {\n const {backend, inputs, attrs} = args;\n const {axis, keepDims} =
attrs;\n const {x} = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n let inputId = xId;\n let input =
x;\n\n const {transposed, axes, originalAxes, inputWasTransposed} =\n permuteAxesAndTranspose(x, axis,
backend);\n\n let reductionAxes = axes;\n if (inputWasTransposed) {\n const transposedId =
backend.dataIdMap.get(transposed.dataId).id;\n if (transposedId !== xId) {\n // transpose was not a no-op. We
will need to dispose of this\n // once we are done.\n input = transposed;\n inputId = transposedId;\n

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reductionAxes = backend_util.getInnerMostAxes(\n reductionAxes.length, input.shape.length);\n }\n }\n\nbackend_util.assertAxesAreInnerMostDims(\n 'sum', reductionAxes, input.shape.length);\n \n const [outShape, reduceShape] =\n backend_util.computeOutAndReduceShapes(input.shape, reductionAxes);\n const reduceSize = util.sizeFromShape(reduceShape);\n \n const out = backend.makeOutput(outShape,\n input.dtype);\n if (util.sizeFromShape(input.shape) !== 0) {\n const outId =\n backend.dataIdMap.get(out.dataId).id;\n wasmSum(inputId, reduceSize, CppDType[out.dtype], outId);\n }\n \n if (inputWasTransposed) {\n // dispose of the transposed tensor.\n backend.disposeData(transposed.dataId);\n }\n \n if (keepDims) {\n // reshape\n const newShape = backend_util.expandShapeToKeepDim(out.shape,\n originalAxes);\n out.shape = newShape;\n }\n \n return out;\n}\n\nexport const sumConfig: KernelConfig = {\n kernelName: Sum,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: sum as { } as\n KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the\n Apache License, Version 2.0 (the "License");\n * you may not\n use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,\n software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES\n OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n governing permissions and\n * limitations under the License.\n *\n =====\n\n */\nimport {KernelConfig, Sub} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from\n './binary_kernel';\nconst supportsFullBroadcast = true;\nexport const subConfig: KernelConfig =\n createBinaryKernelConfig(Sub, supportsFullBroadcast);\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All\n Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this\n file except\n in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,\n software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES\n OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n governing permissions and\n * limitations under the License.\n *\n =====\n\n */\nimport {KernelConfig, KernelFunc, Tile, TileAttrs, TileInputs} from '@tensorflow/tfjs-core';\nimport\n {BackendWasm} from './backend_wasm';\nimport {CppType} from './types';\n\nlet wasmTile: (\n xId:\n number, xShape: Uint8Array, xShapeSize: number, newShape: Uint8Array,\n newShapeSize: number, dtype:\n number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmTile =\n backend.wasm.cwrap(Tile, null /* void */, [\n 'number',\n // x_id\n 'array', // x_shape\n 'number', // x_shape.length\n 'array', // new_shape\n 'number', //\n new_shape.length\n 'number' // out_id\n]);\n\n function tile(\n args: {inputs: TileInputs, backend:\n BackendWasm, attrs: TileAttrs}) {\n const {inputs, backend, attrs} = args;\n const {x} = inputs;\n const xId =\n backend.dataIdMap.get(x.dataId).id;\n const {reps} = attrs;\n const newShape: number[] = new\n Array(x.shape.length);\n for (let i = 0; i < newShape.length; i++) {\n newShape[i] = x.shape[i] * reps[i];\n }\n const xShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);\n const newShapeBytes = new\n Uint8Array(new Int32Array(newShape).buffer);\n const out = backend.makeOutput(newShape, x.dtype);\n const\n outId = backend.dataIdMap.get(out.dataId).id;\n wasmTile(\n xId, xShapeBytes, x.shape.length,\n newShapeBytes, newShape.length,\n CppDType[out.dtype], outId);\n return out;\n }\n\n export const tileConfig:\n KernelConfig\n = {\n kernelName: Tile,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: tile as { } as\n KernelFunc\n };\n\n "/**\n * @license\n * Copyright 2021 Google LLC. All Rights Reserved.\n * Licensed under the\n Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the\n License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n *

```

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=====
*\nimport {KernelConfig, Tan} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from
'./unary_kernel';\n\nexport const tanConfig: KernelConfig =
 createUnaryKernelConfig(Tan);\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in
compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*\nimport {KernelConfig, Tanh} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from
'./unary_kernel';\n\nexport const tanhConfig: KernelConfig = createUnaryKernelConfig(Tanh);\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All
Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {KernelConfig, KernelFunc, TensorInfo, TopK, TopKAttrs, TopKInputs} from '@tensorflow/tfjs-
core';\n\nimport {BackendWasm} from './backend_wasm';\n\nimport {CppType} from './types';\n\nlet wasmTopK:
(\n xId: number, xShapeBytes: Uint8Array, xShapeLength: number,\n xDtype: CppDType, k: number, sorted:
boolean, outValuesId:
number,\n outIndicesId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmTopK =
backend.wasm.cwrap(TopK, null /* void */, [\n 'number', // xId\n 'array', // x.shape\n 'number', //
x.shape.length\n 'number', // x.dtype\n 'number', // k\n 'bool', // sorted\n 'number', // outValuesId\n 'number', // outIndicesId\n]);\n\n export const topk:\n (args: {inputs: TopKInputs, backend: BackendWasm,
attrs: TopKAttrs}) =>\n TensorInfo[] | TensorInfo = ({inputs, backend, attrs}) => {\n const {x} = inputs;\n const {k, sorted} = attrs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const xShapeBytes
= new Uint8Array(new Int32Array(x.shape).buffer);\n const outputShape = x.shape.slice();\n outputShape[outputShape.length - 1] = k;\n const outValues = backend.makeOutput(outputShape, x.dtype);\n const outValuesId = backend.dataIdMap.get(outValues.dataId).id;\n const outIndices = backend.makeOutput(outputShape, 'int32');\n const outIndicesId =
backend.dataIdMap.get(outIndices.dataId).id;\n wasmTopK(\n xId, xShapeBytes, x.shape.length,
CppType[x.dtype], k, sorted,\n outValuesId, outIndicesId);\n return [outValues, outIndices];\n };\n\n export const topKConfig: KernelConfig = {\n kernelName: TopK,\n backendName: 'wasm',\n setupFunc:
setup,\n kernelFunc: topk as { } as KernelFunc,\n };\n\n"/**\n * @license\n * Copyright 2021 Google LLC. All
Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS
```

OF ANY KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*

```
=====
*\n\nimport { KernelConfig, KernelFunc, TensorInfo, Transform, TransformAttrs, TransformInputs, util } from
'@tensorflow/tfjs-core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nlet wasmTransform: (\n imageId:
number, transformsId: number, isBatchTransform: boolean,\n batch: number, outHeight: number, outWidth:
number, numChannels: number,\n imageWidth: number, imageHeight: number, strides: Uint8Array,\n stridesLength: number, interpolationModeId: number, fillModeId: number,\n fillValue: number, outId: number)
=> void;\n\nfunction setup(backend: BackendWasm): void {\n wasmTransform = backend.wasm.cwrap(Transform,
null /*void*/, [\n 'number', // imageId\n 'number', // transformsId\n 'bool', // isBatchTransform\n 'number', // batch\n 'number', // outHeight\n 'number', // outWidth\n 'number', // numChannels\n 'number', // imageWidth\n 'number', // imageHeight\n 'array', // strides\n 'number', // stridesLength\n 'number', // interpolationModeId\n 'number', // fillModeId\n 'number', // fillValue\n 'number' // outId\n]);\n\n function transform(\n args: {\n backend: BackendWasm, inputs: TransformInputs, attrs:
TransformAttrs\n }):\n TensorInfo {\n const { backend, inputs, attrs } = args;\n const { image, transforms } = inputs;\n const { interpolation, fillMode, fillValue, outputShape } = attrs;\n const [batch, imageHeight, imageWidth,
numChannels] = image.shape;\n const [outHeight, outWidth] =\n outputShape != null ? outputShape :
[imageHeight, imageWidth];\n const outShape =\n [batch, outHeight, outWidth,\n numChannels] as
[number, number, number, number];\n const strides =\n new Uint8Array(new
Int32Array(util.computeStrides(image.shape)).buffer);\n\n const out = backend.makeOutput(outShape, image.dtype);\n const outId =
backend.dataIdMap.get(out.dataId).id;\n\n const imageData = backend.dataIdMap.get(image.dataId);\n const
imageId = imageData.id;\n\n const transformsData = backend.dataIdMap.get(transforms.dataId);\n const
transformsId = transformsData.id;\n\n const interpolationModeId = interpolation === 'nearest' ? 1 : 2;\n let
fillModeId;\n switch (fillMode) {\n case 'constant':\n fillModeId = 1;\n break;\n case 'reflect':\n fillModeId = 2;\n break;\n case 'wrap':\n fillModeId = 3;\n break;\n case 'nearest':\n fillModeId = 4;\n break;\n default:\n fillModeId = 1;\n break;\n }\n\n wasmTransform(\n imageId, transformsId,
(transforms.shape[0] > 1), batch, outHeight,\n outWidth, numChannels, imageWidth, imageHeight, strides,\n image.shape.length - 1, interpolationModeId, fillModeId, fillValue,\n outId);\n\n return out;\n }\n\n export const transformConfig: KernelConfig = {\n kernelName: Transform,\n backendName:
'wasm',\n setupFunc: setup,\n kernelFunc: transform as { } as KernelFunc\n };
\n /**\n * @license\n * Copyright
2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n *
you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n *
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n */
\n }
\n}
```

```
=====
*\n\nimport { KernelConfig, KernelFunc, TensorInfo, Unpack, UnpackAttrs, UnpackInputs } from
'@tensorflow/tfjs-core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nimport { slice } from
'./Slice';\n\nfunction unpack(\n args: {\n inputs: UnpackInputs, backend: BackendWasm, attrs: UnpackAttrs\n }):\n TensorInfo[] {\n const { inputs, backend, attrs } = args;\n const { value } = inputs;\n let { axis } = attrs;\n\n if (axis <
0) {\n axis += value.shape.length;\n }\n\n const numOutputs = value.shape[axis];\n const rank =
value.shape.length;\n const outShape: number[] = new Array(rank - 1);\n let outIndex = 0;\n for (let i = 0; i < rank;\n i++) {\n if (i !== axis) {\n outShape[outIndex++] = value.shape[i];\n }\n }\n\n const outs: TensorInfo[] = new
Array(numOutputs);\n const begin = new Array(rank).fill(0);\n const size = value.shape.slice();\n size[axis] = 1;\n for (let i = 0; i < outs.length; i++) {\n begin[axis] = i;\n outs[i] = slice({ inputs: { x: value }, attrs: { begin, size },
backend });\n }\n\n return outs.map(({ dataId, dtype }) => ({ dataId, dtype,
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shape: outShape}});\n\n\nexport const unpackConfig: KernelConfig = {\n kernelName: Unpack,\n backendName: 'wasm',\n kernelFunc: unpack as { } as KernelFunc,\n};\n\n\n"/\*\*\n \* @license\n \* Copyright 2020 Google LLC. All Rights Reserved.\n \* Licensed under the Apache License, Version 2.0 (the "License");\n \* you may not use this file except in compliance with the License.\n \* You may obtain a copy of the License at\n \* \n \* http://www.apache.org/licenses/LICENSE-2.0\n \* \n \* Unless required by applicable law or agreed to in writing, software\n \* distributed under the License is distributed on an "AS IS" BASIS,\n \* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*/

===== \n \*\n//

We explicitly import the modular kernels so they get registered in the\n// global registry when we compile the library. A modular build would replace\n// the contents of this file and import only the kernels that are needed.\nimport { KernelConfig, registerKernel } from '@tensorflow/tfjs-core';\nimport { fusedMatMulConfig } from './kernels/\_FusedMatMul';\nimport { absConfig } from './kernels/Abs';\nimport { addConfig } from './kernels/Add';\nimport { addNConfig } from './kernels/AddN';\nimport { allConfig } from './kernels/All';\nimport { anyConfig } from './kernels/Any';\nimport { argMaxConfig } from './kernels/ArgMax';\nimport { avgPoolConfig } from './kernels/AvgPool';\nimport { batchMatMulConfig } from './kernels/BatchMatMul';\nimport { batchToSpaceNDConfig } from './kernels/BatchToSpaceND';\nimport { castConfig } from './kernels/Cast';\nimport { ceilConfig } from './kernels/Ceil';\nimport { clipByValueConfig } from './kernels/ClipByValue';\nimport { concatConfig } from './kernels/Concat';\nimport { conv2DConfig } from './kernels/Conv2D';\nimport { conv2DBackpropInputConfig } from './kernels/Conv2DBackpropInput';\nimport { cosConfig } from './kernels/Cos';\nimport { coshConfig } from './kernels/Cosh';\nimport { cropAndResizeConfig } from './kernels/CropAndResize';\nimport { cumsumConfig } from './kernels/Cumsum';\nimport { depthToSpaceConfig } from './kernels/DepthToSpace';\nimport { depthwiseConv2dNativeConfig } from './kernels/DepthwiseConv2dNative';\nimport { eluConfig } from './kernels/Elu';\nimport { equalConfig } from './kernels/Equal';\nimport { expConfig } from './kernels/Exp';\nimport { expandDimsConfig } from './kernels/ExpandDims';\nimport { fillConfig } from './kernels/Fill';\nimport { flipLeftRightConfig } from './kernels/FlipLeftRight';\nimport { floorConfig } from './kernels/Floor';\nimport { floorDivConfig } from './kernels/FloorDiv';\nimport { fusedBatchNormConfig } from './kernels/FusedBatchNorm';\nimport { fusedConv2DConfig } from './kernels/FusedConv2D';\nimport { fusedDepthwiseConv2DConfig } from './kernels/FusedDepthwiseConv2D';\nimport { gatherNdConfig } from './kernels/GatherNd';\nimport { gatherV2Config } from './kernels/GatherV2';\nimport { greaterConfig } from './kernels/Greater';\nimport { greaterEqualConfig } from './kernels/GreaterEqual';\nimport { identityConfig } from './kernels/Identity';\nimport { leakyReluConfig } from './kernels/LeakyRelu';\nimport { lessConfig } from './kernels/Less';\nimport { lessEqualConfig } from './kernels/LessEqual';\nimport { logConfig } from './kernels/Log';\nimport { logicalAndConfig } from './kernels/LogicalAnd';\nimport { maxConfig } from './kernels/Max';\nimport { maximumConfig } from './kernels/Maximum';\nimport { maxPoolConfig } from './kernels/MaxPool';\nimport { meanConfig } from './kernels/Mean';\nimport { minConfig } from './kernels/Min';\nimport { minimumConfig } from './kernels/Minimum';\nimport { mirrorPadConfig } from './kernels/MirrorPad';\nimport { multiplyConfig } from './kernels/Multiply';\nimport { negConfig } from './kernels/Neg';\nimport { nonMaxSuppressionV3Config } from './kernels/NonMaxSuppressionV3';\nimport { nonMaxSuppressionV4Config } from './kernels/NonMaxSuppressionV4';\nimport { nonMaxSuppressionV5Config } from './kernels/NonMaxSuppressionV5';\nimport { notEqualConfig } from './kernels/NotEqual';\nimport { oneHotConfig } from './kernels/OneHot';\nimport { onesLikeConfig } from './kernels/OnesLike';\nimport { packConfig } from './kernels/Pack';\nimport { padV2Config } from './kernels/PadV2';\nimport { powConfig } from './kernels/Pow';\nimport { preluConfig } from './kernels/Prelu';\nimport { prodConfig } from './kernels/Prod';\nimport { rangeConfig } from './kernels/Range';\nimport { realDivConfig } from './kernels/RealDiv';\nimport { reluConfig } from './kernels/Relu';\nimport { relu6Config } from

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'./kernels/Relu6';\nimport {reshapeConfig} from './kernels/Reshape';\nimport {resizeBilinearConfig} from
'./kernels/ResizeBilinear';\nimport {reverseConfig} from './kernels/Reverse';\nimport {rotateWithOffsetConfig}
from './kernels/RotateWithOffset';\nimport {roundConfig} from './kernels/Round';\nimport {rsqrtConfig} from
'./kernels/Rsqrt';\nimport {scatterNdConfig} from './kernels/ScatterNd';\nimport
{selectConfig} from './kernels/Select';\nimport {sigmoidConfig} from './kernels/Sigmoid';\nimport {sinConfig}
from './kernels/Sin';\nimport {sliceConfig} from './kernels/Slice';\nimport {softmaxConfig} from
'./kernels/Softmax';\nimport {spaceToBatchNDConfig} from './kernels/SpaceToBatchND';\nimport {splitVConfig}
from './kernels/SplitV';\nimport {sqrtConfig} from './kernels/Sqrt';\nimport {squareConfig} from
'./kernels/Square';\nimport {squaredDifferenceConfig} from './kernels/SquaredDifference';\nimport {stepConfig}
from './kernels/Step';\nimport {stridedSliceConfig} from './kernels/StridedSlice';\nimport {subConfig} from
'./kernels/Sub';\nimport {sumConfig} from './kernels/Sum';\nimport {tanConfig} from './kernels/Tan';\nimport
{tanhConfig} from './kernels/Tanh';\nimport {tileConfig} from './kernels/Tile';\nimport {topKConfig} from
'./kernels/TopK';\nimport {transformConfig} from './kernels/Transform';\nimport {transposeConfig} from
'./kernels/Transpose';\nimport
{unpackConfig} from './kernels/Unpack';\nimport {zerosLikeConfig} from './kernels/ZerosLike';\n\n// List all
kernel configs here\nconst kernelConfigs: KernelConfig[] = [\n absConfig,\n addConfig,\n addNConfig,\n
allConfig,\n anyConfig,\n argMaxConfig,\n avgPoolConfig,\n batchMatMulConfig,\n batchToSpaceNDConfig,\n
castConfig,\n ceilConfig,\n clipByValueConfig,\n concatConfig,\n conv2DConfig,\n
conv2DBackpropInputConfig,\n cosConfig,\n coshConfig,\n cropAndResizeConfig,\n cumsumConfig,\n
depthToSpaceConfig,\n depthwiseConv2dNativeConfig,\n eluConfig,\n equalConfig,\n expConfig,\n
expandDimsConfig,\n fillConfig,\n flipLeftRightConfig,\n floorConfig,\n floorDivConfig,\n
fusedMatMulConfig,\n fusedBatchNormConfig,\n fusedConv2DConfig,\n fusedDepthwiseConv2DConfig,\n
gatherNdConfig,\n gatherV2Config,\n greaterConfig,\n greaterEqualConfig,\n identityConfig,\n
leakyReluConfig,\n lessConfig,\n lessEqualConfig,\n logConfig,\n logicalAndConfig,\n
maxConfig,\n maximumConfig,\n maxPoolConfig,\n meanConfig,\n minConfig,\n minimumConfig,\n
mirrorPadConfig,\n multiplyConfig,\n negConfig,\n nonMaxSuppressionV3Config,\n
nonMaxSuppressionV4Config,\n nonMaxSuppressionV5Config,\n notEqualConfig,\n oneHotConfig,\n
onesLikeConfig,\n packConfig,\n padV2Config,\n powConfig,\n preluConfig,\n prodConfig,\n rangeConfig,\n
realDivConfig,\n reluConfig,\n relu6Config,\n reshapeConfig,\n resizeBilinearConfig,\n reverseConfig,\n
rotateWithOffsetConfig,\n rsqrtConfig,\n roundConfig,\n scatterNdConfig,\n selectConfig,\n sigmoidConfig,\n
sinConfig,\n sliceConfig,\n softmaxConfig,\n spaceToBatchNDConfig,\n splitVConfig,\n sqrtConfig,\n
squareConfig,\n squaredDifferenceConfig,\n stepConfig,\n stridedSliceConfig,\n subConfig,\n sumConfig,\n
tanConfig,\n tanhConfig,\n tileConfig,\n topKConfig,\n transformConfig,\n transposeConfig,\n unpackConfig,\n
zerosLikeConfig\n];\n\nfor (const kernelConfig of kernelConfigs)
{\n registerKernel(kernelConfig);\n}\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {KernelConfig, KernelFunc, ZerosLike, ZerosLikeInputs} from '@tensorflow/tfjs-core';\nimport
{BackendWasm} from './backend_wasm';\n\nfunction zerosLike(args: {inputs: ZerosLikeInputs, backend:
BackendWasm}) {\n
 const {inputs: {x}, backend} = args;\n const out = backend.makeOutput(x.shape, x.dtype);\n const outVals =
backend.typedArrayFromHeap(out);\n outVals.fill(0);\n return out;\n}\n\nexport const zerosLikeConfig:
KernelConfig = {\n kernelName: ZerosLike,\n backendName: 'wasm',\n kernelFunc: zerosLike as {} as

```



KernelFunc,\n};\n","\*\*\n \* @license\n \* Copyright 2020 Google LLC. All Rights Reserved.\n \* Licensed under the Apache License, Version 2.0 (the \"License\");\n \* you may not use this file except in compliance with the License.\n \* You may obtain a copy of the License at\n \* http://www.apache.org/licenses/LICENSE-2.0\n \* Unless required by applicable law or agreed to in writing, software\n \* distributed under the License is distributed on an \"AS IS\" BASIS,\n \* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*

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=====
*\n\nimport {env} from '@tensorflow/tfjs-core';\n\nconst ENV = env();\n\n/**\n * True if SIMD is supported.\n *\n * From: https://github.com/GoogleChromeLabs/wasm-feature-detect\n * ENV.registerFlag(\n // This typed array passed in to WebAssembly.validate is WebAssembly binary\n // code. In this case it is a small program that contains SIMD\n // instructions.\n 'WASM_HAS_SIMD_SUPPORT', async () => WebAssembly.validate(new Uint8Array([\n 0, 97, 115, 109, 1, 0, 0, 0, 1, 4, 1, 96, 0, 0, 3,\n 2, 1, 0, 10, 9, 1, 7, 0, 65, 0, 253, 15, 26, 11\n]));\n\n /**\n * True if threads are supported.\n *\n * From: https://github.com/GoogleChromeLabs/wasm-feature-detect\n * ENV.registerFlag('WASM_HAS_MULTITHREAD_SUPPORT', async () => {\n // TODO(annxingyuan): Enable node support once this is resolved.\n // https://github.com/tensorflow/tfjs/issues/3830\n if (ENV.get('IS_NODE')) {\n return false;\n }\n\n try {\n // Test for transferability of SABs (needed for Firefox)\n // https://groups.google.com/forum/#!msg/mozilla.dev.platform/IHkBZIHETpA/dwsMNchWEQAJ\n new MessageChannel().port1.postMessage(new SharedArrayBuffer(1));\n // This typed array is a WebAssembly program containing threaded\n // instructions.\n return WebAssembly.validate(new Uint8Array([\n 0, 97, 115, 109, 1, 0, 0, 0, 1, 4, 1, 96, 0, 0, 3, 2, 1, 0, 5,\n 4, 1, 3, 1, 10, 11, 1, 9, 0, 65, 0, 254, 16, 2, 0, 26, 11\n]));\n } catch (e) {\n return false;\n }\n\n\n\"nvar WasmBackendModuleThreadedSimd = (function() {\n var _scriptDir = typeof document !== 'undefined' && document.currentScript ? document.currentScript.src : undefined;\n if (typeof __filename !== 'undefined') _scriptDir = _scriptDir || __filename;\n return (function(WasmBackendModuleThreadedSimd) {\n WasmBackendModuleThreadedSimd = WasmBackendModuleThreadedSimd || {};\n\nfunction\nGROWABLE_HEAP_I8(){if(wasmMemory.buffer!=buffer){updateGlobalBufferAndViews(wasmMemory.buffer)}\nreturn\nHEAP8}function\nGROWABLE_HEAP_U8(){if(wasmMemory.buffer!=buffer){updateGlobalBufferAndViews(wasmMemory.buffer)}\nreturn HEAPU8}function\nGROWABLE_HEAP_I32(){if(wasmMemory.buffer!=buffer){updateGlobalBufferAndViews(wasmMemory.buffer)}\nreturn HEAP32}function\nGROWABLE_HEAP_U32(){if(wasmMemory.buffer!=buffer){updateGlobalBufferAndViews(wasmMemory.buffer)}\nreturn HEAPU32}function\nGROWABLE_HEAP_F64(){if(wasmMemory.buffer!=buffer){updateGlobalBufferAndViews(wasmMemory.buffer)}\nreturn HEAPF64}var Module=typeof\nWasmBackendModuleThreadedSimd!=\\\"undefined\\\"?WasmBackendModuleThreadedSimd:{};var\nreadyPromiseResolve,readyPromiseReject;Module[\\\"ready\\\"]=new\nPromise(function(resolve,reject){readyPromiseResolve=resolve;readyPromiseReject=reject});var\nmoduleOverrides={};var key;for(key in\nModule){if(Module.hasOwnProperty(key)){moduleOverrides[key]=Module[key]}}var arguments_=[];var\nthisProgram=\\\"./this.program\\\";var quit_=function(status,toThrow){throw\ntoThrow};var ENVIRONMENT_IS_WEB=false;var ENVIRONMENT_IS_WORKER=false;var\nENVIRONMENT_IS_NODE=false;var ENVIRONMENT_IS_SHELL=false;ENVIRONMENT_IS_WEB=typeof\nwindow===\\\"object\\\";ENVIRONMENT_IS_WORKER=typeof\nimportScripts===\\\"function\\\";ENVIRONMENT_IS_NODE=typeof process===\\\"object\\\"&&typeof
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process.versions===\"object\"&&typeof
process.versions.node===\"string\";ENVIRONMENT_IS_SHELL=!ENVIRONMENT_IS_WEB&&!ENVIRONM
ENT_IS_NODE&&!ENVIRONMENT_IS_WORKER;var
ENVIRONMENT_IS_PTHREAD=Module[\"ENVIRONMENT_IS_PTHREAD\"]||false;if(ENVIRONMENT_IS_P
THREAD){buffer=Module[\"buffer\"]}var scriptDirectory=\\\";function
locateFile(path){if(Module[\"locateFile\"]){return Module[\"locateFile\"](path,scriptDirectory)}return
scriptDirectory+path}var read_,readAsync,readBinary,setWindowTitle;var nodeFS;var
nodePath;if(ENVIRONMENT_IS_NODE){if(ENVIRONMENT_IS_WORKER){scriptDirectory=require(\\\"path\\\").
dirname(scriptDirectory)+\\\"^\"}else{scriptDirectory=__dirname+\\\"^\"}read_=function
shell_read(filename,binary){if(!nodeFS)nodeFS=require(\\\"fs\\\");if(!nodePath)nodePath=require(\\\"path\\\");filename=n
odePath[\\\"normalize\\\"](filename);return
nodeFS[\\\"readFileSync\\\"](filename,binary?null:\\\"utf8\\\");readBinary=function readBinary(filename){var
ret=read_(filename,true);if(!ret.buffer){ret=new Uint8Array(ret)}assert(ret.buffer);return
ret};if(process[\\\"argv\\\"].length>1){thisProgram=process[\\\"argv\\\"]&[1].replace(/\\\\\\\\\\\\g,\\\"^\\\")}arguments_=process[\\\"arg
v\\\"].slice(2);process[\\\"on\\\"](\\\"uncaughtException\\\",function(ex){if(!(ex instanceof ExitStatus)){throw
ex}});process[\\\"on\\\"](\\\"unhandledRejection\\\",abort);quit_=function(status){process[\\\"exit\\\"](status)};Module[\\\"insp
ect\\\"]=function(){return\\\"[Emscripten Module object]\\\"};var
nodeWorkerThreads;try{nodeWorkerThreads=require(\\\"worker_threads\\\")}catch(e){console.error(\\\"The
\\\"worker_threads\\\" module is not supported in this node.js build - perhaps a newer version is needed?\\\");throw
e}global.Worker=nodeWorkerThreads.Worker}else if(ENVIRONMENT_IS_SHELL){if(typeof
read!=\\\"undefined\\\"){read_=function shell_read(f){return read(f)} }readBinary=function readBinary(f){var
data;if(typeof readbuffer===\\\"function\\\"){return new
Uint8Array(readbuffer(f))}data=read(f,\\\"binary\\\");assert(typeof data===\\\"object\\\");return data};if(typeof
scriptArgs!=\\\"undefined\\\"){arguments_=scriptArgs}else if(typeof
arguments!=\\\"undefined\\\"){arguments_=arguments}if(typeof
quit===\\\"function\\\"){quit_=function(status){quit(status)}}if(typeof print!=\\\"undefined\\\"){if(typeof
console===\\\"undefined\\\")console={};console.log=print;console.warn=console.error=typeof
printErr!=\\\"undefined\\\"?printErr:print}}else
if(ENVIRONMENT_IS_WEB||ENVIRONMENT_IS_WORKER){if(ENVIRONMENT_IS_WORKER){scriptDire
ctory=self.location.href}else if(typeof
document!=\\\"undefined\\\"&&document.currentScript){scriptDirectory=document.currentScript.src}if(typeof
_scriptDir !=\\\"undefined\\\" &&
_scriptDir){scriptDirectory=_scriptDir}if(scriptDirectory.indexOf(\\\"blob:\\\")!=0){scriptDirectory=scriptDirectory.s
ubstr(0,scriptDirectory.lastIndexOf(\\\"^\\")+1)}else{scriptDirectory=\\\"}\\\"}if(ENVIRONMENT_IS_NODE){read_=fun
ction
shell_read(filename,binary){if(!nodeFS)nodeFS=require(\\\"fs\\\");if(!nodePath)nodePath=require(\\\"path\\\");filename=n
odePath[\\\"normalize\\\"](filename);return
nodeFS[\\\"readFileSync\\\"](filename,binary?null:\\\"utf8\\\");readBinary=function readBinary(filename){var
ret=read_(filename,true);if(!ret.buffer){ret=new Uint8Array(ret)}assert(ret.buffer);return
ret}}else{read_=function(url){var xhr=new XMLHttpRequest;xhr.open(\\\"GET\\\",url,false);xhr.send(null);return
xhr.responseText};if(ENVIRONMENT_IS_WORKER){readBinary=function(url){var xhr=new
XMLHttpRequest;xhr.open(\\\"GET\\\",url,false);xhr.responseType=\\\"arraybuffer\\\";xhr.send(null);return new
Uint8Array(xhr.response)}}readAsync=function(url,onload,onerror){var xhr=new
XMLHttpRequest;xhr.open(\\\"GET\\\",url,true);xhr.responseType=\\\"arraybuffer\\\";xhr.onload=function(){if(xhr.status
==200||xhr.status==0&&xhr.response){onload(xhr.response);return}onerror();}xhr.onerror=onerror;xhr.send(null)}
}setWindowTitle=function(title){document.title=title}}else{if(ENVIRONMENT_IS_NODE){if(typeof
performance===\\\"undefined\\\"){global.performance=require(\\\"perf_hooks\\\").performance}}var
out=Module[\\\"print\\\"]||console.log.bind(console);var err=Module[\\\"printErr\\\"]||console.warn.bind(console);for(key

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in

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moduleOverrides){if(moduleOverrides.hasOwnProperty(key)){Module[key]=moduleOverrides[key]}}moduleOverr
ides=null;if(Module["arguments\"])arguments_=Module["arguments\"];if(Module["thisProgram\"])thisProgram=
Module["thisProgram\"];if(Module["quit\"])quit_=Module["quit\"];function
warnOnce(text){if(!warnOnce.shown)warnOnce.shown={};if(!warnOnce.shown[text]){warnOnce.shown[text]=1;er
r(text)}}var Atomics_load=Atomics.load;var Atomics_store=Atomics.store;var
Atomics_compareExchange=Atomics.compareExchange;var
wasmBinary;if(Module["wasmBinary\"])wasmBinary=Module["wasmBinary\"];var
noExitRuntime=Module["noExitRuntime\"]||true;if(typeof WebAssembly!=="object"){abort("no
native wasm support detected")}var wasmMemory;var wasmModule;var ABORT=false;var
EXITSTATUS;function assert(condition,text){if(!condition){abort("Assertion failed: "+text)}}function
getCFunc(ident){var func=Module["_"+ident];assert(func,"Cannot call unknown function "+ident+", make sure
it is exported");return func}function ccall(ident,returnType,argTypes,args,opts){var
toC={"string":function(str){var ret=0;if(str!==null&&str!==undefined&&str!==0){var
len=(str.length<<2)+1;ret=stackAlloc(len);stringToUTF8(str,ret,len)}return ret},"array":function(arr){var
ret=stackAlloc(arr.length);writeArrayToMemory(arr,ret);return ret}};function
convertReturnValue(ret){if(returnType==="string")return UTF8ToString(ret);if(returnType==="boolean")return
Boolean(ret);return ret}var func=getCFunc(ident);var cArgs=[];var stack=0;if(args){for(var
i=0;i<args.length;i++){var
converter=toC[argTypes[i]];if(converter){if(stack===0)stack=stackSave();cArgs[i]=converter(args[i])}else{cArgs[i
]=args[i]}}var
ret=func.apply(null,cArgs);ret=convertReturnValue(ret);if(stack!==0)stackRestore(stack);return ret}function
cwrap(ident,returnType,argTypes,opts){argTypes=argTypes||[];var
numericArgs=argTypes.every(function(type){return type==="number"});var
numericRet=returnType!=="string";if(numericRet&&numericArgs&&!opts){return getCFunc(ident)}return
function(){return ccall(ident,returnType,argTypes,arguments,opts)}}function
UTF8ArrayToString(heap,idx,maxBytesToRead){var endIdx=idx+maxBytesToRead;var
str="";while(!(idx>=endIdx)){var u0=heap[idx++];if(!u0)return
str;if(!(u0&128)){str+=String.fromCharCode(u0);continue}var
u1=heap[idx++]&63;if((u0&224)==192){str+=String.fromCharCode((u0&31)<<6|u1);continue}var
u2=heap[idx++]&63;if((u0&240)==224){u0=(u0&15)<<12|u1<<6|u2}else{u0=(u0&7)<<18|u1<<12|u2<<6|heap[id
x++]&63;if(u0<65536){str+=String.fromCharCode(u0)}else{var ch=u0-
65536;str+=String.fromCharCode(55296|ch>>10,56320|ch&1023)}}return str}function
UTF8ToString(ptr,maxBytesToRead){return
ptr?UTF8ArrayToString(GROWABLE_HEAP_U8(),ptr,maxBytesToRead):""}function
stringToUTF8Array(str,heap,outIdx,maxBytesToWrite){if(!(maxBytesToWrite>0))return 0;var startIdx=outIdx;var
endIdx=outIdx+maxBytesToWrite-1;for(var i=0;i<str.length;++i){var
u=str.charCodeAtAt(i);if(u>=55296&&u<=57343){var
u1=str.charCodeAtAt(++i);u=65536+((u&1023)<<10|u1&1023)}if(u<=127){if(outIdx>=endIdx)break;heap[outIdx++]
=u}else if(u<=2047){if(outIdx+1>=endIdx)break;heap[outIdx++]=192|u>>6;heap[outIdx++]=128|u&63}else
if(u<=65535){if(outIdx+2>=endIdx)break;heap[outIdx++]=224|u>>12;heap[outIdx++]=128|u>>6&63;heap[outIdx
++]=128|u&63}else{if(outIdx+3>=endIdx)break;heap[outIdx++]=240|u>>18;heap[outIdx++]=128|u>>12&63;heap[
outIdx++]=128|u>>6&63;heap[outIdx++]=128|u&63}}heap[outIdx]=0;return outIdx-startIdx}function
stringToUTF8(str,outPtr,maxBytesToWrite){return
stringToUTF8Array(str,GROWABLE_HEAP_U8(),outPtr,maxBytesToWrite)}function lengthBytesUTF8(str){var
len=0;for(var i=0;i<str.length;++i){var
u=str.charCodeAtAt(i);if(u>=55296&&u<=57343)u=65536+((u&1023)<<10|str.charCodeAtAt(++i)&1023);if(u<=127)+
+len;else if(u<=2047)len+=2;else if(u<=65535)len+=3;else len+=4}return len}function
```

```

writeArrayToMemory(array,buffer){ GROWABLE_HEAP_I8().set(array,buffer)}function
alignUp(x,multiple){if(x%multiple>0){x+=multiple-x%multiple}return x}var
buffer,HEAP8,HEAPU8,HEAP16,HEAPU16,HEAP32,HEAPU32,HEAPF32,HEAPF64;function
updateGlobalBufferAndViews(buf){buffer=buf;Module["HEAP8"]=HEAP8=new
Int8Array(buf);Module["HEAP16"]=HEAP16=new Int16Array(buf);Module["HEAP32"]=HEAP32=new
Int32Array(buf);Module["HEAPU8"]=HEAPU8=new Uint8Array(buf);Module["HEAPU16"]=HEAPU16=new
Uint16Array(buf);Module["HEAPU32"]=HEAPU32=new
Uint32Array(buf);Module["HEAPF32"]=HEAPF32=new
Float32Array(buf);Module["HEAPF64"]=HEAPF64=new Float64Array(buf)}var
INITIAL_MEMORY=Module["INITIAL_MEMORY"]||16777216;if(ENVIRONMENT_IS_PTHREAD){wasmMem
ory=Module["wasmMemory"];buffer=Module["buffer"]}else{if(Module["wasmMemory"]){wasmMemory=
Module["wasmMemory"]}else{wasmMemory=new
WebAssembly.Memory({\"initial\":INITIAL_MEMORY/65536,\"maximum\":2147483648/65536,\"shared\":true});
if(!(wasmMemory.buffer instanceof SharedArrayBuffer)){err(\"requested a shared WebAssembly.Memory but the
returned buffer is not a SharedArrayBuffer, indicating that while the browser has SharedArrayBuffer it does not
have WebAssembly threads support - you may need to set a
flag\");if(ENVIRONMENT_IS_NODE){console.log(\"(on node you may need: --experimental-wasm-threads --
experimental-wasm-bulk-memory and also use a recent version)\")}throw Error(\"bad
memory\")}}if(wasmMemory){buffer=wasmMemory.buffer}INITIAL_MEMORY=buffer.byteLength;updateGlob
alBufferAndViews(buffer);var wasmTable;var __ATPRERUN__=[];var __ATINIT__=[];var __ATMAIN__=[];var
__ATEXIT__=[];var __ATPOSTRUN__=[];var runtimeInitialized=false;var
runtimeExited=false;if(!ENVIRONMENT_IS_PTHREAD)__ATINIT__.push({func:function(){__wasm_call_ctor
s()}});function
preRun(){if(ENVIRONMENT_IS_PTHREAD)return;if(Module["preRun"]){if(typeof
Module["preRun"]="function")Module["preRun"]=[Module["preRun"]];while(Module["preRun"].length){a
ddOnPreRun(Module["preRun"].shift())}callRuntimeCallbacks(__ATPRERUN__)}function
initRuntime(){runtimeInitialized=true;if(ENVIRONMENT_IS_PTHREAD)return;callRuntimeCallbacks(__ATINIT
__)function
preMain(){if(ENVIRONMENT_IS_PTHREAD)return;callRuntimeCallbacks(__ATMAIN__)}function
exitRuntime(){if(ENVIRONMENT_IS_PTHREAD)return;runtimeExited=true}function
postRun(){if(ENVIRONMENT_IS_PTHREAD)return;if(Module["postRun"]){if(typeof
Module["postRun"]="function")Module["postRun"]=[Module["postRun"]];while(Module["postRun"].lengt
h){addOnPostRun(Module["postRun"].shift())}callRuntimeCallbacks(__ATPOSTRUN__)}function
addOnPreRun(cb){__ATPRERUN__.unshift(cb)}function addOnPostRun(cb){__ATPOSTRUN__.unshift(cb)}var
runDependencies=0;var runDependencyWatcher=null;var dependenciesFulfilled=null;function
addRunDependency(id){assert(!ENVIRONMENT_IS_PTHREAD,\"addRunDependency cannot be used in a
pthread
worker\");runDependencies++;if(Module["monitorRunDependencies"]){Module["monitorRunDependencies\"](ru
nDependencies)}}function removeRunDependency(id){runDependencies--
;if(Module["monitorRunDependencies"]){Module["monitorRunDependencies\"](runDependencies)}if(runDepen
dencies==0){if(runDependencyWatcher!=null){clearInterval(runDependencyWatcher);runDependencyWatcher=nul
l}if(dependenciesFulfilled){var
callback=dependenciesFulfilled;dependenciesFulfilled=null;callback()}}Module["preloadedImages"]={};Module
["preloadedAudios"]={};function
abort(what){if(Module["onAbort"]){Module["onAbort"](what)}if(ENVIRONMENT_IS_PTHREAD)console.err
or(\"Pthread aborting at \"+(new
Error).stack);what+=\"\\n\";err(what);ABORT=true;EXITSTATUS=1;what=\"abort(\"+what+\\n\". Build with -s
ASSERTIONS=1 for more info.\";var e=new WebAssembly.RuntimeError(what);readyPromiseReject(e);throw

```

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e}function hasPrefix(str,prefix){return
String.prototype.startsWith?str.startsWith(prefix):str.indexOf(prefix)===0}var
dataURIPrefix="data:application/octet-stream;base64,\"";function isDataURI(filename){return
hasPrefix(filename,dataURIPrefix)}var fileURIPrefix="file://\";function isFileURI(filename){return
hasPrefix(filename,fileURIPrefix)}var wasmBinaryFile="tfjs-backend-wasm-threaded-
simd.wasm\";if(!isDataURI(wasmBinaryFile)){wasmBinaryFile=locateFile(wasmBinaryFile)}function
getBinary(file){try{if(file===wasmBinaryFile&&wasmBinary){return new
Uint8Array(wasmBinary)}if(readBinary){return readBinary(file)}else{throw\"both async and sync fetching of the
wasm failed\"}}catch(err){abort(err)}}function
getBinaryPromise(){if(!wasmBinary&&(ENVIRONMENT_IS_WEB||ENVIRONMENT_IS_WORKER)){if(typeof
fetch===\"function\"&&!isFileURI(wasmBinaryFile)){return fetch(wasmBinaryFile,{credentials:\"same-
origin\"}).then(function(response){if(!response[\"ok\"]){throw\"failed to load wasm binary file at
\"+wasmBinaryFile+\"\"})return
response[\"arrayBuffer\"]()).catch(function(){return getBinary(wasmBinaryFile)}})}else{if(readAsync){return new
Promise(function(resolve,reject){readAsync(wasmBinaryFile,function(response){resolve(new
Uint8Array(response)),reject}))})}return Promise.resolve().then(function(){return
getBinary(wasmBinaryFile)})}function createWasm(){var info={\"a\":asmLibraryArg};function
receiveInstance(instance,module){var
exports=instance.exports;Module[\"asm\"]=exports;wasmTable=Module[\"asm\"][\"I\"];wasmModule=module;if(!E
NVIRONMENT_IS_PTHREAD){var
numWorkersToLoad=PThread.unusedWorkers.length;PThread.unusedWorkers.forEach(function(w){PThread.load
WasmModuleToWorker(w,function(){if(!--numWorkersToLoad)removeRunDependency(\"wasm-
instantiate\")}))}if(!ENVIRONMENT_IS_PTHREAD){addRunDependency(\"wasm-instantiate\")}function
receiveInstantiatedSource(output){receiveInstance(output[\"instance\"],output[\"module\"])}function
instantiateArrayBuffer(receiver){return getBinaryPromise().then(function(binary){return
WebAssembly.instantiate(binary,info)}).then(receiver,function(reason){err(\"failed to asynchronously prepare
wasm: \"+reason);abort(reason)})}function instantiateAsync(){if(!wasmBinary&&typeof
WebAssembly.instantiateStreaming===\"function\"&&!isDataURI(wasmBinaryFile)&&!isFileURI(wasmBinaryFil
e)&&typeof fetch===\"function\"){return fetch(wasmBinaryFile,{credentials:\"same-
origin\"}).then(function(response){var result=WebAssembly.instantiateStreaming(response,info);return
result.then(receiveInstantiatedSource,function(reason){err(\"wasm streaming compile failed: \"+reason);err(\"falling
back to ArrayBuffer instantiation\");return instantiateArrayBuffer(receiveInstantiatedSource)}))}else{return
instantiateArrayBuffer(receiveInstantiatedSource)}if(Module[\"instantiateWasm\"]){try{var
exports=Module[\"instantiateWasm\"](info,receiveInstance);return exports}catch(e){err(\"Module.instantiateWasm
callback failed with error: \"+e);return false}}instantiateAsync().catch(Promise.reject);return{}}var
ASM_CONSTS={10520:function(){throw\"Canceled!\"},10538:function($0,$1){setTimeout(function(){__emscript
en_do_dispatch_to_thread($0,$1),0})}};function initPthreadsJS(){PThread.initRuntime()}function
callRuntimeCallbacks(callbacks){while(callbacks.length>0){var callback=callbacks.shift();if(typeof
callback===\"function\"){callback(Module);continue}var func=callback.func;if(typeof
func===\"number\"){if(callback.arg===undefined){wasmTable.get(func)}else{wasmTable.get(func)(callback.arg)
}}else{func(callback.arg===undefined?null:callback.arg)}}}var
ERRNO_CODES={EPERM:63,ENOENT:44,ESRCH:71,EINTR:27,EIO:29,ENXIO:60,E2BIG:1,ENOEXEC:45,E
BADF:8,ECHILD:12,EAGAIN:6,EWOULDBLOCK:6,ENOMEM:48,EACCES:2,EFAULT:21,ENOTBLK:105,EB
USY:10,EEXIST:20,EXDEV:75,ENODEV:43,ENOTDIR:54,EISDIR:31,EINVAL:28,ENFILE:41,EMFILE:33,EN
OTTY:59,ETXTBSY:74,EFBIG:22,ENOSPC:51,ESPIPE:70,EROFS:69,EMLINK:34,EPIPE:64,EDOM:18,ERAN
GE:68,ENOMSG:49,EIDRM:24,ECHRNG:106,EL2NSYNC:156,EL3HLT:107,EL3RST:108,ELNRNG:109,EUNA
TCH:110,ENOCSS:111,EL2HLT:112,EDEADLK:16,ENOLCK:46,EBADE:113,EBADR:114,EXFULL:115,ENOA
NO:104,EBADRQC:103,EBADSLT:102,EDEADLOCK:16,EBFONT:101,ENOSTR:100,ENODATA:116,ETIME:

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117,ENOSR:118,ENONET:119,ENOPKG:120,EREMOTE:121,ENOLINK:47,EADV:122,ESRMNT:123,ECOMM
:124,EPROTO:65,EMULTIHOP:36,EDOTDOT:125,EBADMSG:9,ENOTUNIQ:126,EBADFD:127,EREMCHG:1
28,ELIBACC:129,ELIBBAD:130,ELIBSCN:131,ELIBMAX:132,ELIBEXEC:133,ENOSYS:52,ENOTEMPTY:55,
ENAMETOOLONG:37,ELOOP:32,EOPNOTSUPP:138,EPFNOSUPPORT:139,ECONNRESET:15,ENOBUS:42,
EAFNOSUPPORT:5,EPROTOTYPE:67,ENOTSOK:57,ENOPROTOOPT:50,ESHUTDOWN:140,ECONNREFU
SED:14,EADDRINUSE:3,ECONNABORTED:13,ENETUNREACH:40,ENETDOWN:38,ETIMEDOUT:73,EHOS
TDOWN:142,EHOSTUNREACH:23,EINPROGRESS:26,EALREADY:7,EDESTADDRREQ:17,EMSGSIZE:35,E
PROTONOSUPPORT:66,ESOCKTNOSUPPORT:137,EADDRNOTAVAIL:4,ENETRESET:39,EISCONN:30,EN
OTCONN:53,ETOOMANYREFS:141,EUSERS:136,EDQUOT:19,ESTALE:72,ENOTSUP:138,ENOMEDIUM:14
8,EILSEQ:25,E_OVERFLOW:61,ECANCELED:11,ENOTRECOVERABLE:56,EOWNERDEAD:62,ESTRPIPE:13
5};function
_emsripten_futex_wake(addr,count){if(addr<=0||addr>GROWABLE_HEAP_I8().length||addr&3!=0||count<0)retu
rn-28;if(count==0)return 0;if(count>=2147483647)count=Infinity;var
mainThreadWaitAddress=Atomics.load(GROWABLE_HEAP_I32(),_emsripten_main_thread_futex>>2);var
mainThreadWoken=0;if(mainThreadWaitAddress==addr){var
loadedAddr=Atomics.compareExchange(GROWABLE_HEAP_I32(),_emsripten_main_thread_futex>>2,mainTh
readWaitAddress,0);if(loadedAddr==mainThreadWaitAddress){--count;mainThreadWoken=1;if(count<=0)return
1}}var ret=Atomics.notify(GROWABLE_HEAP_I32(),addr>>2,count);if(ret>=0)return
ret+mainThreadWoken;throw\"Atomics.notify returned an unexpected value
\"+ret}Module[\"_emsripten_futex_wake\"]=_emsripten_futex_wake;function
killThread(pthread_ptr){if(ENVIRONMENT_IS_PTHREAD)throw\"Internal Error! killThread() can only ever be
called from main application thread!\";if(!pthread_ptr)throw\"Internal Error! Null pthread_ptr in
killThread!\";GROWABLE_HEAP_I32()[pthread_ptr+12>>2]=0;var
pthread=PThread.threads[pthread_ptr];pthread.worker.terminate();PThread.freeThreadData(pthread);PThread.runni
ngWorkers.splice(PThread.runningWorkers.indexOf(pthread.worker),1);pthread.worker.pthread=undefined}functio
n cancelThread(pthread_ptr){if(ENVIRONMENT_IS_PTHREAD)throw\"Internal Error! cancelThread() can only
ever be called from main application thread!\";if(!pthread_ptr)throw\"Internal Error! Null pthread_ptr in
cancelThread!\";var
pthread=PThread.threads[pthread_ptr];pthread.worker.postMessage({\"cmd\":\"cancel\"})}function
cleanupThread(pthread_ptr){if(ENVIRONMENT_IS_PTHREAD)throw\"Internal Error! cleanupThread() can only
ever be called from main application thread!\";if(!pthread_ptr)throw\"Internal Error! Null pthread_ptr in
cleanupThread!\";var
pthread=PThread.threads[pthread_ptr];if(pthread){GROWABLE_HEAP_I32()[pthread_ptr+12>>2]=0;var
worker=pthread.worker;PThread.returnWorkerToPool(worker)}}var
PThread={unusedWorkers:[],runningWorkers:[],initMainThreadBlock:function(){var
pthreadPoolSize=8;for(var
i=0;i<pthreadPoolSize;++i){PThread.allocateUnusedWorker()}},initRuntime:function(){var
tb=_malloc(228);for(var
i=0;i<228/4;++i)GROWABLE_HEAP_U32()[tb/4+i]=0;GROWABLE_HEAP_I32()[tb+12>>2]=tb;var
headPtr=tb+152;GROWABLE_HEAP_I32()[headPtr>>2]=headPtr;var tlsMemory=_malloc(512);for(var
i=0;i<128;++i)GROWABLE_HEAP_U32()[tlsMemory/4+i]=0;Atomics.store(GROWABLE_HEAP_U32(),tb+100
>>2,tlsMemory);Atomics.store(GROWABLE_HEAP_U32(),tb+40>>2,tb);_emsripten_thread_init(tb,1,ENVIRON
MENT_IS_WORKER,1);_emsripten_register_main_browser_thread_id(tb);initWorker:function(){},threads:{},t
hreadExitHandlers:[],setThreadStatus:function(){},runExitHandlers:function(){while(PThread.threadExitHandlers.l
ength>0){PThread.threadExitHandlers.pop()()if(ENVIRONMENT_IS_PTHREAD&&_pthread_self())__pthread
_tsd_run_dtors()},runExitHandlersAndDeinitThread:function(tb,exitCode){Atomics.store(GROWABLE_HEAP_U
32(),tb+56>>2,1);Atomics.store(GROWABLE_HEAP_U32(),tb+60>>2,0);PThread.runExitHandlers();Atomics.stor
e(GROWABLE_HEAP_U32(),tb+4>>2,exitCode);Atomics.store(GROWABLE_HEAP_U32(),tb+0>>2,1);_emscri

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pten_futex_wake(tb+0,2147483647);__emscripten_thread_init(0,0,0)},threadExit:function(exitCode){var
tb=_pthread_self();if(tb){PThread.runExitHandlersAndDeinitThread(tb,exitCode);if(ENVIRONMENT_IS_PTHRE
AD){postMessage({"cmd\\":"exit\\"})}}},threadCancel:function(){PThread.runExitHandlersAndDeinitThread(_pthr
ead_self(),-1);postMessage({"cmd\\":"cancelDone\\"})},terminateAllThreads:function(){for(var t in
PThread.pthreads){var
pthread=PThread.pthreads[t];if(pthread&&pthread.worker){PThread.returnWorkerToPool(pthread.worker)}PThre
ad.pthreads={};for(var i=0;i<PThread.unusedWorkers.length;++i){var
worker=PThread.unusedWorkers[i];worker.terminate()}PThread.unusedWorkers=[];for(var
i=0;i<PThread.runningWorkers.length;++i){var worker=PThread.runningWorkers[i];var
pthread=worker.pthread;PThread.freeThreadData(pthread);worker.terminate()}PThread.runningWorkers=[]},freeTh
readData:function(pthread){if(!pthread)return;if(pthread.threadInfoStruct){var
tlsMemory=GROWABLE_HEAP_I32()[pthread.threadInfoStruct+100>>2];GROWABLE_HEAP_I32()[pthread.thr
eadInfoStruct+100>>2]=0;_free(tlsMemory);_free(pthread.threadInfoStruct)}pthread.threadInfoStruct=0;if(pthread.
allocatedOwnStack&&pthread.stackBase)_free(pthread.stackBase);pthread.stackBase=0;if(pthread.worker)pthread.
worker.pthread=null},returnWorkerToPool:function(worker){PThread.runWithoutMainThreadQueuedCalls(funcio
n){delete
PThread.pthreads[worker.pthread.threadInfoStruct];PThread.unusedWorkers.push(worker);PThread.runningWorker
s.splice(PThread.runningWorkers.indexOf(worker),1);PThread.freeThreadData(worker.pthread);worker.pthread=un
defined}}},runWithoutMainThreadQueuedCalls:function(func){GROWABLE_HEAP_I32()[__emscripten_allow_m
ain_runtime_queued_calls>>2]=0;try{func()}finally{GROWABLE_HEAP_I32()[__emscripten_allow_main_runti
me_queued_calls>>2]=1}},receiveObjectTransfer:function(data){},loadWasmModuleToWorker:function(worker,o
nFinishedLoading){worker.onmessage=function(e){var
d=e["data"];var
cmd=d["cmd"];if(worker.pthread)PThread.currentProxiedOperationCallerThread=worker.pthread.threadInfoStruct;
if(d["targetThread"]&&d["targetThread"]!=_pthread_self()){var
thread=PThread.pthreads[d.targetThread];if(thread){thread.worker.postMessage(e.data,d["transferList"])}else{con
sole.error('Internal error! Worker sent a message \''+cmd+'\' to target pthread '+d["targetThread"]+', but that
thread no longer
exists!')}PThread.currentProxiedOperationCallerThread=undefined;return}if(cmd==="processQueuedMainThread
Work\\"){__emscripten_main_thread_process_queued_calls()}else
if(cmd==="spawnThread\\"){spawnThread(e.data)}else
if(cmd==="cleanupThread\\"){cleanupThread(d["thread"])}else
if(cmd==="killThread\\"){killThread(d["thread"])}else
if(cmd==="cancelThread\\"){cancelThread(d["thread"])}else
if(cmd==="loaded\\"){worker.loaded=true;if(onFinishedLoading)onFinishedLoading(worker);if(worker.runPthread)
{worker.runPthread();delete
worker.runPthread}}else if(cmd==="print\\"){out("Thread \"+d["threadId"]+"\\": \"+d["text"])}else
if(cmd==="printErr\\"){err("Thread \"+d["threadId"]+"\\": \"+d["text"])}else if(cmd==="alert\\"){alert("Thread
\"+d["threadId"]+"\\": \"+d["text"])}else if(cmd==="exit\\"){var
detached=worker.pthread&&Atomics.load(GROWABLE_HEAP_U32(),worker.pthread.threadInfoStruct+64>>2);if
(detached){PThread.returnWorkerToPool(worker)}else
if(cmd==="exitProcess\\"){try{exit(d["returnCode"])}catch(e){if(e instanceof ExitStatus)return;throw e}}else
if(cmd==="cancelDone\\"){PThread.returnWorkerToPool(worker)}else
if(cmd==="objectTransfer\\"){PThread.receiveObjectTransfer(e.data)}else
if(e.data.target==="setimmediate\\"){worker.postMessage(e.data)}else{err("worker sent an unknown command
\'"+cmd')PThread.currentProxiedOperationCallerThread=undefined};worker.onerror=function(e){err("pthread sent
an error! \"+e.filename+"\\": \"+e.lineno+"\\":
\'+e.message)};if(ENVIRONMENT_IS_NODE){worker.on("message",function(data){worker.onmessage({data:d

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ata}));worker.on("error",function(data){worker.onerror(data)});worker.on("exit",function(data){})}worker.postMessage({\cmd\":"load\","urlOrBlob\":"Module[\mainScriptUrlOrBlob\"]|_scriptDir,\wasmMemory\":"wasmMemory\","wasmModule\":"wasmModule"}),allocateUnusedWorker:function(){var pthreadMainJs=locateFile("tfjs-backend-wasm-threaded-simd.worker.js");PThread.unusedWorkers.push(new Worker(pthreadMainJs)),getNewWorker:function(){if(PThread.unusedWorkers.length==0){PThread.allocateUnusedWorker();PThread.loadWasmModuleToWorker(PThread.unusedWorkers[0])}if(PThread.unusedWorkers.length>0)return PThread.unusedWorkers.pop();else return null},busySpinWait:function(msecs){var t=performance.now()+msecs;while(performance.now()<t){}};function establishStackSpace(stackTop,stackMax){_emscripten_stack_set_limits(stackTop,stackMax);stackRestore(stackTop)}Module[\establishStackSpace\"]=establishStackSpace;function getNoExitRuntime(){return noExitRuntime}Module[\getNoExitRuntime\"]=getNoExitRuntime;function invokeEntryPoint(ptr,arg){return wasmTable.get(ptr)(arg)}Module[\invokeEntryPoint\"]=invokeEntryPoint;function __assert_fail(condition,filename,line,func){abort("Assertion failed: '"+UTF8ToString(condition)+'', at: '"+[filename?UTF8ToString(filename):"unknown filename",line,func?UTF8ToString(func):"unknown function"]')})function __call_main(argc,argv){var returnCode=_main(argc,argv)}var _emscripten_get_now;if(ENVIRONMENT_IS_NODE){_emscripten_get_now=function(){var t=process["hrtime"]();return t[0]*1e3+t[1]/1e6}}else if(ENVIRONMENT_IS_PTHREAD){_emscripten_get_now=function(){return performance.now()-Module[__performance_now_clock_drift\"]}}else if(typeof dateNow!="undefined"){_emscripten_get_now=dateNow}else _emscripten_get_now=function(){return performance.now()};function setErrNo(value){GROWABLE_HEAP_I32()[__errno_location()>>2]=value;return value}function _atexit(func,arg){if(ENVIRONMENT_IS_PTHREAD)return _emscripten_proxy_to_main_thread_js(1,1,func,arg)}function __emscripten_notify_thread_queue(targetThreadId,mainThreadId){if(targetThreadId==mainThreadId){postMessage({\cmd\":"processQueuedMainThreadWork\"})}}else if(ENVIRONMENT_IS_PTHREAD){postMessage({\targetThread\":"targetThreadId,\cmd\":"processThreadQueue\"})}}else{var pthread=PThread.threads[targetThreadId];var worker=pthread&&pthread.worker;if(!worker){return}worker.postMessage({\cmd\":"processThreadQueue\"})}}return 1}function _abort(){abort()}function _emscripten_asm_const_int(code,sigPtr,argbuf){var args=readAsmConstArgs(sigPtr,argbuf);return ASM_CONSTS[code].apply(null,args)}function _emscripten_conditional_set_current_thread_status(expectedStatus,newStatus){}function _emscripten_futex_wait(addr,val,timeout){if(addr<=0||addr>GROWABLE_HEAP_I8().length||addr&3!=0)return-28;if(!ENVIRONMENT_IS_WEB){var ret=Atomics.wait(GROWABLE_HEAP_I32(),addr>>2,val,timeout);if(ret=="timed-out")return-73;if(ret=="not-equal")return-6;if(ret=="ok")return 0;throw"Atomics.wait returned an unexpected value '"+ret}else{if(Atomics.load(GROWABLE_HEAP_I32(),addr>>2)!=val){return-6}var tNow=performance.now();var tEnd=tNow+timeout;var lastAddr=Atomics.exchange(GROWABLE_HEAP_I32(),__emscripten_main_thread_futex>>2,addr);while(1){tNow=performance.now();if(tNow>tEnd){lastAddr=Atomics.exchange(GROWABLE_HEAP_I32(),__emscripten_main_thread_futex>>2,0);return-73}lastAddr=Atomics.exchange(GROWABLE_HEAP_I32(),__emscripten_main_thread_futex>>2,0);if(lastAddr==0){break}_emscripten_main_thread_process_queued_calls();if(Atomics.load(GROWABLE_HEAP_I32(),addr>>2)!=val){return-6}lastAddr=Atomics.exchange(GROWABLE_HEAP_I32(),__emscripten_main_thread_futex>>2,addr)}return 0}}function _emscripten_memcpy_big(dest,src,num){GROWABLE_HEAP_U8().copyWithin(dest,src,src+num)}function _emscripten_num_logical_cores(){if(ENVIRONMENT_IS_NODE)return require("os").cpus().length;return

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navigator[\"hardwareConcurrency\"]}function
_emsripten_proxy_to_main_thread_js(index, sync){ var numCallArgs=arguments.length-2; var
stack=stackSave(); var serializedNumCallArgs=numCallArgs; var args=stackAlloc(serializedNumCallArgs*8); var
b=args>>3; for(var i=0; i<numCallArgs; i++){ var arg=arguments[2+i]; GROWABLE_HEAP_F64()[b+i]=arg } var
ret=_emsripten_run_in_main_runtime_thread_js(index, serializedNumCallArgs, args, sync); stackRestore(stack); return
ret } var _emsripten_receive_on_main_thread_js_callArgs=[]; var readAsmConstArgsArray=[]; function
readAsmConstArgs(sigPtr, buf){ readAsmConstArgsArray.length=0; var
ch; buf>>=2; while(ch=GROWABLE_HEAP_U8()[sigPtr++){ var
double=ch<105; if(double&&buf&1) buf++; readAsmConstArgsArray.push(double?GROWABLE_HEAP_F64()[buf
++>>1]:GROWABLE_HEAP_I32()[buf]); ++buf } return readAsmConstArgsArray } function
_emsripten_receive_on_main_thread_js(index, numCallArgs, args){ _emsripten_receive_on_main_thread_js_callA
rgs.length=numCallArgs; var b=args>>3; for(var
i=0; i<numCallArgs; i++){ _emsripten_receive_on_main_thread_js_callArgs[i]=GROWABLE_HEAP_F64()[b+i] } v
ar
isEmAsmConst=index<0; var func=!isEmAsmConst?proxiedFunctionTable[index]:ASM_CONSTS[-index-
1]; return func.apply(null, _emsripten_receive_on_main_thread_js_callArgs) } function
_emsripten_get_heap_size(){ return GROWABLE_HEAP_U8().length } function
emsripten_realloc_buffer(size){ try { wasmMemory.grow(size-
buffer.byteLength+65535>>>16); updateGlobalBufferAndViews(wasmMemory.buffer); return
1 } catch(e) { } } function _emsripten_resize_heap(requestedSize){ var
oldSize=_emsripten_get_heap_size(); if(requestedSize<=oldSize){ return false } var
maxHeapSize=2147483648; if(requestedSize>maxHeapSize){ return false } for(var
cutDown=1; cutDown<=4; cutDown*=2){ var
overGrownHeapSize=oldSize*(1+.2/cutDown); overGrownHeapSize=Math.min(overGrownHeapSize, requestedSize
+100663296); var
newSize=Math.min(maxHeapSize, alignUp(Math.max(requestedSize, overGrownHeapSize), 65536)); var
replacement=emsripten_realloc_buffer(newSize); if(replacement){ return true } } return false } var
JSEvents={ inEventHandler:0, removeAllEventListeners:function(){ for(var
i=JSEvents.eventHandlers.length-1; i>=0; --
i){ JSEvents._removeHandler(i) } JSEvents.eventHandlers=[]; JSEvents.deferredCalls=[]; }, registerRemoveEventListen
ers:function(){ if(!JSEvents.removeEventListenersRegistered){ __ATEXIT__.push(JSEvents.removeAllEventListene
rs); JSEvents.removeEventListenersRegistered=true } }, deferredCalls:[], deferCall:function(targetFunction, precedence
, argsList){ function arraysHaveEqualContent(arrA, arrB){ if(arrA.length!=arrB.length) return false; for(var i in
arrA){ if(arrA[i]!=arrB[i]) return false } return true } for(var i in JSEvents.deferredCalls){ var
call=JSEvents.deferredCalls[i]; if(call.targetFunction==targetFunction&&arraysHaveEqualContent(call.argsList, args
List)) { return } } JSEvents.deferredCalls.push({ targetFunction:targetFunction, precedence:precedence, argsList:argsList
}); JSEvents.deferredCalls.sort(function(x, y){ return
x.precedence<y.precedence }); }, removeDeferredCalls:function(targetFunction){ for(var
i=0; i<JSEvents.deferredCalls.length; ++i){ if(JSEvents.deferredCalls[i].targetFunction==targetFunction){ JSEvents.d
eferredCalls.splice(i, 1); --i } } }, canPerformEventHandlerRequests:function(){ return
JSEvents.inEventHandler&&JSEvents.currentEventHandler.allowsDeferredCalls }, runDeferredCalls:function(){ if(!J
SEvents.canPerformEventHandlerRequests()){ return } for(var i=0; i<JSEvents.deferredCalls.length; ++i){ var
call=JSEvents.deferredCalls[i]; JSEvents.deferredCalls.splice(i, 1); --
i; call.targetFunction.apply(null, call.argsList) } }, eventHandlers:[], removeAllHandlersOnTarget:function(target, event
TypeString){ for(var
i=0; i<JSEvents.eventHandlers.length; ++i){ if(JSEvents.eventHandlers[i].target==target&&(!eventTypeString||event
TypeString==JSEvents.eventHandlers[i].eventTypeString)){ JSEvents._removeHandler(i--
)}} }, _removeHandler:function(i){ var

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h=JSEvents.eventHandlers[i];h.target.removeEventListener(h.eventTypeString,h.eventListenerFunc,h.useCapture);J
SEvents.eventHandlers.splice(i,1)},registerOrRemoveHandler:function(eventHandler){var
jsEventHandler=function
jsEventHandler(event){++JSEvents.inEventHandler;JSEvents.currentEventHandler=eventHandler;JSEvents.runDef
erredCalls();eventHandler.handlerFunc(event);JSEvents.runDeferredCalls();--
JSEvents.inEventHandler};if(eventHandler.callbackfunc){eventHandler.eventListenerFunc=jsEventHandler;eventH
andler.target.addEventListener(eventHandler.eventTypeString,jsEventHandler,eventHandler.useCapture);JSEvents.e
ventHandlers.push(eventHandler);JSEvents.registerRemoveEventListeners()}else{for(var
i=0;i<JSEvents.eventHandlers.length;++i){if(JSEvents.eventHandlers[i].target==eventHandler.target&&JSEvents.e
ventHandlers[i].eventTypeString==eventHandler.eventTypeString){JSEvents._removeHandler(i--
)}}},queueEventHandlerOnThread_iiii:function(targetThread,eventHandlerFunc,eventTypeId,eventData,userData)
{var stackTop=stackSave();var
varargs=stackAlloc(12);GROWABLE_HEAP_I32()[varargs>>2]=eventTypeId;GROWABLE_HEAP_I32()[varargs
+4>>2]=eventData;GROWABLE_HEAP_I32()[varargs+8>>2]=userData;__emscripten_call_on_thread(0,targetThr
ead,637534208,eventHandlerFunc,eventData,varargs);stackRestore(stackTop)},getTargetThreadForEventCallback:f
unction(targetThread){switch(targetThread){case
1:return 0;case 2:return PThread.currentProxiedOperationCallerThread;default:return
targetThread}},getNodeNameForTarget:function(target){if(!target)return\"";if(target==window)return\"#window\";
if(target==screen)return\"#screen\";return
target&&target.nodeName?target.nodeName:\"\"},fullscreenEnabled:function(){return
document.fullscreenEnabled||document.webkitFullscreenEnabled}};function stringToNewUTF8(jsString){var
length=lengthBytesUTF8(jsString)+1;var cString=_malloc(length);stringToUTF8(jsString,cString,length);return
cString}function
_emscripten_set_offscreencanvas_size_on_target_thread_js(targetThread,targetCanvas,width,height){var
stackTop=stackSave();var varargs=stackAlloc(12);var
targetCanvasPtr=0;if(targetCanvas){targetCanvasPtr=stringToNewUTF8(targetCanvas)}GROWABLE_HEAP_I32(
)[varargs>>2]=targetCanvasPtr;GROWABLE_HEAP_I32()[varargs+4>>2]=width;GROWABLE_HEAP_I32()[var
args+8>>2]=height;__emscripten_call_on_thread(0,targetThread,657457152,0,targetCanvasPtr,varargs);stackRestor
e(stackTop)}function
_emscripten_set_offscreencanvas_size_on_target_thread(targetThread,targetCanvas,width,height){targetCanvas=tar
getCanvas?UTF8ToString(targetCanvas):\"\";_emscripten_set_offscreencanvas_size_on_target_thread_js(targetThr
ead,targetCanvas,width,height)}function maybeCStringToJsString(cString){return
cString>2?UTF8ToString(cString):cString}var specialHTMLTargets=[0,typeof
document!=\"undefined\"?document:0,typeof window!=\"undefined\"?window:0];function
findEventTarget(target){target=maybeCStringToJsString(target);var
domElement=specialHTMLTargets[target]||(typeof
document!=\"undefined\"?document.querySelector(target):undefined);return domElement}function
findCanvasEventTarget(target){return findEventTarget(target)}function
_emscripten_set_canvas_element_size_calling_thread(target,width,height){var
canvas=findCanvasEventTarget(target);if(!canvas)return-
4;if(canvas.canvasSharedPtr){GROWABLE_HEAP_I32()[canvas.canvasSharedPtr>>2]=width;GROWABLE_HEA
P_I32()[canvas.canvasSharedPtr+4>>2]=height}if(canvas.offscreenCanvas||!canvas.controlTransferredOffscreen){if
(canvas.offscreenCanvas)canvas=canvas.offscreenCanvas;var
autoResizeViewport=false;if(canvas.GLctxObject&&canvas.GLctxObject.GLctx){var
prevViewport=canvas.GLctxObject.GLctx.getParameter(2978);autoResizeViewport=prevViewport[0]==0&&prev
Viewport[1]==0&&prevViewport[2]==canvas.width&&prevViewport[3]==canvas.height}canvas.width=width;
canvas.height=height;if(autoResizeViewport){canvas.GLctxObject.GLctx.viewport(0,0,width,height)}}else
if(canvas.canvasSharedPtr){var

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targetThread=GROWABLE_HEAP_I32()[canvas.canvasSharedPtr+8>>2];_emscripten_set_offscreencanvas_size_o
n_target_thread(targetThread,target,width,height);return 1}else{return-4}return 0}function
_emscripten_set_canvas_element_size_main_thread(target,width,height){if(ENVIRONMENT_IS_PTHREAD)retur
n
_emscripten_proxy_to_main_thread_js(2,1,target,width,height);return
_emscripten_set_canvas_element_size_calling_thread(target,width,height)}function
_emscripten_set_canvas_element_size(target,width,height){var
canvas=findCanvasEventTarget(target);if(canvas){return
_emscripten_set_canvas_element_size_calling_thread(target,width,height)}else{return
_emscripten_set_canvas_element_size_main_thread(target,width,height)}}function
_emscripten_set_current_thread_status(newStatus){}function
_emscripten_set_thread_name(threadId,name){}function __webgl_enable_ANGLE_instanced_arrays(ctx){var
ext=ctx.getExtension("\ANGLE_instanced_arrays");if(ext){ctx["vertexAttribDivisor"]=function(index,divisor){ex
t["vertexAttribDivisorANGLE"](index,divisor)};ctx["drawArraysInstanced"]=function(mode,first,count,primcou
nt){ext["drawArraysInstancedANGLE"](mode,first,count,primcount)};ctx["drawElementsInstanced"]=function(
mode,count,type,indices,primcount){ext["drawElementsInstancedANGLE"](mode,count,type,indices,primcount)};
return
1}}function __webgl_enable_OES_vertex_array_object(ctx){var
ext=ctx.getExtension("\OES_vertex_array_object");if(ext){ctx["createVertexArray"]=function(){return
ext["createVertexArrayOES"]();};ctx["deleteVertexArray"]=function(vao){ext["deleteVertexArrayOES"](vao)};
ctx["bindVertexArray"]=function(vao){ext["bindVertexArrayOES"](vao)};ctx["isVertexArray"]=function(vao)
{return ext["isVertexArrayOES"](vao)};return 1}}function __webgl_enable_WEBGL_draw_buffers(ctx){var
ext=ctx.getExtension("\WEBGL_draw_buffers");if(ext){ctx["drawBuffers"]=function(n,bufs){ext["drawBuffers
WEBGL"](n,bufs)};return 1}}function
__webgl_enable_WEBGL_multi_draw(ctx){return!!(ctx.multiDrawWebgl=ctx.getExtension("\WEBGL_multi_dra
w"))}var
GL={counter:1,buffers:[],programs:[],framebuffers:[],renderbuffers:[],textures:[],uniforms:[],shaders:[],vaos:[],cont
exts:{},offscreenCanvases:{},timerQueriesEXT:[],programInfos:{},stringCache:{},unpackAlignment:4,recordError:
function
recordError(errorCode){if(!GL.lastError){GL.lastError=errorCode}},getNewId:function(table){var
ret=GL.counter++;for(var i=table.length;i<ret;i++){table[i]=null}return
ret},getSource:function(shader,count,string,length){var source="";for(var i=0;i<count;++i){var
len=length?GROWABLE_HEAP_I32()[length+i*4>>2]:-
1;source+=UTF8ToString(GROWABLE_HEAP_I32()[string+i*4>>2],len<0?undefined:len)}return
source},createContext:function(canvas,webGLContextAttributes){var
ctx=canvas.getContext("\webgl",webGLContextAttributes);if(!ctx)return 0;var
handle=GL.registerContext(ctx,webGLContextAttributes);return
handle},registerContext:function(ctx,webGLContextAttributes){var
handle=_malloc(8);GROWABLE_HEAP_I32()[handle+4>>2]=_pthread_self();var
context={handle:handle,attributes:webGLContextAttributes,version:webGLContextAttributes.majorVersion,GLctx:
ctx};if(ctx.canvas)ctx.canvas.GLctxObject=context;GL.contexts[handle]=context;if(typeof
webGLContextAttributes.enableExtensionsByDefault===\undefined\||webGLContextAttributes.enableExtensions
ByDefault){GL.initExtensions(context)}return
handle},makeContextCurrent:function(contextHandle){GL.currentContext=GL.contexts[contextHandle];Module.ctx
=GLctx=GL.currentContext&&GL.currentContext.GLctx;return!(contextHandle&&!GLctx)},getContext:function(c
ontextHandle){return
GL.contexts[contextHandle]},deleteContext:function(contextHandle){if(GL.currentContext===GL.contexts[context
Handle])GL.currentContext=null;if(typeof

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JSEvents===\"object\")JSEvents.removeAllHandlersOnTarget(GL.contexts[contextHandle].GLctx.canvas);if(GL.co
ntexts[contextHandle]&&GL.contexts[contextHandle].GLctx.canvas)GL.contexts[contextHandle].GLctx.canvas.GL
ctxObject=undefined;_free(GL.contexts[contextHandle].handle);GL.contexts[contextHandle]=null},initExtensions:f
unction(context){if(!context)context=GL.currentContext;if(context.initExtensionsDone)return;context.initExtension
sDone=true;var
GLctx=context.GLctx;__webgl_enable_ANGLE_instanced_arrays(GLctx);__webgl_enable_OES_vertex_array_obj
ect(GLctx);__webgl_enable_WEBGL_draw_buffers(GLctx);GLctx.disjointTimerQueryExt=GLctx.getExtension(\"
EXT_disjoint_timer_query\");__webgl_enable_WEBGL_multi_draw(GLctx);var
exts=GLctx.getSupportedExtensions()||[];exts.forEach(function(ext){if(ext.indexOf(\"lose_context\")<0&&ext.inde
xOf(\"debug\")<0){GLctx.getExtension(ext)}}),populateUniformTable:function(program){var
p=GL.programs[program];var
ptable=GL.programInfos[program]={uniforms:{},maxUniformLength:0,maxAttributeLength:-
1,maxUniformBlockNameLength:-1};var utable=ptable.uniforms;var
numUniforms=GLctx.getProgramParameter(p,35718);for(var i=0;i<numUniforms;++i){var
u=GLctx.getActiveUniform(p,i);var
name=u.name;ptable.maxUniformLength=Math.max(ptable.maxUniformLength,name.length+1);if(name.slice(-
1)===\"\\\"){name=name.slice(0,name.lastIndexOf(\"\\\"))}var loc=GLctx.getUniformLocation(p,name);if(loc){var
id=GL.getNewId(GL.uniforms);utable[name]=[u.size,id];GL.uniforms[id]=loc;for(var
j=1;j<u.size;++j){var
n=name+\"\\\"+j+\"\\\"\";loc=GLctx.getUniformLocation(p,n);id=GL.getNewId(GL.uniforms);GL.uniforms[id]=loc}}
}};var __emscripten_webgl_power_preferences=[\"default\", \"low-power\", \"high-performance\"];function
__emscripten_webgl_do_create_context(target,attributes){var a=attributes>>2;var
powerPreference=GROWABLE_HEAP_I32()[a+(24>>2)];var
contextAttributes={\"alpha\":!!GROWABLE_HEAP_I32()[a+(0>>2)],\"depth\":!!GROWABLE_HEAP_I32()[a+(4
>>2)],\"stencil\":!!GROWABLE_HEAP_I32()[a+(8>>2)],\"antialias\":!!GROWABLE_HEAP_I32()[a+(12>>2)],\"p
remultipliedAlpha\":!!GROWABLE_HEAP_I32()[a+(16>>2)],\"preserveDrawingBuffer\":!!GROWABLE_HEAP_
I32()[a+(20>>2)],\"powerPreference\":__emscripten_webgl_power_preferences[powerPreference],\"failIfMajorPerf
ormanceCaveat\":!!GROWABLE_HEAP_I32()[a+(28>>2)],majorVersion:GROWABLE_HEAP_I32()[a+(32>>2)],
minorVersion:GROWABLE_HEAP_I32()[a+(36>>2)],enableExtensionsByDefault:GROWABLE_HEAP_I32()[a+(
40>>2)],explicitSwapControl:GROWABLE_HEAP_I32()[a+(44>>2)],proxyContextToMainThread:GROWABLE_
HEAP_I32()[a+(48>>2)],renderViaOffscreenBackBuffer:GROWABLE_HEAP_I32()[a+(52>>2)]};var
canvas=findCanvasEventTarget(target);if(!canvas){return 0}if(contextAttributes.explicitSwapControl){return
0}var contextHandle=GL.createContext(canvas,contextAttributes);return contextHandle}function
__emscripten_webgl_create_context(a0,a1){return __emscripten_webgl_do_create_context(a0,a1)}var
SYSCALLS={mappings:{},buffers:[null,[],[]],printChar:function(stream,curr){var
buffer=SYSCALLS.buffers[stream];if(curr===0||curr===10){(stream===1?out:err)(UTF8ArrayToString(buffer,0));
buffer.length=0}else{buffer.push(curr)}};varargs:undefined,get:function(){SYSCALLS.varargs+=4;var
ret=GROWABLE_HEAP_I32()[SYSCALLS.varargs-4>>2];return ret},getStr:function(ptr){var
ret=UTF8ToString(ptr);return ret},get64:function(low,high){return low}};function
_fd_close(fd){if(ENVIRONMENT_IS_PTHREAD)return __emscripten_proxy_to_main_thread_js(3,1,fd);return
0}function _fd_seek(fd,offset_low,offset_high,whence,newOffset){if(ENVIRONMENT_IS_PTHREAD)return
__emscripten_proxy_to_main_thread_js(4,1,fd,offset_low,offset_high,whence,newOffset)}function
_fd_write(fd,iov,iovcnt,pnum){if(ENVIRONMENT_IS_PTHREAD)return
__emscripten_proxy_to_main_thread_js(5,1,fd,iov,iovcnt,pnum);var num=0;for(var i=0;i<iovcnt;i++){var
ptr=GROWABLE_HEAP_I32()[iov+i*8>>2];var len=GROWABLE_HEAP_I32()[iov+(i*8+4)>>2];for(var
j=0;j<len;j++){SYSCALLS.printChar(fd,GROWABLE_HEAP_U80)[ptr+j]}num+=len}GROWABLE_HEAP_I32
()[pnum>>2]=num;return 0}function _pthread_cleanup_pop(execute){var
routine=PThread.threadExitHandlers.pop();if(execute)routine()}function

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pthread_cleanup_push(routine,arg){PThread.threadExitHandlers.push(function(){ wasmTable.get(routine)(arg)}})function spawnThread(threadParams){if(ENVIRONMENT_IS_PTHREAD)throw"Internal Error! spawnThread() can only ever be called from main application thread!";var worker=PThread.getNewWorker();if(worker.pthread!==undefined)throw"Internal error!";if(!threadParams.pthread_ptr)throw"Internal error, no pthread ptr!";PThread.runningWorkers.push(worker);var tlsMemory=_malloc(128*4);for(var i=0;i<128;++i){ GROWABLE_HEAP_I32()[tlsMemory+i*4>>2]=0}var stackHigh=threadParams.stackBase+threadParams.stackSize;var pthread=PThread.pthreads[threadParams.pthread_ptr]={ worker:worker,stackBase:threadParams.stackBase,stackSize:threadParams.stackSize,allocatedOwnStack:threadParams.allocatedOwnStack,threadInfoStruct:threadParams.pthread_ptr};var tis=pthread.threadInfoStruct>>2;Atomics.store(GROWABLE_HEAP_U32(),tis+(64>>2),threadParams.detached);Atomics.store(GROWABLE_HEAP_U32(),tis+(100>>2),tlsMemory);Atomics.store(GROWABLE_HEAP_U32(),tis+(40>>2),pthread.threadInfoStruct);Atomics.store(GROWABLE_HEAP_U32(),tis+(80>>2),threadParams.stackSize);Atomics.store(GROWABLE_HEAP_U32(),tis+(76>>2),stackHigh);Atomics.store(GROWABLE_HEAP_U32(),tis+(104>>2),threadParams.stackSize);Atomics.store(GROWABLE_HEAP_U32(),tis+(104+8>>2),stackHigh);Atomics.store(GROWABLE_HEAP_U32(),tis+(104+12>>2),threadParams.detached);var global_libc=_emscripten_get_global_libc();var global_locale=global_libc+40;Atomics.store(GROWABLE_HEAP_U32(),tis+(172>>2),global_locale);worker.pthread=pthread;var msg={"cmd\\":\\"run\\",\\"start_routine\\":threadParams.startRoutine,\\"arg\\":threadParams.arg,\\"threadInfoStruct\\":threadParams.pthread_ptr,\\"stackBase\\":threadParams.stackBase,\\"stackSize\\":threadParams.stackSize};worker.runPthread=function(){ msg.time=performance.now();worker.postMessage(msg,threadParams.transferList)};if(worker.loaded){ worker.runPthread();delete worker.runPthread}}function pthread_create(pthread_ptr,attr,start_routine,arg){if(typeof SharedArrayBuffer==="undefined"){err("Current environment does not support SharedArrayBuffer, pthreads are not available!");return 6}if(!pthread_ptr){err("pthread_create called with a null thread pointer!");return 28}var transferList=[];var error=0;if(ENVIRONMENT_IS_PTHREAD&&(transferList.length===0||error)){return _emscripten_sync_run_in_main_thread_4(687865856,pthread_ptr,attr,start_routine,arg)}if(error)return error;var stackSize=0;var stackBase=0;var detached=0;if(attr&&attr!=1){ stackSize=GROWABLE_HEAP_I32()[attr>>2];stackSize+=81920;stackBase=GROWABLE_HEAP_I32()[attr+8>>2];detached=GROWABLE_HEAP_I32()[attr+12>>2]!==0}else{ stackSize=2097152}var allocatedOwnStack=stackBase==0;if(allocatedOwnStack){stackBase=_memalign(16,stackSize)}else{stackBase=stackSize;assert(stackBase>0)}var threadInfoStruct=_malloc(228);for(var i=0;i<228>>2;++i)GROWABLE_HEAP_U32()[threadInfoStruct>>2+i]=0;GROWABLE_HEAP_I32()[pthread_ptr>>2]=threadInfoStruct;GROWABLE_HEAP_I32()[threadInfoStruct+12>>2]=threadInfoStruct;var headPtr=threadInfoStruct+152;GROWABLE_HEAP_I32()[headPtr>>2]=headPtr;var threadParams={ stackBase:stackBase,stackSize:stackSize,allocatedOwnStack:allocatedOwnStack,detached:detached,startRoutine:start_routine,pthread_ptr:threadInfoStruct,arg:arg,transferList:transferList};if(ENVIRONMENT_IS_PTHREAD){threadParams.cmd="spawnThread";postMessage(threadParams,transferList)}else{spawnThread(threadParams)}return 0}function __pthread_testcancel_js(){if(!ENVIRONMENT_IS_PTHREAD)return;var tb=__pthread_self();if(!tb)return;var cancelDisabled=Atomics.load(GROWABLE_HEAP_U32(),tb+56>>2);if(cancelDisabled)return;var canceled=Atomics.load(GROWABLE_HEAP_U32(),tb+0>>2);if(canceled==2)throw"Canceled!";function _emscripten_check_blocking_allowed(){if(ENVIRONMENT_IS_NODE)return;if(ENVIRONMENT_IS_WORKER)return;warnOnce("Blocking on the main thread is very dangerous, see https://emscripten.org/docs/porting/pthreads.html#blocking-on-the-main-browser-thread")}}function

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__emscripten_do_pthread_join(thread,status,block){if(!thread){err("\pthread_join attempted on a null thread
pointer!");return
ERRNO_CODES.ESRCH}if(ENVIRONMENT_IS_PTHREAD&&_pthread_self()==thread){err("\PThread
\"+thread+\" is attempting to join to itself!");return ERRNO_CODES.EDEADLK}else
if(!ENVIRONMENT_IS_PTHREAD&&_emscripten_main_browser_thread_id()==thread){err("\Main
thread \"+thread+\" is attempting to join to itself!");return ERRNO_CODES.EDEADLK}var
self=GROWABLE_HEAP_I32()[thread+12>>2];if(self!==thread){err("\pthread_join attempted on thread
\"+thread+\", which does not point to a valid thread, or does not exist anymore!");return
ERRNO_CODES.ESRCH}var
detached=Atomics.load(GROWABLE_HEAP_U32(),thread+64>>2);if(detached){err("\Attempted to join thread
\"+thread+\", which was already detached!");return
ERRNO_CODES.EINVAL}if(block){_emscripten_check_blocking_allowed()}for(;;){var
threadStatus=Atomics.load(GROWABLE_HEAP_U32(),thread+0>>2);if(threadStatus==1){var
threadExitCode=Atomics.load(GROWABLE_HEAP_U32(),thread+4>>2);if(status)GROWABLE_HEAP_I32()[sta
tus>>2]=threadExitCode;Atomics.store(GROWABLE_HEAP_U32(),thread+64>>2,1);if(!ENVIRONMENT_IS_PT
HREAD)cleanupThread(thread);else postMessage({"cmd":\"cleanupThread\", \"thread\":thread});return
0}if(!block){return
ERRNO_CODES.EBUSY}}_pthread_testcancel_js();if(!ENVIRONMENT_IS_PTHREAD)_emscripten_main_thre
ad_process_queued_calls();_emscripten_futex_wait(thread+0,threadStatus,ENVIRONMENT_IS_PTHREAD?100:1
)}}function
_pthread_join(thread,status){return __emscripten_do_pthread_join(thread,status,true)}function
_sysconf(name){if(ENVIRONMENT_IS_PTHREAD)return
_emscripten_proxy_to_main_thread_js(6,1,name);switch(name){case 30:return 16384;case 85:var
maxHeapSize=2147483648;return maxHeapSize/16384;case 132:case 133:case 12:case 137:case 138:case 15:case
235:case 16:case 17:case 18:case 19:case 20:case 149:case 13:case 10:case 236:case 153:case 9:case 21:case 22:case
159:case 154:case 14:case 77:case 78:case 139:case 82:case 68:case 67:case 164:case 11:case 29:case 47:case
48:case 95:case 52:case 51:case 46:return 200809;case 27:case 246:case 127:case 128:case 23:case 24:case 160:case
161:case 181:case 182:case 242:case 183:case 184:case 243:case 244:case 245:case 165:case 178:case 179:case
49:case 50:case 168:case 169:case 175:case 170:case 171:case 172:case
97:case 76:case 32:case 173:case 35:case 80:case 81:case 79:return-1;case 176:case 177:case 7:case 155:case 8:case
157:case 125:case 126:case 92:case 93:case 129:case 130:case 131:case 94:case 91:return 1;case 74:case 60:case
69:case 70:case 4:return 1024;case 31:case 42:case 72:return 32;case 87:case 26:case 33:return 2147483647;case
34:case 1:return 47839;case 38:case 36:return 99;case 43:case 37:return 2048;case 0:return 2097152;case 3:return
65536;case 28:return 32768;case 44:return 32767;case 75:return 16384;case 39:return 1e3;case 89:return 700;case
71:return 256;case 40:return 255;case 2:return 100;case 180:return 64;case 25:return 20;case 5:return 16;case
6:return 6;case 73:return 4;case 84:{if(typeof navigator===\"object\")return
navigator[\"hardwareConcurrency\"]||1;return 1}}setErrNo(28);return-
1}if(!ENVIRONMENT_IS_PTHREAD)PThread.initMainThreadBlock();var GLctx;var
proxiedFunctionTable=[null,_atexit,_emscripten_set_canvas_element_size_main_thread,_fd_close,_fd_seek,_fd_wr
ite,_sysconf];var
asmLibraryArg={\"e\":__assert_fail,\"r\":__call_main,\"x\":__emscripten_notify_thread_queue,\"b\":_abort,\"y\":
_emscripten_asm_const_int,\"j\":_emscripten_conditional_set_current_thread_status,\"d\":_emscripten_futex_wait,\"c\":_emscripten_futex_wake,\"f\":_emscripten_get_now,\"p\":_emscripten_memcpy_big,\"A\":_emscripten_num_l
ogical_cores,\"u\":_emscripten_receive_on_main_thread_js,\"q\":_emscripten_resize_heap,\"v\":_emscripten_set_ca
nvas_element_size,\"i\":_emscripten_set_current_thread_status,\"s\":_emscripten_set_thread_name,\"w\":_emscript
en_webgl_create_context,\"l\":_fd_close,\"n\":_fd_seek,\"g\":_fd_write,\"o\":initPthreadsJS,\"a\":wasmMemory||Mo
dule[\"wasmMemory\"],\"z\":_pthread_cleanup_pop,\"k\":_pthread_cleanup_push,\"h\":_pthread_create,\"m\":_pthr
ead_join,\"t\":_sysconf};var asm=createWasm();var

```

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__wasm_call_ctors=Module["__wasm_call_ctors"]=function(){return(__wasm_call_ctors=Module["__wasm
_call_ctors"]=Module["asm"])[["B"]].apply(null,arguments)};var
_init=Module["_init"]=function(){return(_init=Module["_init"]=Module["asm"])[["C"]].apply(null,arguments)};
var
_init_with_threads_count=Module["_init_with_threads_count"]=function(){return(_init_with_threads_count=Mod
ule["_init_with_threads_count"]=Module["asm"])[["D"]].apply(null,arguments)};var
_get_threads_count=Module["_get_threads_count"]=function(){return(_get_threads_count=Module["_get_threads
_count"]=Module["asm"])[["E"]].apply(null,arguments)};var
_register_tensor=Module["_register_tensor"]=function(){return(_register_tensor=Module["_register_tensor"]=M
odule["asm"])[["F"]].apply(null,arguments)};var
_dispose_data=Module["_dispose_data"]=function(){return(_dispose_data=Module["_dispose_data"]=Module["a
sm"])[["G"]].apply(null,arguments)};var
_dispose=Module["_dispose"]=function(){return(_dispose=Module["_dispose"]=Module["asm"])[["H"]].apply(
null,arguments)};var
_Abs=Module["_Abs"]=function(){return(_Abs=Module["_Abs"]=Module["asm"])[["J"]].apply(null,arguments
)};var
_Add=Module["_Add"]=function(){return(_Add=Module["_Add"]=Module["asm"])[["K"]].apply(null,argumen
ts)};var
_AddN=Module["_AddN"]=function(){return(_AddN=Module["_AddN"]=Module["asm"])[["L"]].apply(null,ar
guments)};var
_All=Module["_All"]=function(){return(_All=Module["_All"]=Module["asm"])[["M"]].apply(null,arguments)};
var
_Any=Module["_Any"]=function(){return(_Any=Module["_Any"]=Module["asm"])[["N"]].apply(null,argumen
ts)};var
_ArgMax=Module["_ArgMax"]=function(){return(_ArgMax=Module["_ArgMax"]=Module["asm"])[["O"]].ap
ply(null,arguments)};var
_AvgPool=Module["_AvgPool"]=function(){return(_AvgPool=Module["_AvgPool"]=Module["asm"])[["P"]].a
pply(null,arguments)};var
_BatchMatMul=Module["_BatchMatMul"]=function(){return(_BatchMatMul=Module["_BatchMatMul"]=Modu
le["asm"])[["Q"]].apply(null,arguments)};var
_Ceil=Module["_Ceil"]=function(){return(_Ceil=Module["_Ceil"]=Module["asm"])[["R"]].apply(null,argument
s)};var
_ClipByValue=Module["_ClipByValue"]=function(){return(_ClipByValue=Module["_ClipByValue"]=Module[
"asm"])[["S"]].apply(null,arguments)};var
_Conv2D=Module["_Conv2D"]=function(){return(_Conv2D=Module["_Conv2D"]=Module["asm"])[["T"]].app
ly(null,arguments)};var
_Conv2DBackpropInput=Module["_Conv2DBackpropInput"]=function(){return(_Conv2DBackpropInput=Modul
e["_Conv2DBackpropInput"]=Module["asm"])[["U"]].apply(null,arguments)};var
_Cos=Module["_Cos"]=function(){return(_Cos=Module["_Cos"]=Module["asm"])[["V"]].apply(null,arguments
)};var
_Cosh=Module["_Cosh"]=function(){return(_Cosh=Module["_Cosh"]=Module["asm"])[["W"]].apply(null,argu
ments)};var
_CropAndResize=Module["_CropAndResize"]=function(){return(_CropAndResize=Module["_CropAndResize"]=
Module["asm"])[["X"]].apply(null,arguments)};var
_Cumsum=Module["_Cumsum"]=function(){return(_Cumsum=Module["_Cumsum"]=Module["asm"])[["Y"]].a
pply(null,arguments)};var
_DepthToSpace=Module["_DepthToSpace"]=function(){return(_DepthToSpace=Module["_DepthToSpace"]=M
odule["asm"])[["Z"]].apply(null,arguments)};var

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_DepthwiseConv2dNative=Module["_DepthwiseConv2dNative"]=function(){return(_DepthwiseConv2dNative=Module["_DepthwiseConv2dNative"]=Module["_asm"][_"_"]).apply(null,arguments));var
_Elu=Module["_Elu"]=function(){return(_Elu=Module["_Elu"]=Module["_asm"][_"$"]).apply(null,arguments)};var
_Equal=Module["_Equal"]=function(){return(_Equal=Module["_Equal"]=Module["_asm"][_"aa"]).apply(null,arguments)};var
_Exp=Module["_Exp"]=function(){return(_Exp=Module["_Exp"]=Module["_asm"][_"ba"]).apply(null,arguments)};var
_FlipLeftRight=Module["_FlipLeftRight"]=function(){return(_FlipLeftRight=Module["_FlipLeftRight"]=Module["_asm"][_"ca"]).apply(null,arguments)};var
_Floor=Module["_Floor"]=function(){return(_Floor=Module["_Floor"]=Module["_asm"][_"da"]).apply(null,arguments)};var
_FloorDiv=Module["_FloorDiv"]=function(){return(_FloorDiv=Module["_FloorDiv"]=Module["_asm"][_"ea"]).apply(null,arguments)};var
_FusedBatchNorm=Module["_FusedBatchNorm"]=function(){return(_FusedBatchNorm=Module["_FusedBatchNorm"]=Module["_asm"][_"fa"]).apply(null,arguments)};var
_FusedConv2D=Module["_FusedConv2D"]=function(){return(_FusedConv2D=Module["_FusedConv2D"]=Module["_asm"][_"ga"]).apply(null,arguments)};var
_FusedDepthwiseConv2D=Module["_FusedDepthwiseConv2D"]=function(){return(_FusedDepthwiseConv2D=Module["_FusedDepthwiseConv2D"]=Module["_asm"][_"ha"]).apply(null,arguments)};var
_Gather=Module["_Gather"]=function(){return(_Gather=Module["_Gather"]=Module["_asm"][_"ia"]).apply(null,arguments)};var
_GatherNd=Module["_GatherNd"]=function(){return(_GatherNd=Module["_GatherNd"]=Module["_asm"][_"ja"]).apply(null,arguments)};var
_Greater=Module["_Greater"]=function(){return(_Greater=Module["_Greater"]=Module["_asm"][_"ka"]).apply(null,arguments)};var
_GreaterEqual=Module["_GreaterEqual"]=function(){return(_GreaterEqual=Module["_GreaterEqual"]=Module["_asm"][_"la"]).apply(null,arguments)};var
_LeakyRelu=Module["_LeakyRelu"]=function(){return(_LeakyRelu=Module["_LeakyRelu"]=Module["_asm"][_"ma"]).apply(null,arguments)};var
_Less=Module["_Less"]=function(){return(_Less=Module["_Less"]=Module["_asm"][_"na"]).apply(null,arguments)};var
_LessEqual=Module["_LessEqual"]=function(){return(_LessEqual=Module["_LessEqual"]=Module["_asm"][_"oa"]).apply(null,arguments)};var
_Log=Module["_Log"]=function(){return(_Log=Module["_Log"]=Module["_asm"][_"pa"]).apply(null,arguments)};var
_LogicalAnd=Module["_LogicalAnd"]=function(){return(_LogicalAnd=Module["_LogicalAnd"]=Module["_asm"][_"qa"]).apply(null,arguments)};var
_Max=Module["_Max"]=function(){return(_Max=Module["_Max"]=Module["_asm"][_"ra"]).apply(null,arguments)};var
_MaxPool=Module["_MaxPool"]=function(){return(_MaxPool=Module["_MaxPool"]=Module["_asm"][_"sa"]).apply(null,arguments)};var
_Maximum=Module["_Maximum"]=function(){return(_Maximum=Module["_Maximum"]=Module["_asm"][_"ta"]).apply(null,arguments)};var
_Mean=Module["_Mean"]=function(){return(_Mean=Module["_Mean"]=Module["_asm"][_"ua"]).apply(null,arguments)};var
_Min=Module["_Min"]=function(){return(_Min=Module["_Min"]=Module["_asm"][_"va"]).apply(null,arguments)};var

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_Minimum=Module["_Minimum"]=function(){return(_Minimum=Module["_Minimum"]=Module["asm"])[_wa
]).apply(null,arguments)};var
_MirrorPad=Module["_MirrorPad"]=function(){return(_MirrorPad=Module["_MirrorPad"]=Module["asm"])[_xa
a").apply(null,arguments)};var
_Multiply=Module["_Multiply"]=function(){return(_Multiply=Module["_Multiply"]=Module["asm"])[_ya
).apply(null,arguments)};var
_Neg=Module["_Neg"]=function(){return(_Neg=Module["_Neg"]=Module["asm"])[_za").apply(null,argumen
ts)};var
_NonMaxSuppressionV3=Module["_NonMaxSuppressionV3"]=function(){return(_NonMaxSuppressionV3=Mod
ule["_NonMaxSuppressionV3"]=Module["asm"])[_Aa").apply(null,arguments)};var
_NonMaxSuppressionV4=Module["_NonMaxSuppressionV4"]=function(){return(_NonMaxSuppressionV4=Mod
ule["_NonMaxSuppressionV4"]=Module["asm"])[_Ba").apply(null,arguments)};var
_NonMaxSuppressionV5=Module["_NonMaxSuppressionV5"]=function(){return(_NonMaxSuppressionV5=Mod
ule["_NonMaxSuppressionV5"]=Module["asm"])[_Ca").apply(null,arguments)};var
_NotEqual=Module["_NotEqual"]=function(){return(_NotEqual=Module["_NotEqual"]=Module["asm"])[_Da
).apply(null,arguments)};var
_OneHot=Module["_OneHot"]=function(){return(_OneHot=Module["_OneHot"]=Module["asm"])[_Ea").appl
y(null,arguments)};var
_PadV2=Module["_PadV2"]=function(){return(_PadV2=Module["_PadV2"]=Module["asm"])[_Fa").apply(nu
ll,arguments)};var
_Pow=Module["_Pow"]=function(){return(_Pow=Module["_Pow"]=Module["asm"])[_Ga").apply(null,argume
nts)};var
_Prelu=Module["_Prelu"]=function(){return(_Prelu=Module["_Prelu"]=Module["asm"])[_Ha").apply(null,arg
uments)};var
_Prod=Module["_Prod"]=function(){return(_Prod=Module["_Prod"]=Module["asm"])[_Ia").apply(null,argum
ents)};var
_RealDiv=Module["_RealDiv"]=function(){return(_RealDiv=Module["_RealDiv"]=Module["asm"])[_Ja").app
ly(null,arguments)};var
_Relu=Module["_Relu"]=function(){return(_Relu=Module["_Relu"]=Module["asm"])[_Ka").apply(null,argum
ents)};var
_Relu6=Module["_Relu6"]=function(){return(_Relu6=Module["_Relu6"]=Module["asm"])[_La").apply(null,a
rguments)};var
_ResizeBilinear=Module["_ResizeBilinear"]=function(){return(_ResizeBilinear=Module["_ResizeBilinear"]=Mo
dule["asm"])[_Ma").apply(null,arguments)};var
_Reverse=Module["_Reverse"]=function(){return(_Reverse=Module["_Reverse"]=Module["asm"])[_Na").app
ly(null,arguments)};var
_RotateWithOffset=Module["_RotateWithOffset"]=function(){return(_RotateWithOffset=Module["_RotateWith
Offset"]=Module["asm"])[_Oa").apply(null,arguments)};var
_Round=Module["_Round"]=function(){return(_Round=Module["_Round"]=Module["asm"])[_Pa").apply(nul
l,arguments)};var
_Rsqrt=Module["_Rsqrt"]=function(){return(_Rsqrt=Module["_Rsqrt"]=Module["asm"])[_Qa").apply(null,arg
uments)};var
_ScatterNd=Module["_ScatterNd"]=function(){return(_ScatterNd=Module["_ScatterNd"]=Module["asm"])[_Ra
").apply(null,arguments)};var
_SelectV2=Module["_SelectV2"]=function(){return(_SelectV2=Module["_SelectV2"]=Module["asm"])[_Sa").
apply(null,arguments)};var
_Sigmoid=Module["_Sigmoid"]=function(){return(_Sigmoid=Module["_Sigmoid"]=Module["asm"])[_Ta").ap
ply(null,arguments)};var

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_Sin=Module["_Sin"]=function(){return(_Sin=Module["_Sin"]=Module["asm"][_"Ua"]).apply(null,arguments)
};var
_Softmax=Module["_Softmax"]=function(){return(_Softmax=Module["_Softmax"]=Module["asm"][_"Va"]).a
pply(null,arguments)};var
_Sqrt=Module["_Sqrt"]=function(){return(_Sqrt=Module["_Sqrt"]=Module["asm"][_"Wa"]).apply(null,argume
nts)};var
_Square=Module["_Square"]=function(){return(_Square=Module["_Square"]=Module["asm"][_"Xa"]).apply(n
ull,arguments)};var
_SquaredDifference=Module["_SquaredDifference"]=function(){return(_SquaredDifference=Module["_Squared
Difference"]=Module["asm"][_"Ya"]).apply(null,arguments)};var
_Step=Module["_Step"]=function(){return(_Step=Module["_Step"]=Module["asm"][_"Za"]).apply(null,argume
nts)};var
_StridedSlice=Module["_StridedSlice"]=function(){return(_StridedSlice=Module["_StridedSlice"]=Module["as
m"][_"a"]).apply(null,arguments)};var
_Sub=Module["_Sub"]=function(){return(_Sub=Module["_Sub"]=Module["asm"][_"$a"]).apply(null,argument
s)};var
_Sum=Module["_Sum"]=function(){return(_Sum=Module["_Sum"]=Module["asm"][_"ab"]).apply(null,argume
nts)};var
_Tan=Module["_Tan"]=function(){return(_Tan=Module["_Tan"]=Module["asm"][_"bb"]).apply(null,argument
s)};var
_Tanh=Module["_Tanh"]=function(){return(_Tanh=Module["_Tanh"]=Module["asm"][_"cb"]).apply(null,argu
ments)};var
_Tile=Module["_Tile"]=function(){return(_Tile=Module["_Tile"]=Module["asm"][_"db"]).apply(null,argument
s)};var
_TopK=Module["_TopK"]=function(){return(_TopK=Module["_TopK"]=Module["asm"][_"eb"]).apply(null,ar
guments)};var
_Transform=Module["_Transform"]=function(){return(_Transform=Module["_Transform"]=Module["asm"][_"f
b"]).apply(null,arguments)};var
_Transpose=Module["_Transpose"]=function(){return(_Transpose=Module["_Transpose"]=Module["asm"][_"g
b"]).apply(null,arguments)};var
__FusedMatMul=Module["__FusedMatMul"]=function(){return(__FusedMatMul=Module["__FusedMatMul"]=
Module["asm"][_"hb"]).apply(null,arguments)};var
_malloc=Module["_malloc"]=function(){return(_malloc=Module["_malloc"]=Module["asm"][_"ib"]).apply(nul
l,arguments)};var
_free=Module["_free"]=function(){return(_free=Module["_free"]=Module["asm"][_"jb"]).apply(null,arguments
)};var
__errno_location=Module["__errno_location"]=function(){return(__errno_location=Module["__errno_locati
on"]=Module["asm"][_"kb"]).apply(null,arguments)};var
_emscripten_get_global_libc=Module["_emscripten_get_global_libc"]=function(){return(_emscripten_get_global
_libc=Module["_emscripten_get_global_libc"]=Module["asm"][_"lb"]).apply(null,arguments)};var
_pthread_self=Module["_pthread_self"]=function(){return(_pthread_self=Module["_pthread_self"]=Module["as
m"][_"mb"]).apply(null,arguments)};var
__pthread_tsd_run_dtors=Module["__pthread_tsd_run_dtors"]=function(){return(__pthread_tsd_run_dtors=M
odule["__pthread_tsd_run_dtors"]=Module["asm"][_"nb"]).apply(null,arguments)};var
_emscripten_main_thread_process_queued_calls=Module["_emscripten_main_thread_process_queued_calls"]=fu
nction(){return(_emscripten_main_thread_process_queued_calls=Module["_emscripten_main_thread_process_que
ued_calls"]=Module["asm"][_"ob"]).apply(null,arguments)};var
_emscripten_current_thread_process_queued_calls=Module["_emscripten_current_thread_process_queued_calls"]

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=function(){return(_emscripten_current_thread_process_queued_calls=Module["_emscripten_current_thread_proc
ess_queued_calls"]=Module["_asm\"][\["pb\"]).apply(null,arguments));var
_emscripten_register_main_browser_thread_id=Module["_emscripten_register_main_browser_thread_id"]=functi
on(){return(_emscripten_register_main_browser_thread_id=Module["_emscripten_register_main_browser_thread_
id"]=Module["_asm\"][\["qb\"]).apply(null,arguments));var
_emscripten_main_browser_thread_id=Module["_emscripten_main_browser_thread_id"]=function(){return(_ems
cripten_main_browser_thread_id=Module["_emscripten_main_browser_thread_id"]=Module["_asm\"][\["rb\"]).app
ly(null,arguments));var
__emscripten_do_dispatch_to_thread=Module["___emscripten_do_dispatch_to_thread"]=function(){return(__ems
cripten_do_dispatch_to_thread=Module["___emscripten_do_dispatch_to_thread"]=Module["_asm\"][\["sb\"]).apply(n
ull,arguments));var
_emscripten_sync_run_in_main_thread_4=Module["_emscripten_sync_run_in_main_thread_4"]=function(){retur
n(_emscripten_sync_run_in_main_thread_4=Module["_emscripten_sync_run_in_main_thread_4"]=Module["_asm\
"]\["tb\"]).apply(null,arguments));var
_emscripten_run_in_main_runtime_thread_js=Module["_emscripten_run_in_main_runtime_thread_js"]=function(
){return(_emscripten_run_in_main_runtime_thread_js=Module["_emscripten_run_in_main_runtime_thread_js"]=
Module["_asm\"][\["ub\"]).apply(null,arguments));var
__emscripten_call_on_thread=Module["___emscripten_call_on_thread"]=function(){return(__emscripten_call_on_t
hread=Module["___emscripten_call_on_thread"]=Module["_asm\"][\["vb\"]).apply(null,arguments));var
_emscripten_tls_init=Module["_emscripten_tls_init"]=function(){return(_emscripten_tls_init=Module["_emscrip
ten_tls_init"]=Module["_asm\"][\["wb\"]).apply(null,arguments));var
__emscripten_thread_init=Module["___emscripten_thread_init"]=function(){return(__emscripten_thread_init=Mod
ule["___emscripten_thread_init"]=Module["_asm\"][\["xb\"]).apply(null,arguments));var
stackSave=Module["stackSave"]=function(){return(stackSave=Module["stackSave"]=Module["_asm\"][\["yb\"]).a
pply(null,arguments));var
stackRestore=Module["stackRestore"]=function(){return(stackRestore=Module["stackRestore"]=Module["_asm\
"]\["zb\"]).apply(null,arguments));var
stackAlloc=Module["stackAlloc"]=function(){return(stackAlloc=Module["stackAlloc"]=Module["_asm\"][\["Ab\
"]\]).apply(null,arguments));var
_emscripten_stack_set_limits=Module["_emscripten_stack_set_limits"]=function(){return(_emscripten_stack_set_
limits=Module["_emscripten_stack_set_limits"]=Module["_asm\"][\["Bb\"]).apply(null,arguments));var
_memalign=Module["_memalign"]=function(){return(_memalign=Module["_memalign"]=Module["_asm\"][\["Cb
\"]).apply(null,arguments));var
__emscripten_allow_main_runtime_queued_calls=Module["___emscripten_allow_main_runtime_queued_calls"]=1
0512;var
__emscripten_main_thread_futex=Module["___emscripten_main_thread_futex"]=12148;Module["cwrap"]=cwrap
;Module["PThread"]=PThread;Module["PThread"]=PThread;Module["wasmMemory"]=wasmMemory;Module
["ExitStatus"]=ExitStatus;var
calledRun;function ExitStatus(status){this.name="ExitStatus";this.message="Program terminated with
exit(\"+status+\")";this.status=status}dependenciesFulfilled=function
runCaller(){if(!calledRun)run();if(!calledRun)dependenciesFulfilled=runCaller};function
run(args){args=args||arguments;if(runDependencies>0){return}if(ENVIRONMENT_IS_PTHREAD){readyPromis
eResolve(Module);initRuntime();postMessage({"cmd":"loaded"});return}preRun();if(runDependencies>0){retur
n}function
doRun(){if(calledRun)return;calledRun=true;Module["calledRun"]=true;if(ABORT)return;initRuntime();preMain(
);readyPromiseResolve(Module);if(Module["onRuntimeInitialized"]){Module["onRuntimeInitialized"]();}postRun(
)}if(Module["setStatus"]){Module["setStatus"]("Running...");setTimeout(function(){setTimeout(function(){Mo
dule["setStatus"]("\n"),1});doRun(),1)}else{doRun()}}Module["run"]=run;function

```

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exit(status,implicit){if(implicit&&noExitRuntime&&status===0){return}if(!implicit){if(ENVIRONMENT_IS_PT
HREAD){postMessage({\"cmd\": \"exitProcess\", \"returnCode\": status});throw
new
ExitStatus(status)}else{}}if(noExitRuntime){}else{PThread.terminateAllThreads();EXITSTATUS=status;exitRunTi
me();if(Module[\"onExit\"]Module[\"onExit\"](status);ABORT=true}quit_(status,new
ExitStatus(status))}if(Module[\"preInit\"]){if(typeof
Module[\"preInit\"]==\"function\")Module[\"preInit\"]=[Module[\"preInit\"]];while(Module[\"preInit\"].length>0){
Module[\"preInit\"].pop()())}if(ENVIRONMENT_IS_PTHREAD){noExitRuntime=false;PThread.initWorker()}run
();\n\n\n return WasmBackendModuleThreadedSimd.ready\n}\n);\n\nif (typeof exports === 'object' && typeof
module === 'object')\n module.exports = WasmBackendModuleThreadedSimd;\nelse if (typeof define ===
'function' && define['amd'])\n define([], function() { return WasmBackendModuleThreadedSimd; });\nelse if
(typeof exports === 'object')\n exports[\"WasmBackendModuleThreadedSimd\"]
= WasmBackendModuleThreadedSimd;\n\", \"\nvar WasmBackendModule = (function() { \n var _scriptDir = typeof
document !== 'undefined' && document.currentScript ? document.currentScript.src : undefined;\n if (typeof
__filename !== 'undefined') _scriptDir = _scriptDir || __filename;\n return (\nfunction(WasmBackendModule) { \n
WasmBackendModule = WasmBackendModule || {};\n\nvar Module=typeof
WasmBackendModule!=\"undefined\"?WasmBackendModule: {};var
readyPromiseResolve,readyPromiseReject;Module[\"ready\"] =new
Promise(function(resolve,reject){ readyPromiseResolve=resolve;readyPromiseReject=reject});var
moduleOverrides={ };var key;for(key in
Module){if(Module.hasOwnProperty(key)){ moduleOverrides[key]=Module[key] }}var arguments_=[];var
thisProgram=\"./this.program\";var quit_=function(status,toThrow){throw toThrow};var
ENVIRONMENT_IS_WEB=false;var ENVIRONMENT_IS_WORKER=false;var
ENVIRONMENT_IS_NODE=false;var ENVIRONMENT_IS_SHELL=false;ENVIRONMENT_IS_WEB=typeof
window===\"object\";ENVIRONMENT_IS_WORKER=typeof
importScripts===\"function\";ENVIRONMENT_IS_NODE=typeof process===\"object\"&&typeof
process.versions===\"object\"&&typeof
process.versions.node===\"string\";ENVIRONMENT_IS_SHELL=!ENVIRONMENT_IS_WEB&&!ENVIRONM
ENT_IS_NODE&&!ENVIRONMENT_IS_WORKER;var scriptDirectory=\"\";function
locateFile(path){if(Module[\"locateFile\"]){return Module[\"locateFile\"](path,scriptDirectory)}return
scriptDirectory+path}var read_,readAsync,readBinary,setWindowTitle;var nodeFS;var
nodePath;if(ENVIRONMENT_IS_NODE){if(ENVIRONMENT_IS_WORKER){scriptDirectory=require(\"path\").
dirname(scriptDirectory)+\"/\"}else{scriptDirectory=__dirname+\"/\"}read_=function
shell_read(filename,binary){if(!nodeFS)nodeFS=require(\"fs\");if(!nodePath)nodePath=require(\"path\");filename=n
odePath[\"normalize\"](filename);return
nodeFS[\"readFileSync\"](filename,binary?null:\"utf8\");};readBinary=function readBinary(filename){var
ret=read_(filename,true);if(!ret.buffer){ret=new Uint8Array(ret)}assert(ret.buffer);return
ret};if(process[\"argv\"].length>1){thisProgram=process[\"argv\"][1].replace(/\\\\\\\\g,\"/\")}arguments_=process[\"arg
v\"].slice(2);process[\"on\"](\"uncaughtException\",function(ex){if(!(ex instanceof ExitStatus)){throw
ex}});process[\"on\"](\"unhandledRejection\",abort);quit_=function(status){process[\"exit\"](status)};Module[\"insp
ect\"] =function(){return\"[Emscripten Module object]\"}}else if(ENVIRONMENT_IS_SHELL){if(typeof
read!=\"undefined\"){read_=function shell_read(f){return read(f)}}readBinary=function readBinary(f){var
data;if(typeof readbuffer===\"function\"){return new
Uint8Array(readbuffer(f))}data=read(f,\"binary\");assert(typeof data===\"object\");return data};if(typeof
scriptArgs!=\"undefined\"){arguments_=scriptArgs}else if(typeof
arguments!=\"undefined\"){arguments_=arguments}if(typeof
quit===\"function\"){quit_=function(status){quit(status)}}if(typeof print!=\"undefined\"){if(typeof
console===\"undefined\")console={};console.log=print;console.warn=console.error=typeof

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printErr!=="undefined"?printErr:print}}else
if(ENVIRONMENT_IS_WEB||ENVIRONMENT_IS_WORKER){if(ENVIRONMENT_IS_WORKER){scriptDire
ctory=self.location.href}else if(typeof
document!=="undefined"&&document.currentScript){scriptDirectory=document.currentScript.src}if(_scriptDir){s
criptDirectory=_scriptDir;if(scriptDirectory.indexOf("blob:")!==0){scriptDirectory=scriptDirectory.substr(0,script
Directory.lastIndexOf("/")+1)}else{scriptDirectory=""}}{read_=function(url){var xhr=new
XMLHttpRequest;xhr.open("GET",url,false);xhr.send(null);return
xhr.responseText};if(ENVIRONMENT_IS_WORKER){readBinary=function(url){var xhr=new
XMLHttpRequest;xhr.open("GET",url,false);xhr.responseType="arraybuffer";xhr.send(null);return new
Uint8Array(xhr.response)}}readAsync=function(url,onload,onerror){var xhr=new
XMLHttpRequest;xhr.open("GET",url,true);xhr.responseType="arraybuffer";xhr.onload=function(){if(xhr.status
==200||xhr.status==0&&xhr.response){onload(xhr.response);return}onerror();}xhr.onerror=onerror;xhr.send(null)}
}setWindowTitle=function(title){document.title=title}}else{var
out=Module["print"]||console.log.bind(console);var err=Module["printErr"]||console.warn.bind(console);for(key
in
moduleOverrides){if(moduleOverrides.hasOwnProperty(key)){Module[key]=moduleOverrides[key]}}moduleOverr
ides=null;if(Module["arguments"])arguments_=Module["arguments"];if(Module["thisProgram"])thisProgram=
Module["thisProgram"];if(Module["quit"])quit_=Module["quit"];var
wasmBinary;if(Module["wasmBinary"])wasmBinary=Module["wasmBinary"];var
noExitRuntime=Module["noExitRuntime"]||true;if(typeof WebAssembly!=="object"){abort("no native wasm
support detected")}var wasmMemory;var ABORT=false;var EXITSTATUS;function
assert(condition,text){if(!condition){abort("Assertion failed: "+text)}}function getCFunc(ident){var
func=Module["_"+ident];assert(func,"Cannot call unknown function "+ident+"", make sure it is exported");return
func}function ccall(ident,returnType,argTypes,args,opts){var
toC={"string":function(str){var ret=0;if(str===null&&str!==undefined&&str!==0){var
len=(str.length<<2)+1;ret=stackAlloc(len);stringToUTF8(str,ret,len)}return ret},"array":function(arr){var
ret=stackAlloc(arr.length);writeArrayToMemory(arr,ret);return ret}};function
convertReturnValue(ret){if(returnType==="string")return UTF8ToString(ret);if(returnType==="boolean")return
Boolean(ret);return ret}var func=getCFunc(ident);var cArgs=[];var stack=0;if(args){for(var
i=0;i<args.length;i++){var
converter=toC[argTypes[i]];if(converter){if(stack===0)stack=stackSave();cArgs[i]=converter(args[i])}else{cArgs[i
]=args[i]}}var ret=func.apply(null,cArgs);ret=convertReturnValue(ret);if(stack!==0)stackRestore(stack);return
ret}function cwrap(ident,returnType,argTypes,opts){argTypes=argTypes||[];var
numericArgs=argTypes.every(function(type){return type==="number"});var
numericRet=returnType!=="string";if(numericRet&&numericArgs&&!opts){return getCFunc(ident)}return
function(){return ccall(ident,returnType,argTypes,arguments,opts)}}var UTF8Decoder=typeof
TextDecoder!=="undefined"?new TextDecoder("utf8"):undefined;function
UTF8ArrayToString(heap,idx,maxBytesToRead){var endIdx=idx+maxBytesToRead;var
endPtr=idx;while(heap[endPtr]&&!(endPtr>=endIdx))++endPtr;if(endPtr-
idx>16&&heap.subarray&&UTF8Decoder){return UTF8Decoder.decode(heap.subarray(idx,endPtr))}else{var
str="";while(idx<endPtr){var u0=heap[idx++];if(!(u0&128)){str+=String.fromCharCode(u0);continue}var
u1=heap[idx++]&63;if((u0&224)==192){str+=String.fromCharCode((u0&31)<<6|u1);continue}var
u2=heap[idx++]&63;if((u0&240)==224){u0=(u0&15)<<12|u1<<6|u2}else{u0=(u0&7)<<18|u1<<12|u2<<6|heap[id
x++]&63;if(u0<65536){str+=String.fromCharCode(u0)}else{var ch=u0-
65536;str+=String.fromCharCode(55296|ch>>10,56320|ch&1023)}}}return str}function
UTF8ToString(ptr,maxBytesToRead){return
ptr?UTF8ArrayToString(HEAPU8,ptr,maxBytesToRead):""}function
stringToUTF8Array(str,heap,outIdx,maxBytesToWrite){if(!(maxBytesToWrite>0))return

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0;var startIdx=outIdx;var endIdx=outIdx+maxBytesToWrite-1;for(var i=0;i<str.length;++i){ var
u=str.charCodeAt(i);if(u>=55296&&u<=57343){ var
u1=str.charCodeAt(++i);u=65536+((u&1023)<<10)|u1&1023 }if(u<=127){ if(outIdx>=endIdx)break;heap[outIdx++]
=u} else if(u<=2047){ if(outIdx+1>=endIdx)break;heap[outIdx++]=192|u>>6;heap[outIdx++]=128|u&63 } else
if(u<=65535){ if(outIdx+2>=endIdx)break;heap[outIdx++]=224|u>>12;heap[outIdx++]=128|u>>6&63;heap[outIdx
++]=128|u&63 } else { if(outIdx+3>=endIdx)break;heap[outIdx++]=240|u>>18;heap[outIdx++]=128|u>>12&63;heap[
outIdx++]=128|u>>6&63;heap[outIdx++]=128|u&63 } } heap[outIdx]=0;return outIdx-startIdx }function
stringToUTF8(str,outPtr,maxBytesToWrite){ return
stringToUTF8Array(str,HEAPU8,outPtr,maxBytesToWrite)}function
writeArrayToMemory(array,buffer){ HEAP8.set(array,buffer)}function
alignUp(x,multiple){ if(x%multiple>0){ x+=multiple-x%multiple }return x }var
buffer,HEAP8,HEAPU8,HEAP16,HEAPU16,HEAP32,HEAPU32,HEAPF32,HEAPF64;function
updateGlobalBufferAndViews(buf){ buffer=buf;Module[\"HEAP8\"] =HEAP8=new
Int8Array(buf);Module[\"HEAP16\"] =HEAP16=new Int16Array(buf);Module[\"HEAP32\"] =HEAP32=new
Int32Array(buf);Module[\"HEAPU8\"] =HEAPU8=new Uint8Array(buf);Module[\"HEAPU16\"] =HEAPU16=new
Uint16Array(buf);Module[\"HEAPU32\"] =HEAPU32=new
Uint32Array(buf);Module[\"HEAPF32\"] =HEAPF32=new
Float32Array(buf);Module[\"HEAPF64\"] =HEAPF64=new Float64Array(buf) }var
INITIAL_MEMORY=Module[\"INITIAL_MEMORY\"]||16777216;var wasmTable;var __ATPRERUN__=[];var
__ATINIT__=[];var __ATMAIN__=[];var __ATPOSTRUN__=[];var
runtimeInitialized=false;__ATINIT__.push({ func:function(){ __wasm_call_ctors() } });function
preRun(){ if(Module[\"preRun\"]){ if(typeof
Module[\"preRun\"] !== \"function\") Module[\"preRun\"] = [Module[\"preRun\"]];while(Module[\"preRun\"].length){ a
ddOnPreRun(Module[\"preRun\"].shift()) } } callRuntimeCallbacks(__ATPRERUN__) }function
initRuntime(){ runtimeInitialized=true;callRuntimeCallbacks(__ATINIT__) }function
preMain(){ callRuntimeCallbacks(__ATMAIN__) }function
postRun(){ if(Module[\"postRun\"]){ if(typeof
Module[\"postRun\"] !== \"function\") Module[\"postRun\"] = [Module[\"postRun\"]];while(Module[\"postRun\"].lengt
h){ addOnPostRun(Module[\"postRun\"].shift()) } } callRuntimeCallbacks(__ATPOSTRUN__) }function
addOnPreRun(cb){ __ATPRERUN__.unshift(cb) }function addOnPostRun(cb){ __ATPOSTRUN__.unshift(cb) }var
runDependencies=0;var runDependencyWatcher=null;var dependenciesFulfilled=null;function
addRunDependency(id){ runDependencies++;if(Module[\"monitorRunDependencies\"]){ Module[\"monitorRunDep
endencies\"](runDependencies) } }function removeRunDependency(id){ runDependencies--
;if(Module[\"monitorRunDependencies\"]){ Module[\"monitorRunDependencies\"](runDependencies) } if(runDepend
encies==0){ if(runDependencyWatcher!==null){ clearInterval(runDependencyWatcher);runDependencyWatcher=null
} } if(dependenciesFulfilled){ var
callback=dependenciesFulfilled;dependenciesFulfilled=null;callback() } } Module[\"preloadedImages\"]={ };Module
[\"preloadedAudios\"]={ };function
abort(what){ if(Module[\"onAbort\"]){ Module[\"onAbort\"](what) } what+=\"\\\";err(what);ABORT=true;EXITSTAT
US=1;what=\"abort(\\\"+what+\\\"). Build with -s ASSERTIONS=1 for more info.\";var e=new
WebAssembly.RuntimeError(what);readyPromiseReject(e);throw e }function hasPrefix(str,prefix){ return
String.prototype.startsWith?str.startsWith(prefix):str.indexOf(prefix)===0 }var
dataURIPrefix=\"data:application/octet-stream;base64,\";function isDataURI(filename){ return
hasPrefix(filename,dataURIPrefix) }var fileURIPrefix=\"file://\";function isFileURI(filename){ return
hasPrefix(filename,fileURIPrefix) }var wasmBinaryFile=\"tfjs-backend-
wasm.wasm\";if(!isDataURI(wasmBinaryFile)){ wasmBinaryFile=locateFile(wasmBinaryFile) }function
getBinary(file){ try { if(file===wasmBinaryFile&&wasmBinary){ return new
Uint8Array(wasmBinary) } if(readBinary){ return readBinary(file) } } else { throw \"both async and sync fetching of the

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wasm failed\"} } catch(err){ abort(err)} } function
getBinaryPromise(){ if(!wasmBinary&&(ENVIRONMENT_IS_WEB||ENVIRONMENT_IS_WORKER)){ if(typeof
fetch===\"function\"&&!isFileURI(wasmBinaryFile)){ return fetch(wasmBinaryFile,{ credentials:\"same-
origin\").then(function(response){ if(!response[\"ok\"]){ throw\"failed to load wasm binary file at
\"+wasmBinaryFile+\"\\\" } return response[\"arrayBuffer\"]()}).catch(function(){ return
getBinary(wasmBinaryFile)}) } else{ if(readAsync){ return new
Promise(function(resolve,reject){ readAsync(wasmBinaryFile,function(response){ resolve(new
Uint8Array(response))),reject})) } } return Promise.resolve().then(function(){ return
getBinary(wasmBinaryFile)}) } } function createWasm(){ var info={\"a\":asmLibraryArg};function
receiveInstance(instance,module){ var
exports=instance.exports;Module[\"asm\"] = exports;wasmMemory=Module[\"asm\"][\"j\"];updateGlobalBufferAnd
Views(wasmMemory.buffer);wasmTable=Module[\"asm\"][\"r\"];removeRunDependency(\"wasm-
instantiate\");addRunDependency(\"wasm-instantiate\");function
receiveInstantiatedSource(output){ receiveInstance(output[\"instance\"])}function
instantiateArrayBuffer(receiver){ return getBinaryPromise().then(function(binary){ return
WebAssembly.instantiate(binary,info)).then(receiver,function(reason){ err(\"failed to asynchronously prepare
wasm: \" + reason);abort(reason)}) } } function instantiateAsync(){ if(!wasmBinary&&typeof
WebAssembly.instantiateStreaming===\"function\"&&!isDataURI(wasmBinaryFile)&&!isFileURI(wasmBinaryFil
e)&&typeof fetch===\"function\"){ return fetch(wasmBinaryFile,{ credentials:\"same-
origin\").then(function(response){ var result=WebAssembly.instantiateStreaming(response,info);return
result.then(receiveInstantiatedSource,function(reason){ err(\"wasm streaming compile failed: \" + reason);err(\"falling
back to ArrayBuffer instantiation\");return instantiateArrayBuffer(receiveInstantiatedSource)})}) } } else{ return
instantiateArrayBuffer(receiveInstantiatedSource)} } if(Module[\"instantiateWasm\"]){ try{ var
exports=Module[\"instantiateWasm\"](info,receiveInstance);return exports } catch(e){ err(\"Module.instantiateWasm
callback failed with error: \" + e);return false } } instantiateAsync().catch(Promise.reject);return { } } function
callRuntimeCallbacks(callbacks){ while(callbacks.length>0){ var callback=callbacks.shift();if(typeof
callback===\"function\"){ callback(Module);continue } var func=callback.func;if(typeof
func===\"number\"){ if(callback.arg===undefined){ wasmTable.get(func)() } else{ wasmTable.get(func)(callback.arg)
} } else{ func(callback.arg===undefined?null:callback.arg) } } } function _abort(){ abort() } function
_emscripten_memcpy_big(dest,src,num){ HEAPU8.copyWithin(dest,src,src+num) } function
_emscripten_get_heap_size(){ return HEAPU8.length } function
emscripten_realloc_buffer(size){ try{ wasmMemory.grow(size-
buffer.byteLength+65535>>>16);updateGlobalBufferAndViews(wasmMemory.buffer);return
1 } catch(e){ } } function _emscripten_resize_heap(requestedSize){ var oldSize=_emscripten_get_heap_size();var
maxHeapSize=2147483648;if(requestedSize>maxHeapSize){ return false } for(var
cutDown=1;cutDown<=4;cutDown*=2){ var
overGrownHeapSize=oldSize*(1+.2/cutDown);overGrownHeapSize=Math.min(overGrownHeapSize,requestedSize
+100663296);var
newSize=Math.min(maxHeapSize,alignUp(Math.max(requestedSize,overGrownHeapSize),65536));var
replacement=emscripten_realloc_buffer(newSize);if(replacement){ return true } } return false } var
SYSCALLS={ mappings:{ }, buffers:[null,[],[]], printChar:function(stream,curr){ var
buffer=SYSCALLS.buffers[stream];if(curr===0||curr===10){ (stream===1?out:err)(UTF8ArrayToString(buffer,0));
buffer.length=0 } else{ buffer.push(curr) } }, varargs:undefined, get:function(){ SYSCALLS.varargs+=4;var
ret=HEAP32[SYSCALLS.varargs-4>>2];return ret }, getStr:function(ptr){ var ret=UTF8ToString(ptr);return
ret }, get64:function(low,high){ return low } }, function _fd_close(fd){ return 0 } function
_fd_seek(fd,offset_low,offset_high,whence,newOffset){ } function _fd_write(fd,iiov,iiovcnt,pnum){ var num=0;for(var
i=0;i<iiovcnt;i++){ var ptr=HEAP32[iiov+i*8>>2];var len=HEAP32[iiov+(i*8+4)>>2];for(var
j=0;j<len;j++){ SYSCALLS.printChar(fd,HEAPU8[ptr+j]) } num+=len } HEAP32[pnum>>2]=num;return

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0}function _pthread_create(){return 6}function _pthread_join(){return 28}function
setErrNo(value){HEAP32[___errno_location()>>2]=value;return value}function
_sysconf(name){switch(name){case 30:return 16384;case 85:var maxHeapSize=2147483648;return
maxHeapSize/16384;case 132:case 133:case 12:case 137:case 138:case 15:case 235:case 16:case 17:case 18:case
19:case 20:case 149:case 13:case 10:case 236:case 153:case 9:case 21:case 22:case 159:case 154:case 14:case
77:case 78:case 139:case 82:case 68:case 67:case 164:case 11:case 29:case 47:case 48:case 95:case 52:case 51:case
46:return 200809;case 27:case 246:case 127:case 128:case 23:case 24:case 160:case 161:case 181:case 182:case
242:case 183:case 184:case 243:case 244:case 245:case 165:case 178:case 179:case 49:case 50:case 168:case
169:case 175:case 170:case 171:case 172:case 97:case 76:case 32:case 173:case 35:case 80:case 81:case 79:return-
1;case 176:case 177:case 7:case
155:case 8:case 157:case 125:case 126:case 92:case 93:case 129:case 130:case 131:case 94:case 91:return 1;case
74:case 60:case 69:case 70:case 4:return 1024;case 31:case 42:case 72:return 32;case 87:case 26:case 33:return
2147483647;case 34:case 1:return 47839;case 38:case 36:return 99;case 43:case 37:return 2048;case 0:return
2097152;case 3:return 65536;case 28:return 32768;case 44:return 32767;case 75:return 16384;case 39:return
1e3;case 89:return 700;case 71:return 256;case 40:return 255;case 2:return 100;case 180:return 64;case 25:return
20;case 5:return 16;case 6:return 6;case 73:return 4;case 84:{if(typeof navigator===\"object\")return
navigator[\"hardwareConcurrency\"]||1;return 1}}setErrNo(28);return-1}var
asmLibraryArg={\"a\":_abort,\"d\":_emscripten_memcpy_big,\"e\":_emscripten_resize_heap,\"f\":_fd_close,\"c\":_f
d_seek,\"b\":_fd_write,\"h\":_pthread_create,\"g\":_pthread_join,\"i\":_sysconf};var asm=createWasm();var
___wasm_call_ctors=Module[\"___wasm_call_ctors\"]=function(){return(___wasm_call_ctors=Module[\"___wasm
_call_ctors\"]=Module[\"asm\"][\"k\"]).apply(null,arguments)};var
_init=Module[\"_init\"]=function(){return(_init=Module[\"_init\"]=Module[\"asm\"][\"l\"]).apply(null,arguments)};
var
_init_with_threads_count=Module[\"_init_with_threads_count\"]=function(){return(_init_with_threads_count=Mod
ule[\"_init_with_threads_count\"]=Module[\"asm\"][\"m\"]).apply(null,arguments)};var
_get_threads_count=Module[\"_get_threads_count\"]=function(){return(_get_threads_count=Module[\"_get_threads
_count\"]=Module[\"asm\"][\"n\"]).apply(null,arguments)};var
_register_tensor=Module[\"_register_tensor\"]=function(){return(_register_tensor=Module[\"_register_tensor\"]=M
odule[\"asm\"][\"o\"]).apply(null,arguments)};var
_dispose_data=Module[\"_dispose_data\"]=function(){return(_dispose_data=Module[\"_dispose_data\"]=Module[\"
asm\"][\"p\"]).apply(null,arguments)};var
_dispose=Module[\"_dispose\"]=function(){return(_dispose=Module[\"_dispose\"]=Module[\"asm\"][\"q\"]).apply(n
ull,arguments)};var
_Abs=Module[\"_Abs\"]=function(){return(_Abs=Module[\"_Abs\"]=Module[\"asm\"][\"s\"]).apply(null,arguments
)};var
_Add=Module[\"_Add\"]=function(){return(_Add=Module[\"_Add\"]=Module[\"asm\"][\"t\"]).apply(null,argument
s)};var
_AddN=Module[\"_AddN\"]=function(){return(_AddN=Module[\"_AddN\"]=Module[\"asm\"][\"u\"]).apply(null,ar
guments)};var
_All=Module[\"_All\"]=function(){return(_All=Module[\"_All\"]=Module[\"asm\"][\"v\"]).apply(null,arguments)};
var
_Any=Module[\"_Any\"]=function(){return(_Any=Module[\"_Any\"]=Module[\"asm\"][\"w\"]).apply(null,argumen
ts)};var
_ArgMax=Module[\"_ArgMax\"]=function(){return(_ArgMax=Module[\"_ArgMax\"]=Module[\"asm\"][\"x\"]).app
ly(null,arguments)};var
_AvgPool=Module[\"_AvgPool\"]=function(){return(_AvgPool=Module[\"_AvgPool\"]=Module[\"asm\"][\"y\"]).a
pply(null,arguments)};var
_BatchMatMul=Module[\"_BatchMatMul\"]=function(){return(_BatchMatMul=Module[\"_BatchMatMul\"]=Modu

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le["asm\"][\"z\").apply(null,arguments));var
_Ceil=Module["_Ceil"]=function(){return(_Ceil=Module["_Ceil"]=Module["asm\"][\"A\").apply(null,arguments));var
_ClipByValue=Module["_ClipByValue"]=function(){return(_ClipByValue=Module["_ClipByValue"]=Module["asm\"][\"B\").apply(null,arguments));var
_Conv2D=Module["_Conv2D"]=function(){return(_Conv2D=Module["_Conv2D"]=Module["asm\"][\"C\").apply(null,arguments));var
_Conv2DBackpropInput=Module["_Conv2DBackpropInput"]=function(){return(_Conv2DBackpropInput=Module["_Conv2DBackpropInput"]=Module["asm\"][\"D\").apply(null,arguments));var
_Cos=Module["_Cos"]=function(){return(_Cos=Module["_Cos"]=Module["asm\"][\"E\").apply(null,arguments));var
_Cosh=Module["_Cosh"]=function(){return(_Cosh=Module["_Cosh"]=Module["asm\"][\"F\").apply(null,arguments));var
_CropAndResize=Module["_CropAndResize"]=function(){return(_CropAndResize=Module["_CropAndResize"]=Module["asm\"][\"G\").apply(null,arguments));var
_Cumsum=Module["_Cumsum"]=function(){return(_Cumsum=Module["_Cumsum"]=Module["asm\"][\"H\").apply(null,arguments));var
_DepthToSpace=Module["_DepthToSpace"]=function(){return(_DepthToSpace=Module["_DepthToSpace"]=Module["asm\"][\"I\").apply(null,arguments));var
_DepthwiseConv2dNative=Module["_DepthwiseConv2dNative"]=function(){return(_DepthwiseConv2dNative=Module["_DepthwiseConv2dNative"]=Module["asm\"][\"J\").apply(null,arguments));var
_Elu=Module["_Elu"]=function(){return(_Elu=Module["_Elu"]=Module["asm\"][\"K\").apply(null,arguments));var
_Equal=Module["_Equal"]=function(){return(_Equal=Module["_Equal"]=Module["asm\"][\"L\").apply(null,arguments));var
_Exp=Module["_Exp"]=function(){return(_Exp=Module["_Exp"]=Module["asm\"][\"M\").apply(null,arguments));var
_FlipLeftRight=Module["_FlipLeftRight"]=function(){return(_FlipLeftRight=Module["_FlipLeftRight"]=Module["asm\"][\"N\").apply(null,arguments));var
_Floor=Module["_Floor"]=function(){return(_Floor=Module["_Floor"]=Module["asm\"][\"O\").apply(null,arguments));var
_FloorDiv=Module["_FloorDiv"]=function(){return(_FloorDiv=Module["_FloorDiv"]=Module["asm\"][\"P\").apply(null,arguments));var
_FusedBatchNorm=Module["_FusedBatchNorm"]=function(){return(_FusedBatchNorm=Module["_FusedBatchNorm"]=Module["asm\"][\"Q\").apply(null,arguments));var
_FusedConv2D=Module["_FusedConv2D"]=function(){return(_FusedConv2D=Module["_FusedConv2D"]=Module["asm\"][\"R\").apply(null,arguments));var
_FusedDepthwiseConv2D=Module["_FusedDepthwiseConv2D"]=function(){return(_FusedDepthwiseConv2D=Module["_FusedDepthwiseConv2D"]=Module["asm\"][\"S\").apply(null,arguments));var
_Gather=Module["_Gather"]=function(){return(_Gather=Module["_Gather"]=Module["asm\"][\"T\").apply(null,arguments));var
_GatherNd=Module["_GatherNd"]=function(){return(_GatherNd=Module["_GatherNd"]=Module["asm\"][\"U\").apply(null,arguments));var
_Greater=Module["_Greater"]=function(){return(_Greater=Module["_Greater"]=Module["asm\"][\"V\").apply(null,arguments));var
_GreaterEqual=Module["_GreaterEqual"]=function(){return(_GreaterEqual=Module["_GreaterEqual"]=Module["asm\"][\"W\").apply(null,arguments));var
_LeakyRelu=Module["_LeakyRelu"]=function(){return(_LeakyRelu=Module["_LeakyRelu"]=Module["asm\"][\"

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"X\").apply(null,arguments));var
_Less=Module["_Less"]=function(){return(_Less=Module["_Less"]=Module["asm\"][\"Y\"]).apply(null,arguments));var
_LessEqual=Module["_LessEqual"]=function(){return(_LessEqual=Module["_LessEqual"]=Module["asm\"][\"Z\"]).apply(null,arguments));var
_Log=Module["_Log"]=function(){return(_Log=Module["_Log"]=Module["asm\"][\"_\"]).apply(null,arguments));var
_LogicalAnd=Module["_LogicalAnd"]=function(){return(_LogicalAnd=Module["_LogicalAnd"]=Module["asm\"][\"$\"]).apply(null,arguments));var
_Max=Module["_Max"]=function(){return(_Max=Module["_Max"]=Module["asm\"][\"aa\"]).apply(null,arguments));var
_MaxPool=Module["_MaxPool"]=function(){return(_MaxPool=Module["_MaxPool"]=Module["asm\"][\"ba\"]).apply(null,arguments));var
_Maximum=Module["_Maximum"]=function(){return(_Maximum=Module["_Maximum"]=Module["asm\"][\"ca\"]).apply(null,arguments));var
_Mean=Module["_Mean"]=function(){return(_Mean=Module["_Mean"]=Module["asm\"][\"da\"]).apply(null,arguments));var
_Min=Module["_Min"]=function(){return(_Min=Module["_Min"]=Module["asm\"][\"ea\"]).apply(null,arguments));var
_Minimum=Module["_Minimum"]=function(){return(_Minimum=Module["_Minimum"]=Module["asm\"][\"fa\"]).apply(null,arguments));var
_MirrorPad=Module["_MirrorPad"]=function(){return(_MirrorPad=Module["_MirrorPad"]=Module["asm\"][\"ga\"]).apply(null,arguments));var
_Multiply=Module["_Multiply"]=function(){return(_Multiply=Module["_Multiply"]=Module["asm\"][\"ha\"]).apply(null,arguments));var
_Neg=Module["_Neg"]=function(){return(_Neg=Module["_Neg"]=Module["asm\"][\"ia\"]).apply(null,arguments));var
_NonMaxSuppressionV3=Module["_NonMaxSuppressionV3"]=function(){return(_NonMaxSuppressionV3=Module["_NonMaxSuppressionV3"]=Module["asm\"][\"ja\"]).apply(null,arguments));var
_NonMaxSuppressionV4=Module["_NonMaxSuppressionV4"]=function(){return(_NonMaxSuppressionV4=Module["_NonMaxSuppressionV4"]=Module["asm\"][\"ka\"]).apply(null,arguments));var
_NonMaxSuppressionV5=Module["_NonMaxSuppressionV5"]=function(){return(_NonMaxSuppressionV5=Module["_NonMaxSuppressionV5"]=Module["asm\"][\"la\"]).apply(null,arguments));var
_NotEqual=Module["_NotEqual"]=function(){return(_NotEqual=Module["_NotEqual"]=Module["asm\"][\"ma\"]).apply(null,arguments));var
_OneHot=Module["_OneHot"]=function(){return(_OneHot=Module["_OneHot"]=Module["asm\"][\"na\"]).apply(null,arguments));var
_PadV2=Module["_PadV2"]=function(){return(_PadV2=Module["_PadV2"]=Module["asm\"][\"oa\"]).apply(null,arguments));var
_Pow=Module["_Pow"]=function(){return(_Pow=Module["_Pow"]=Module["asm\"][\"pa\"]).apply(null,arguments));var
_Prelu=Module["_Prelu"]=function(){return(_Prelu=Module["_Prelu"]=Module["asm\"][\"qa\"]).apply(null,arguments));var
_Prod=Module["_Prod"]=function(){return(_Prod=Module["_Prod"]=Module["asm\"][\"ra\"]).apply(null,arguments));var
_RealDiv=Module["_RealDiv"]=function(){return(_RealDiv=Module["_RealDiv"]=Module["asm\"][\"sa\"]).apply(null,arguments));var
_Relu=Module["_Relu"]=function(){return(_Relu=Module["_Relu"]=Module["asm\"][\"ta\"]).apply(null,arguments));var

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nts));var
_Relu6=Module["_Relu6"]=function(){return(_Relu6=Module["_Relu6"]=Module["asm"]()["ua"]).apply(null,arguments));var
_ResizeBilinear=Module["_ResizeBilinear"]=function(){return(_ResizeBilinear=Module["_ResizeBilinear"]=Module["asm"]()["va"]).apply(null,arguments));var
_Reverse=Module["_Reverse"]=function(){return(_Reverse=Module["_Reverse"]=Module["asm"]()["wa"]).apply(null,arguments));var
_RotateWithOffset=Module["_RotateWithOffset"]=function(){return(_RotateWithOffset=Module["_RotateWithOffset"]=Module["asm"]()["xa"]).apply(null,arguments));var
_Round=Module["_Round"]=function(){return(_Round=Module["_Round"]=Module["asm"]()["ya"]).apply(null,arguments));var
_Rsqrt=Module["_Rsqrt"]=function(){return(_Rsqrt=Module["_Rsqrt"]=Module["asm"]()["za"]).apply(null,arguments));var
_ScatterNd=Module["_ScatterNd"]=function(){return(_ScatterNd=Module["_ScatterNd"]=Module["asm"]()["Aa"]).apply(null,arguments));var
_SelectV2=Module["_SelectV2"]=function(){return(_SelectV2=Module["_SelectV2"]=Module["asm"]()["Ba"]).apply(null,arguments));var
_Sigmoid=Module["_Sigmoid"]=function(){return(_Sigmoid=Module["_Sigmoid"]=Module["asm"]()["Ca"]).apply(null,arguments));var
_Sin=Module["_Sin"]=function(){return(_Sin=Module["_Sin"]=Module["asm"]()["Da"]).apply(null,arguments)};var
_Softmax=Module["_Softmax"]=function(){return(_Softmax=Module["_Softmax"]=Module["asm"]()["Ea"]).apply(null,arguments));var
_Sqrt=Module["_Sqrt"]=function(){return(_Sqrt=Module["_Sqrt"]=Module["asm"]()["Fa"]).apply(null,arguments)};var
_Square=Module["_Square"]=function(){return(_Square=Module["_Square"]=Module["asm"]()["Ga"]).apply(null,arguments)};var
_SquaredDifference=Module["_SquaredDifference"]=function(){return(_SquaredDifference=Module["_SquaredDifference"]=Module["asm"]()["Ha"]).apply(null,arguments)};var
_Step=Module["_Step"]=function(){return(_Step=Module["_Step"]=Module["asm"]()["Ia"]).apply(null,arguments)};var
_StridedSlice=Module["_StridedSlice"]=function(){return(_StridedSlice=Module["_StridedSlice"]=Module["asm"]()["Ja"]).apply(null,arguments)};var
_Sub=Module["_Sub"]=function(){return(_Sub=Module["_Sub"]=Module["asm"]()["Ka"]).apply(null,arguments)};var
_Sum=Module["_Sum"]=function(){return(_Sum=Module["_Sum"]=Module["asm"]()["La"]).apply(null,arguments)};var
_Tan=Module["_Tan"]=function(){return(_Tan=Module["_Tan"]=Module["asm"]()["Ma"]).apply(null,arguments)};var
_Tanh=Module["_Tanh"]=function(){return(_Tanh=Module["_Tanh"]=Module["asm"]()["Na"]).apply(null,arguments)};var
_Tile=Module["_Tile"]=function(){return(_Tile=Module["_Tile"]=Module["asm"]()["Oa"]).apply(null,arguments)};var
_TopK=Module["_TopK"]=function(){return(_TopK=Module["_TopK"]=Module["asm"]()["Pa"]).apply(null,arguments)};var
_Transform=Module["_Transform"]=function(){return(_Transform=Module["_Transform"]=Module["asm"]()["Qa"]).apply(null,arguments)};var
_Transpose=Module["_Transpose"]=function(){return(_Transpose=Module["_Transpose"]=Module["asm"]()["R

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this.dataIdMap = new DataStorage(this, engine());\n }\n\n write(values:
backend_util.BackendValues, shape: number[], dtype: DataType):\n DataId {\n const dataId = {id:
this.dataIdNextNumber++};\n this.move(dataId, values, shape, dtype, 1);\n return dataId;\n }\n\n numDataIds(): number {\n return this.dataIdMap.numDataIds();\n }\n\n async time(f: () => void):
Promise<BackendTimingInfo> {\n const start = util.now();\n f();\n const kernelMs = util.now() - start;\n return {kernelMs};\n }\n\n move(\n dataId: DataId, values: backend_util.BackendValues, shape: number[],\n dtype: DataType, refCount: number): void {\n const id = this.dataIdNextNumber++;\n if (dtype === 'string') {\n const stringBytes = values as Uint8Array[];\n this.dataIdMap.set(\n dataId,\n {id, stringBytes,
shape, dtype, memoryOffset: null, refCount});\n return;\n }\n const size = util.sizeFromShape(shape);\n const numBytes = size * util.bytesPerElement(dtype);\n const memoryOffset = this.wasm._malloc(numBytes);\n this.dataIdMap.set(dataId, {id, memoryOffset, shape, dtype, refCount});\n this.wasm.tfjs.registerTensor(id,
size, memoryOffset);\n if (values != null) {\n this.wasm.HEAPU8.set(\n new Uint8Array(\n
(values as backend_util.TypedArray).buffer,\n (values as backend_util.TypedArray).byteOffset,
numBytes),\n memoryOffset);\n }\n }\n\n async read(dataId: DataId):
Promise<backend_util.BackendValues> {\n return this.readSync(dataId);\n }\n\n readSync(dataId: DataId):
backend_util.BackendValues {\n const {memoryOffset, dtype, shape, stringBytes} =\n this.dataIdMap.get(dataId);\n if (dtype === 'string') {\n return stringBytes;\n }\n const bytes =
this.wasm.HEAPU8.slice(\n memoryOffset,\n memoryOffset + util.sizeFromShape(shape) *
util.bytesPerElement(dtype));\n return typedArrayFromBuffer(bytes.buffer, dtype);\n }\n\n /**\n * Dispose the
memory if the dataId has
0 refCount. Return true if the memory\n * is released, false otherwise.\n * @param dataId\n * @oaram force
Optional, remove the data regardless of refCount\n */\n disposeData(dataId: DataId, force = false): boolean {\n if
(this.dataIdMap.has(dataId)) {\n const data = this.dataIdMap.get(dataId);\n data.refCount--;\n if (!force
&& data.refCount > 0) {\n return false;\n }\n this.wasm._free(data.memoryOffset);\n this.wasm.tfjs.disposeData(data.id);\n this.dataIdMap.delete(dataId);\n }\n return true;\n }\n\n /** Return
refCount of a `TensorData`.\n */\n refCount(dataId: DataId): number {\n if (this.dataIdMap.has(dataId)) {\n
const tensorData = this.dataIdMap.get(dataId);\n return tensorData.refCount;\n }\n return 0;\n }\n\n
incRef(dataId: DataId) {\n const data = this.dataIdMap.get(dataId);\n if (data != null) {\n data.refCount++;\n
}\n }\n\n floatPrecision(): 32 {\n return 32;\n }\n\n
// Returns the memory offset of a tensor. Useful for debugging and unit\n // testing.\n getMemoryOffset(dataId:
DataId): number {\n return this.dataIdMap.get(dataId).memoryOffset;\n }\n\n dispose() {\n this.wasm.tfjs.dispose();\n if ('PThread' in this.wasm) {\n this.wasm.PThread.terminateAllThreads();\n }\n this.wasm = null;\n }\n\n memory() {\n return {unreliable: false};\n }\n\n /**\n * Make a tensor info for the
output of an op. If `memoryOffset` is not\n * present, this method allocates memory on the WASM heap. If
`memoryOffset`\n * is present, the memory was allocated elsewhere (in c++) and we just record\n * the pointer
where that memory lives.\n */\n makeOutput(shape: number[], dtype: DataType, memoryOffset?: number):\n TensorInfo {\n let dataId: {};\n if (memoryOffset == null) {\n dataId = this.write(null /* values */, shape,
dtype);\n } else {\n const id = this.dataIdNextNumber++;\n dataId = {id};\n this.dataIdMap.set(dataId,
{id, memoryOffset, shape, dtype, refCount: 1});\n const size = util.sizeFromShape(shape);\n this.wasm.tfjs.registerTensor(id, size, memoryOffset);\n }\n return {dataId, shape, dtype};\n }\n\n
typedArrayFromHeap({shape, dtype, dataId}: TensorInfo):\n backend_util.TypedArray {\n const buffer =
this.wasm.HEAPU8.buffer;\n const {memoryOffset} = this.dataIdMap.get(dataId);\n const size =
util.sizeFromShape(shape);\n switch (dtype) {\n case 'float32':\n return new Float32Array(buffer,
memoryOffset, size);\n case 'int32':\n return new Int32Array(buffer, memoryOffset, size);\n case 'bool':\n
return new Uint8Array(buffer, memoryOffset, size);\n default:\n throw new Error(`Unknown dtype
${dtype}`);\n }\n }\n }\n\nfunction createInstantiateWasmFunc(path: string) {\n // this will be replace by rollout
plugin patchWechatWebAssembly in\n // minprogram's output.\n // tslint:disable-next-line:no-any\n

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 return (imports: any, callback: any) => {\n util.fetch(path, {credentials: 'same-origin'}).then((response) => {\n
if (!response['ok']) {\n imports.env.a(`failed to load wasm binary file at '${path}'`);\n }\n
response.arrayBuffer().then(binary => {\n WebAssembly.instantiate(binary, imports).then(output => {\n
callback(output.instance, output.module);\n });\n });\n });\n return {};\n });\n\n\n**\n * Returns the
path of the WASM binary.\n * @param simdSupported whether SIMD is supported\n * @param threadsSupported
whether multithreading is supported\n * @param wasmModuleFolder the directory containing the WASM
binaries.\n * \nfunction getPathToWasmBinary(\n simdSupported: boolean, threadsSupported: boolean,\n wasmModuleFolder: string) {\n if (wasmPath != null) {\n // If wasmPath is defined, the user has supplied a full
path to\n // the vanilla .wasm binary.\n return wasmPath;\n }\n\n let path: WasmBinaryName
= 'tfjs-backend-wasm.wasm';\n if (simdSupported && threadsSupported) {\n path = 'tfjs-backend-wasm-
threaded-simd.wasm';\n } else if (simdSupported) {\n path = 'tfjs-backend-wasm-simd.wasm';\n }\n\n if
(wasmFileMap != null) {\n if (wasmFileMap[path] != null) {\n return wasmFileMap[path];\n }\n }\n\n
return wasmModuleFolder + path;\n }\n\n\n**\n * Initializes the wasm module and creates the js <--> wasm bridge.\n
*\n * NOTE: We wrap the wasm module in a object with property 'wasm' instead of\n * returning
Promise<BackendWasmModule> to avoid freezing Chrome (last tested\n * in Chrome 76).\n * \nexport async
function init(): Promise<{wasm: BackendWasmModule}> {\n const [simdSupported, threadsSupported] = await
Promise.all([\n env().getAsync('WASM_HAS_SIMD_SUPPORT'),\n
env().getAsync('WASM_HAS_MULTITHREAD_SUPPORT')\n]);\n\n return new Promise((resolve, reject) =>
{\n const factoryConfig: WasmFactoryConfig = {};\n\n /**\n * This function overrides
the Emscripten module locateFile utility.\n * @param path The relative path to the file that needs to be loaded.\n
 * @param prefix The path to the main JavaScript file's directory.\n * \n factoryConfig.locateFile = (path,
prefix) => {\n if (path.endsWith('.worker.js')) {\n const response = wasmWorkerContents;\n const blob
= new Blob([response], {type: 'application/javascript'});\n return URL.createObjectURL(blob);\n }\n\n if
(path.endsWith('.wasm')) {\n return getPathToWasmBinary(\n simdSupported as boolean,
threadsSupported as boolean,\n wasmPathPrefix != null ? wasmPathPrefix : prefix);\n }\n return prefix
+ path;\n };\n\n // Use the instantiateWasm override when system fetch is not available.\n // Reference:\n //
https://github.com/emscripten-core/emscripten/blob/2bca083cbbd5a4133db61fbd74d04f7feecfa907/tests/manual_wasm_instantiate.html#L170\n
if (customFetch) {\n
factoryConfig.instantiateWasm =\n createInstantiateWasmFunc(getPathToWasmBinary(\n
simdSupported as boolean, threadsSupported as boolean,\n wasmPathPrefix != null ? wasmPathPrefix :
")));\n }\n\n let initialized = false;\n factoryConfig.onAbort = () => {\n if (initialized) {\n // Emscripten
already called console.warn so no need to double log.\n return;\n }\n if (initAborted) {\n //
Emscripten calls `onAbort` twice, resulting in double error\n // messages.\n return;\n }\n initAborted
= true;\n const rejectMsg =\n 'Make sure the server can serve the `.wasm` file relative to the ' +\n
'bundled js file. For more details see https://github.com/tensorflow/tfjs/blob/master/tfjs-backend-
wasm/README.md#using-bundlers';\n reject({message: rejectMsg});\n };\n\n let wasm:
Promise<BackendWasmModule>;\n // If `wasmPath` has been defined we must initialize the
vanilla module.\n if (threadsSupported && simdSupported && wasmPath == null) {\n
factoryConfig.mainScriptUrlOrBlob = new Blob(\n [\n var WasmBackendModuleThreadedSimd = ` +\n
wasmFactoryThreadedSimd.toString(),\n {type: 'text/javascript'}\n];\n wasm =
wasmFactoryThreadedSimd(factoryConfig);\n } else {\n // The wasmFactory works for both vanilla and SIMD
binaries.\n wasm = wasmFactory(factoryConfig);\n }\n\n // The WASM module has been successfully
created by the factory.\n // Any error will be caught by the onAbort callback defined above.\n
wasm.then((module) => {\n initialized = true;\n initAborted = false;\n\n const voidReturnType: string =
null;\n // Using the tfjs namespace to avoid conflict with emscripten's API.\n module.tfjs = {\n init:
module.cwrap('init', null, []),\n initWithThreadsCount:\n module.cwrap('init_with_threads_count', null,
['number']),\n getThreadsCount:

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module.cwrap('get_threads_count', 'number', [],\n registerTensor: module.cwrap(\n 'register_tensor',
null,\n [\n 'number', // id\n 'number', // size\n 'number', // memoryOffset\n]),\n disposeData: module.cwrap('dispose_data', voidReturnType, ['number']),\n dispose:
module.cwrap('dispose', voidReturnType, [],\n);\n\n resolve({ wasm: module });\n });\n });\n\n\nfunction
typedArrayFromBuffer(\n buffer: ArrayBuffer, dtype: DataType): backend_util.TypedArray {\n switch (dtype)
{\n case 'float32':\n return new Float32Array(buffer);\n case 'int32':\n return new Int32Array(buffer);\n case 'bool':\n return new Uint8Array(buffer);\n default:\n throw new Error(`Unknown dtype ${dtype}`);\n }\n}\n\nconst wasmBinaryNames = [\n 'tfjs-backend-wasm.wasm', 'tfjs-backend-wasm-simd.wasm',\n 'tfjs-backend-wasm-threaded-simd.wasm'\n] as const;\n\nlet
WasmBinaryName = typeof wasmBinaryNames[number];\n\nlet wasmPath: string = null;\nlet wasmPathPrefix:
string = null;\nlet wasmFileMap: {[key in WasmBinaryName]?: string} = {};\nlet initAborted = false;\nlet
customFetch = false;\n\n/**\n * @deprecated Use `setWasmPaths` instead.\n * Sets the path to the `.wasm` file
which will be fetched when the wasm\n * backend is initialized. See\n *
https://github.com/tensorflow/tfjs/blob/master/tfjs-backend-wasm/README.md#using-bundlers\n * for more
details.\n * @param path wasm file path or url\n * @param usePlatformFetch optional boolean to use platform fetch
to download\n * the wasm file, default to false.\n * \n * @doc {heading: 'Environment', namespace: 'wasm'}\n
*/\n\nexport function setWasmPath(path: string, usePlatformFetch = false): void {\n deprecationWarn(\n
'setWasmPath has been deprecated in favor of setWasmPaths and' +\n ' ' will be removed in a future release.);\n if
(initAborted) {\n throw new Error(\n 'The
WASM backend was already initialized. Make sure you call ' +\n '`setWasmPath()` before you call
`tf.setBackend()` or `tf.ready()`');\n }\n wasmPath = path;\n customFetch = usePlatformFetch;\n}\n\n/**\n *
Configures the locations of the WASM binaries.\n * \n * ```js\n * setWasmPaths({\n * 'tfjs-backend-wasm.wasm':
'renamed.wasm',\n * 'tfjs-backend-wasm-simd.wasm': 'renamed-simd.wasm',\n * 'tfjs-backend-wasm-threaded-
simd.wasm': 'renamed-threaded-simd.wasm'\n * });\n * \n * tf.setBackend('wasm');\n * \n * \n * @param
prefixOrFileMap This can be either a string or object:\n * - (string) The path to the directory where the WASM
binaries are located.\n * Note that this prefix will be used to load each binary (vanilla,\n * SIMD-enabled,
threading-enabled, etc.).\n * - (object) Mapping from names of WASM binaries to custom\n * full paths
specifying the locations of those binaries. This is useful if\n * your WASM binaries are not all located in the same
directory, or
if your\n * WASM binaries have been renamed.\n * @param usePlatformFetch optional boolean to use platform
fetch to download\n * the wasm file, default to false.\n * \n * @doc {heading: 'Environment', namespace:
'wasm'}\n */\n\nexport function setWasmPaths(\n prefixOrFileMap: string|{[key in WasmBinaryName]?: string},\n
usePlatformFetch = false): void {\n if (initAborted) {\n throw new Error(\n 'The WASM backend was already
initialized. Make sure you call ' +\n '`setWasmPaths()` before you call `tf.setBackend()` or ' +\n
 '`tf.ready()`');\n }\n\n if (typeof prefixOrFileMap === 'string') {\n wasmPathPrefix = prefixOrFileMap;\n } else
{\n wasmFileMap = prefixOrFileMap;\n const missingPaths =\n wasmBinaryNames.filter(name =>
wasmFileMap[name] == null);\n if (missingPaths.length > 0) {\n throw new Error(\n `There were no
entries found for the following binaries: ` +\n `${missingPaths.join(',')}`. Please either call
setWasmPaths with a ` +\n `map providing a path for each binary, or with a string indicating ` +\n
 `the directory where all the binaries can be found.`);\n }\n }\n\n customFetch = usePlatformFetch;\n}\n\n/**\n *
Used in unit tests.\n */\n\nexport function resetWasmPath(): void {\n wasmPath = null;\n wasmPathPrefix = null;\n
wasmFileMap = {};\n customFetch = false;\n initAborted = false;\n}\n\nlet threadsCount = -1;\nlet
actualThreadsCount = -1;\n\n/**\n * Sets the number of threads that will be used by XNNPACK to create\n *
threadpool (default to the number of logical CPU cores).\n * \n * This must be called before calling
`tf.setBackend('wasm')`.\n */\n\nexport function setThreadsCount(numThreads: number) {\n threadsCount =
numThreads;\n}\n\n/**\n * Gets the actual threads count that is used by XNNPACK.\n * \n * It is set after the
backend is initialized.\n */\n\nexport function getThreadsCount(): number {\n if (actualThreadsCount === -1) {\n
throw new Error(`WASM

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backend not initialized.`);\n }\n return actualThreadsCount;\n}\n","export const wasmWorkerContents = 'var
Module={};function threadPrintErr(){var text=Array.prototype.slice.call(arguments).join(
");console.error(text)}function threadAlert(){var text=Array.prototype.slice.call(arguments).join(
");postMessage({cmd:"alert",text:text,threadId:Module["_pthread_self"]()})}var
err=threadPrintErr;this.alert=threadAlert;Module["instantiateWasm"]=function(info,receiveInstance){var
instance=new
WebAssembly.Instance(Module["wasmModule"],info);Module["wasmModule"]=null;receiveInstance(instance);r
eturn instance.exports};function
moduleLoaded(){this.onmessage=function(e){try{if(e.data.cmd===\load"){Module["wasmModule"]=e.data.wa
smModule;Module["wasmMemory"]=e.data.wasmMemory;Module["buffer"]=Module["wasmMemory"].buffer;
Module["ENVIRONMENT_IS_PTHREAD"]=true;if(typeof
e.data.urlOrBlob===\string"){importScripts(e.data.urlOrBlob)}else{var
objectUrl=URL.createObjectURL(e.data.urlOrBlob);importScripts(objectUrl);URL.revokeObjectURL(objectUrl)}
WasmBackendModuleThreadedSimd(Module).then(function(instance){Module=instance;moduleLoaded()})}else
if(e.data.cmd===\objectTransfer"){Module["PThread"].receiveObjectTransfer(e.data)}else
if(e.data.cmd===\run"){Module["__performance_now_clock_drift"]=performance.now()-
e.data.time;Module["__emscripten_thread_init"](e.data.threadInfoStruct,0,0);var max=e.data.stackBase;var
top=e.data.stackBase+e.data.stackSize;Module["establishStackSpace"](top,max);Module["__emscripten_tls_init"](
);Module["PThread"].receiveObjectTransfer(e.data);Module["PThread"].setThreadStatus(Module["_pthread_self
"](),1);try{var
result=Module["invokeEntryPoint"](e.data.start_routine,e.data.arg);if(!Module["getNoExitRuntime"]())Module[
"PThread"].threadExit(result)}catch(ex){if(ex===\Canceled!){Module["PThread"].threadCancel()}else
if(ex!==\unwind"){if(ex instanceof
Module["ExitStatus"]){if(Module["getNoExitRuntime"]()){}}else{Module["PThread"].threadExit(ex.status)}}el
se{Module["PThread"].threadExit(-2);throw
ex}}}}else
if(e.data.cmd===\cancel){if(Module["_pthread_self"]()){Module["PThread"].threadCancel()}else
if(e.data.target===\setimmediate){}}else
if(e.data.cmd===\processThreadQueue){if(Module["_pthread_self"]()){Module["__emscripten_current_thread_
process_queued_calls"]())}else{err(\worker.js received unknown command
"+e.data.cmd);err(e.data)}}catch(ex){err(\worker.js onmessage() captured an uncaught exception:
"+ex);if(ex&&ex.stack)err(ex.stack);throw ex}};if(typeof process===\object"&&typeof
process.versions===\object"&&typeof process.versions.node===\string"){self={location:{href:__filename}};var
onmessage=this.onmessage;var
nodeWorkerThreads=require(\worker_threads");global.Worker=nodeWorkerThreads.Worker;var
parentPort=nodeWorkerThreads.parentPort;parentPort.on(\message",function(data){onmessage({data:data})});var
nodeFS=require(\fs");var nodeRead=function(filename){return
nodeFS.readFileSync(filename,\utf8");};function
globalEval(x){global.require=require;global.Module=Module;eval.call(null,x)}importScripts=function(f){globalEva
l(nodeRead(f));postMessage=function(msg){parentPort.postMessage(msg)};if(typeof
performance===\undefined"){performance={now:function(){return Date.now()}}}}";"/**\n * @license\n *
Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
\License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an \AS IS\ BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
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*/\n\nimport './flags_wasm';\n\nimport {registerBackend} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm,
init} from './backend_wasm';\n\nexport {BackendWasm, getThreadsCount, setThreadsCount, setWasmPath,
setWasmPaths} from './backend_wasm';\n\nexport {version as version_wasm} from './version';\n\nconst
WASM_PRIORITY = 2;\nregisterBackend('wasm', async () => {\n const {wasm} = await init();\n return new
BackendWasm(wasm);\n}, WASM_PRIORITY);\n\n/** @license See the LICENSE file. */\n\n// This code is
auto-generated, do not modify this file!\n\nconst version = '3.11.0';\n\nexport
{version};\n\n"], "names": ["CppType", "FusableActivation", "wasmFusedMatMul", "fusedMatMulConfig", "kernelName",
"_FusedMatMul", "backendName", "setupFunc", "backend", "wasm", "cwrap", "kernelFunc", "args", "inputs", "attrs",
"a", "b", "bias", "preluActivationWeights", "dtype", "Error", "transposeA", "transposeB", "activation", "leakyreluAlpha",
"aid", "dataIdMap", "get", "dataId", "id", "bId", "biasId", "biasData", "shape", "length", "preluActivationWeightsId", "fuse
dActivation", "leftDim", "rightDim", "batchDim", "out", "makeOutput", "outId", "aShapeBytes", "Uint8Array", "Int32Arr
ay", "buffer", "bShapeBytes", "createUnaryKernelConfig", "outType", "wasmFunc", "x", "xId", "util", "sizeFromShape", "
absConfig", "Abs", "createBinaryKernelConfig", "supportsFullBroadcast", "outputType", "newShape", "backend_util", "
assertAndGetBroadcastShape", "aBroadcastDims", "getBroadcastDims", "bBroadcastDims", "loopsOverAllOfA", "eve
ry", "v", "i", "loopsOverAllOfB", "addConfig", "Add", "addNConfig", "AddN", "inputIds", "map", "inputIdsBytes", "identi
ty", "inVals", "typedArrayFromHeap", "set", "wasmTranspose", "identityConfig", "Identity", "transpose", "_a", "perm", "n
ewPerm", "push", "minValIdx", "j", "reducedShape", "permIsNoOp", "outShape", "inShape", "Array", "computeOutShap
e", "cloned", "permBytes", "xShapeBytes", "wasmAll", "transposeConfig", "Transpose", "permuteAxesAndTranspose", "
axis", "xShape", "xRank", "originalAxes", "parseAxisParam", "axes", "permutedAxes", "getAxesPermutation", "xTransp
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[illegible]

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in path(s):

\* /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/tf-backend-wasm.min.js.map

No license file was found, but licenses were detected in source scan.

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AAwB;CACrC,CAAC","sourcesContent":["/*\n * @license\n * Copyright 2019 Google LLC. All Rights
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except in compliance with the License.\n * You may obtain a copy
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agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====
\n
*\n\nimport { Cast, CastAttrs, CastInputs, KernelConfig, KernelFunc } from '@tensorflow/tfjs-core';\nimport
{ TensorInfo } from '@tensorflow/tfjs-core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nexport function
cast(\n args: { inputs: CastInputs, attrs: CastAttrs, backend: BackendWasm }):\n TensorInfo {\n const { inputs:
{x}, attrs: { dtype }, backend } = args;\n const out = backend.makeOutput(x.shape, dtype);\n const inVals =
backend.toArrayFromHeap(x);\n const outVals = backend.toArrayFromHeap(out);\n outVals.set(inVals);\n return out;\n }\n\nexport const castConfig: KernelConfig = {\n kernelName: Cast,\n backendName: 'wasm',\n kernelFunc: cast as { } as KernelFunc,\n};\n\n"]}
```

Found in path(s):

\* /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Cast.js.map

No license file was found, but licenses were detected in source scan.

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License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You
may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required
by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\"
BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the
License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport { KernelConfig, LessEqual } from '@tensorflow/tfjs-core';\n\nimport { createBinaryKernelConfig } from
'./binary_kernel';\n\nconst supportsFullBroadcast = false;\n\nexport const lessEqualConfig: KernelConfig =\ncreateBinaryKernelConfig(LessEqual, supportsFullBroadcast, 'bool');\n\n]]

```

Found in path(s):

\* /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/LessEqual.js.map  
No license file was found, but licenses were detected in source scan.

```

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Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in
compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n
*
=====
*\n\nimport { KernelConfig, Relu6 } from '@tensorflow/tfjs-core';\n\nimport { createUnaryKernelConfig } from
'./unary_kernel';\n\nexport const relu6Config: KernelConfig = createUnaryKernelConfig(Relu6);\n\n]]

```

Found in path(s):

\* /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Relu6.js.map  
No license file was found, but licenses were detected in source scan.

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under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
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Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n
*
=====
*\n\nimport { Floor, KernelConfig } from '@tensorflow/tfjs-core';\n\nimport { createUnaryKernelConfig } from

```



```
'./unary_kernel';\nexport const floorConfig: KernelConfig = createUnaryKernelConfig(Floor);\n"]}
```

Found in path(s):

\* /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Floor.js.map

No license file was found, but licenses were detected in source scan.

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law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====
\n
*\n\nimport {FlipLeftRight, FlipLeftRightInputs, KernelConfig, KernelFunc, TensorInfo}
from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nlet wasmFlipLeftRight: (\n
xId: number, batch: number, imageHeight: number, imageWidth: number,\n numChannels: number, outId:
number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmFlipLeftRight =
backend.wasm.cwrap(FlipLeftRight, null /* void */, [\n 'number', // xId\n 'number', // batch\n 'number', //
imageHeight\n 'number', // imageWidth\n 'number', // numChannels\n 'number', // outId\n]);\n}\n\nexport
function flipLeftRight(\n args: {inputs: FlipLeftRightInputs, backend: BackendWasm}): TensorInfo {\n const
{inputs, backend} = args;\n const {image} = inputs;\n\n const out = backend.makeOutput(image.shape,
image.dtype);\n const imageId = backend.dataIdMap.get(image.dataId).id;\n const outId =
backend.dataIdMap.get(out.dataId).id;\n\n const [batch, imageHeight, imageWidth, numChannels] =
image.shape;\n\n wasmFlipLeftRight(\n imageId, batch,
 imageHeight, imageWidth, numChannels, outId);\n return out;\n}\n\nexport const flipLeftRightConfig:
KernelConfig = {\n kernelName: FlipLeftRight,\n backendName: 'wasm',\n kernelFunc: flipLeftRight as { } as
KernelFunc,\n setupFunc: setup\n};\n"]}
```

Found in path(s):

\* /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/FlipLeftRight.js.map

No license file was found, but licenses were detected in source scan.

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AAC,MAAM,gBAAGB,CAAC;AACvD,MAAM,CAAC,MAAM,WAAW,GAAiB,uBAAB,CAAC,KAAK,CAAC,CAAC", "sourcesContent":["/\*\n \* @license\n \* Copyright 2019 Google LLC. All Rights Reserved.\n \* Licensed under the Apache License, Version 2.0 (the \"License\");\n \* you may not use this file except in compliance with the License.\n \* You may obtain a copy of the License at\n \* http://www.apache.org/licenses/LICENSE-2.0\n \* Unless required by applicable law or agreed to in writing, software\n \* distributed under the License is distributed on an \"AS IS\" BASIS,\n \* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n

```
* =====\n*\nimport { KernelConfig, Rsqrt } from '@tensorflow/tfjs-core';\nimport { createUnaryKernelConfig } from './unary_kernel';\nexport const rsqrtConfig: KernelConfig = createUnaryKernelConfig(Rsqrt);\n]]
```

Found in path(s):

\* /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Rsqrt.js.map

No license file was found, but licenses were detected in source scan.

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BackendWasm extends KernelBackend {\n // 0 is reserved for null data ids.\n private dataIdNextNumber = 1;\n dataIdMap: DataStorage<TensorData>;\n\n constructor(public wasm:
BackendWasmModule|BackendWasmThreadedSimdModule) {\n super();\n
this.wasm.tfjs.initWithThreadsCount(threadsCount);\n actualThreadsCount = this.wasm.tfjs.getThreadsCount();\n
this.dataIdMap = new DataStorage(this, engine());\n }\n\n write(values: backend_util.BackendValues, shape:
number[], dtype: DataType):\n DataId {\n const dataId = {id: this.dataIdNextNumber++};\n
this.move(dataId, values, shape, dtype, 1);\n return dataId;\n }\n\n numDataIds(): number {\n return
this.dataIdMap.numDataIds();\n }\n\n async time(f: () => void): Promise<BackendTimingInfo>\n
{\n const start = util.now();\n f();\n const kernelMs = util.now() - start;\n return {kernelMs};\n }\n\n
move(\n dataId: DataId, values: backend_util.BackendValues, shape: number[],\n dtype: DataType, refCount:
number): void {\n const id = this.dataIdNextNumber++;\n if (dtype === 'string') {\n const stringBytes =
values as Uint8Array[];\n this.dataIdMap.set(\n dataId,\n {id, stringBytes, shape, dtype,
memoryOffset: null, refCount});\n return;\n }\n\n const size = util.sizeFromShape(shape);\n const
numBytes = size * util.bytesPerElement(dtype);\n const memoryOffset = this.wasm._malloc(numBytes);\n\n
this.dataIdMap.set(dataId, {id, memoryOffset, shape, dtype, refCount});\n\n this.wasm.tfjs.registerTensor(id, size,
memoryOffset);\n\n if (values != null) {\n this.wasm.HEAPU8.set(\n new Uint8Array(\n (values
as backend_util.TypedArray).buffer,\n (values as backend_util.TypedArray).byteOffset,\n numBytes),\n memoryOffset);\n }\n\n async read(dataId: DataId):
Promise<backend_util.BackendValues> {\n return this.readSync(dataId);\n }\n\n readSync(dataId: DataId):
backend_util.BackendValues {\n const {memoryOffset, dtype, shape, stringBytes} =\n
this.dataIdMap.get(dataId);\n if (dtype === 'string') {\n return stringBytes;\n }\n const bytes =
this.wasm.HEAPU8.slice(\n memoryOffset,\n memoryOffset + util.sizeFromShape(shape) *
util.bytesPerElement(dtype));\n return typedArrayFromBuffer(bytes.buffer, dtype);\n }\n\n /**\n * Dispose the
memory if the dataId has 0 refCount. Return true if the memory\n * is released, false otherwise.\n * @param
dataId\n * @param force Optional, remove the data regardless of refCount\n */\n disposeData(dataId: DataId,
force = false): boolean {\n if (this.dataIdMap.has(dataId)) {\n const data = this.dataIdMap.get(dataId);\n
data.refCount--;\n

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 if (!force && data.refCount > 0) {\n return false;\n }\n this.wasm._free(data.memoryOffset);\n this.wasm.tfjs.disposeData(data.id);\n this.dataIdMap.delete(dataId);\n }\n return true;\n }\n\n /** Return\n refCount of a `TensorData`. */\n refCount(dataId: DataId): number {\n if (this.dataIdMap.has(dataId)) {\n const tensorData = this.dataIdMap.get(dataId);\n return tensorData.refCount;\n }\n return 0;\n }\n\n incRef(dataId: DataId) {\n const data = this.dataIdMap.get(dataId);\n if (data != null) {\n data.refCount++;\n }\n }\n\n floatPrecision(): 32 {\n return 32;\n }\n\n // Returns the memory offset of a tensor. Useful for\n debugging and unit\n // testing.\n getMemoryOffset(dataId: DataId): number {\n return\n this.dataIdMap.get(dataId).memoryOffset;\n }\n\n dispose() {\n this.wasm.tfjs.dispose();\n if ('PThread' in\n this.wasm) {\n this.wasm.PThread.terminateAllThreads();\n }\n this.wasm\n = null;\n }\n\n memory() {\n return {unreliable: false};\n }\n\n /**\n * Make a tensor info for the output of an\n op. If `memoryOffset` is not\n * present, this method allocates memory on the WASM heap. If `memoryOffset`\n * is present, the memory was allocated elsewhere (in c++) and we just record\n * the pointer where that memory\n lives.\n */\n makeOutput(shape: number[], dtype: DataType, memoryOffset?: number):\n TensorInfo {\n let\n dataId: {};\n if (memoryOffset == null) {\n dataId = this.write(null /* values */, shape, dtype);\n } else {\n const id = this.dataIdNextNumber++;\n dataId = {id};\n this.dataIdMap.set(dataId, {id, memoryOffset, shape,\n dtype, refCount: 1});\n const size = util.sizeFromShape(shape);\n this.wasm.tfjs.registerTensor(id, size,\n memoryOffset);\n }\n return {dataId, shape, dtype};\n }\n\n typedArrayFromHeap({shape, dtype, dataId}:\n TensorInfo):\n backend_util.TypedArray {\n const buffer\n = this.wasm.HEAPU8.buffer;\n const {memoryOffset} = this.dataIdMap.get(dataId);\n const size =\n util.sizeFromShape(shape);\n switch (dtype) {\n case 'float32':\n return new Float32Array(buffer,\n memoryOffset, size);\n case 'int32':\n return new Int32Array(buffer, memoryOffset, size);\n case 'bool':\n return new Uint8Array(buffer, memoryOffset, size);\n default:\n throw new Error(`Unknown dtype\n ${dtype}`);\n }\n }\n\n function createInstantiateWasmFunc(path: string) {\n // this will be replace by rollout\n plugin patchWechatWebAssembly in\n // minprogram's output.\n // tslint:disable-next-line:no-any\n return\n (imports: any, callback: any) => {\n util.fetch(path, {credentials: 'same-origin'}).then((response) => {\n if\n (!response['ok']) {\n imports.env.a(`failed to load wasm binary file at '${path}'`);\n }\n response.arrayBuffer().then(binary => {\n WebAssembly.instantiate(binary, imports).then(output\n => {\n callback(output.instance, output.module);\n });\n });\n });\n return {};\n });\n }\n\n /**\n * Returns the path of the WASM binary.\n * @param simdSupported whether SIMD is supported\n * @param\n threadsSupported whether multithreading is supported\n * @param wasmModuleFolder the directory containing the\n WASM binaries.\n */\n function getPathToWasmBinary(\n simdSupported: boolean, threadsSupported: boolean,\n wasmModuleFolder: string) {\n if (wasmPath != null) {\n // If wasmPath is defined, the user has supplied a full\n path to\n // the vanilla .wasm binary.\n return wasmPath;\n }\n let path: WasmBinaryName = 'tfjs-backend-\n wasm.wasm';\n if (simdSupported && threadsSupported) {\n path = 'tfjs-backend-wasm-threaded-simd.wasm';\n } else if (simdSupported) {\n path = 'tfjs-backend-wasm-simd.wasm';\n }\n if (wasmFileMap != null) {\n if\n (wasmFileMap[path] != null) {\n return wasmFileMap[path];\n }\n }\n return\n wasmModuleFolder + path;\n }\n\n /**\n * Initializes the wasm module and creates the js <--> wasm bridge.\n */\n NOTE: We wrap the wasm module in a object with property 'wasm' instead of\n * returning\n Promise<BackendWasmModule> to avoid freezing Chrome (last tested\n * in Chrome 76).\n */\n export async\n function init(): Promise<{wasm: BackendWasmModule}> {\n const [simdSupported, threadsSupported] = await\n Promise.all([\n env().getAsync('WASM_HAS_SIMD_SUPPORT'),\n env().getAsync('WASM_HAS_MULTITHREAD_SUPPORT')\n]);\n return new Promise((resolve, reject) =>\n {\n const factoryConfig: WasmFactoryConfig = {};\n /**\n * This function overrides the Emscripten\n module locateFile utility.\n * @param path The relative path to the file that needs to be loaded.\n * @param\n prefix The path to the main JavaScript file's directory.\n */\n factoryConfig.locateFile = (path, prefix) => {\n if (path.endsWith('.worker.js')) {\n const response = wasmWorkerContents;\n const blob = new Blob([response], {type: 'application/javascript'});\n return\n URL.createObjectURL(blob);\n }\n if (path.endsWith('.wasm')) {\n return getPathToWasmBinary(\n
```

```

 simdSupported as boolean, threadsSupported as boolean,\n wasmPathPrefix != null ? wasmPathPrefix :
 prefix);\n }\n return prefix + path;\n };\n\n // Use the instantiateWasm override when system fetch is not
 available.\n // Reference:\n // https://github.com/emscripten-
 core/emscripten/blob/2bca083cbbd5a4133db61fbd74d04f7feecfa907/tests/manual_wasm_instantiate.html#L170\n if (customFetch) {\n factoryConfig.instantiateWasm =\n createInstantiateWasmFunc(getPathToWasmBinary(\n simdSupported as boolean, threadsSupported as
 boolean,\n wasmPathPrefix != null ? wasmPathPrefix : '));\n }\n let initialized = false;\n factoryConfig.onAbort = () => {\n if (initialized) {\n // Emscripten
 already called console.warn so no need to double log.\n return;\n }\n if (initAborted) {\n //
 Emscripten calls `onAbort` twice, resulting in double error\n // messages.\n return;\n }\n initAborted
 = true;\n const rejectMsg =\n 'Make sure the server can serve the `.wasm` file relative to the ' +\n
 'bundled js file. For more details see https://github.com/tensorflow/tfjs/blob/master/tfjs-backend-
 wasm/README.md#using-bundlers';\n reject({message: rejectMsg});\n };\n let wasm:
 Promise<BackendWasmModule>;\n // If `wasmPath` has been defined we must initialize the vanilla module.\n if
 (threadsSupported && simdSupported && wasmPath == null) {\n factoryConfig.mainScriptUrlOrBlob = new
 Blob(\n [var WasmBackendModuleThreadedSimd = ` +\n wasmFactoryThreadedSimd.toString()),\n
 {type: 'text/javascript'});\n wasm = wasmFactoryThreadedSimd(factoryConfig);\n } else
 {\n // The wasmFactory works for both vanilla and SIMD binaries.\n wasm = wasmFactory(factoryConfig);\n
 }\n }\n // The WASM module has been successfully created by the factory.\n // Any error will be caught by the
 onAbort callback defined above.\n wasm.then((module) => {\n initialized = true;\n initAborted = false;\n
 }\n const voidReturnType: string = null;\n // Using the tfjs namespace to avoid conflict with emscripten's API.\n
 module.tfjs = {\n init: module.cwrap('init', null, []),\n initWithThreadsCount:\n
 module.cwrap('init_with_threads_count', null, ['number']),\n getThreadsCount:\n
 module.cwrap('get_threads_count', 'number', []),\n registerTensor: module.cwrap(\n 'register_tensor',
 null,\n [\n 'number', // id\n 'number', // size\n 'number', // memoryOffset\n
]),\n disposeData: module.cwrap('dispose_data', voidReturnType,\n ['number']),\n dispose: module.cwrap('dispose', voidReturnType, []),\n };\n resolve({ wasm:
 module});\n });\n });\n\n function typedArrayFromBuffer(\n buffer: ArrayBuffer, dtype: DataType):
 backend_util.TypedArray {\n switch (dtype) {\n case 'float32':\n return new Float32Array(buffer);\n
 case 'int32':\n return new Int32Array(buffer);\n case 'bool':\n return new Uint8Array(buffer);\n
 default:\n throw new Error(`Unknown dtype ${dtype}`);\n }\n }\n\n const wasmBinaryNames = [\n 'tfjs-backend-
 wasm.wasm', 'tfjs-backend-wasm-simd.wasm',\n 'tfjs-backend-wasm-threaded-simd.wasm'\n] as const;\n type
 WasmBinaryName = typeof wasmBinaryNames[number];\n\n let wasmPath: string = null;\n let wasmPathPrefix:
 string = null;\n let wasmFileMap: {[key in WasmBinaryName]?: string} = {};\n let initAborted = false;\n let
 customFetch = false;\n\n /**\n * @deprecated Use `setWasmPaths` instead.\n * Sets the path to the `.wasm` file
 which will be fetched\n * when the wasm\n * backend is initialized. See\n * https://github.com/tensorflow/tfjs/blob/master/tfjs-backend-
 wasm/README.md#using-bundlers\n * for more details.\n * @param path wasm file path or url\n * @param
 usePlatformFetch optional boolean to use platform fetch to download\n * the wasm file, default to false.\n */\n
 @doc {heading: 'Environment', namespace: 'wasm'}\n /**\n * @export function setWasmPath(path: string,\n
 usePlatformFetch = false): void {\n deprecationWarn(\n 'setWasmPath has been deprecated in favor of
 setWasmPaths and '\n 'will be removed in a future release.';\n }\n if (initAborted) {\n throw new Error(\n
 'The WASM backend was already initialized. Make sure you call '\n 'setWasmPath()' before you call
 `tf.setBackend()` or `tf.ready()`);\n }\n wasmPath = path;\n customFetch = usePlatformFetch;\n }\n\n /**\n
 * Configures the locations of the WASM binaries.\n */\n /**\n * `js`\n * setWasmPaths({\n * 'tfjs-backend-wasm.wasm':
 'renamed.wasm',\n *\n * 'tfjs-backend-wasm-simd.wasm': 'renamed-simd.wasm',\n *\n * 'tfjs-backend-wasm-threaded-simd.wasm': 'renamed-
 threaded-simd.wasm'\n * });\n * tf.setBackend('wasm');\n */\n /**\n * @param prefixOrFileMap This can be either

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```
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```
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```

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=====\n*/\n\nimport { KernelConfig, KernelFunc, Reshape, ReshapeAttrs, ReshapeInputs, util } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\n\nexport function reshape(\n inputs: ReshapeInputs, attrs: ReshapeAttrs, backend: BackendWasm) {\n const { inputs, attrs } = args;\n const { x } = inputs;\n const { shape } = attrs;\n const xSize = util.sizeFromShape(x.shape);\n const $shape = util.inferFromImplicitShape(shape, xSize);\n util.assert(\n xSize === util.sizeFromShape($shape),\n () => `new shape: ${$shape}, old shape: ${x.shape}. New shape and old ` +\n `shape must have the same number of elements.`);\n // Backend needs to track refCount for the dataId for reshape op\n args.backend.incRef(x.dataId);\n return { dataId: x.dataId, shape: $shape, dtype: x.dtype };\n}\n\nexport const reshapeConfig: KernelConfig = {\n kernelName: Reshape,\n backendName: 'wasm',\n kernelFunc: reshape as { } as KernelFunc\n};\n}}
```

Found in path(s):

\* /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Reshape.js.map

No license file was found, but licenses were detected in source scan.

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AAC","sourcesContent":["/\*\*\n

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```
=====\n*\n\nimport { backend_util, KernelConfig, KernelFunc, Slice, slice_util, SliceAttrs, SliceInputs, TypedArray, util }
from '@tensorflow/tfjs-core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nimport { sliceImplCPU } from
 '../kernel_utils/shared';\n\n\nexport function slice(\n args: { inputs: SliceInputs, attrs: SliceAttrs, backend:
 BackendWasm }) {\n const { inputs: { x }, attrs: { begin, size }, backend } = args;\n\n const [begin_, size_] =
 slice_util.parseSliceParams(x, begin, size);\n\n const isContinuous = slice_util.isSliceContinuous(x.shape, begin_,
 size_);\n\n const xVals = backend.readSync(x.dataId);\n const out = backend.makeOutput(size_, x.dtype);\n const xStrides =
 util.computeStrides(x.shape);\n const outData = backend.dataIdMap.get(out.dataId);\n\n if (isContinuous) {\n const flatOffset = slice_util.computeFlatOffset(begin_, xStrides);\n\n if (x.dtype === 'string') {\n outData.stringBytes =\n (xVals as Uint8Array[]).slice(flatOffset, flatOffset +
 util.sizeFromShape(size_));\n } else {\n const outVals = backend.typedArrayFromHeap(out);\n outVals.set(\n (xVals as TypedArray).subarray(flatOffset, flatOffset +
 util.sizeFromShape(size_)),\n);\n\n return out;\n }\n\n if (x.dtype === 'string') {\n const res =
 sliceImplCPU(xVals, begin_, size_, x.shape, x.dtype);\n outData.stringBytes = res as Uint8Array[];\n return
 out;\n }\n\n const outVals = backend.typedArrayFromHeap(out);\n const rank = x.shape.length;\n if (rank === 2)
 {\n slice2d(\n xVals as TypedArray, xStrides[0], outVals, begin_ as [number, number],\n size_ as [number, number]);\n }
 else if (rank === 3) {\n slice3d(\n xVals as TypedArray, xStrides[0], xStrides[1], outVals,\n begin_ as [number, number, number], size_ as [number, number, number]);\n }
 else if (rank === 4) {\n slice4d(\n xVals as TypedArray, xStrides[0], xStrides[1], xStrides[2], outVals,\n begin_ as [number, number, number, number], size_ as [number, number, number, number]);\n }
 else {\n const res =\n sliceImplCPU(xVals, begin_, size_, x.shape, x.dtype) as TypedArray;\n outVals.set(res);\n }\n\n return out;\n }\n\n function slice2d(\n xVals: backend_util.TypedArray, xStride: number,\n outVals: backend_util.TypedArray, begin: [number, number],\n size: [number, number]): void {\n let outOffset = 0;\n const beginI = begin[0];\n const beginJ =
 begin[1];\n const endI = beginI + size[0];\n for (let i = beginI; i < endI; i++) {\n const xOffset = i * xStride + beginJ;\n outVals.set(xVals.subarray(xOffset, xOffset + size[1]),
 outOffset);\n outOffset += size[1];\n }\n }\n\n function slice3d(\n xVals: backend_util.TypedArray, xStride1:
 number, xStride2: number,\n outVals: backend_util.TypedArray, begin: [number, number, number],\n size: [number, number, number]): void {\n let outOffset = 0;\n const beginI = begin[0];\n const beginJ = begin[1];\n const beginK = begin[2];\n const endI = beginI + size[0];\n const endJ = beginJ + size[1];\n for (let i = beginI; i <
 endI; i++) {\n for (let j = beginJ; j < endJ; j++) {\n const xOffset = i * xStride1 + j * xStride2 + beginK;\n outVals.set(xVals.subarray(xOffset, xOffset + size[2]),
 outOffset);\n outOffset += size[2];\n }\n }\n }\n\n function slice4d(\n xVals: backend_util.TypedArray, xStride1: number, xStride2: number,\n xStride3: number, outVals: backend_util.TypedArray,\n begin: [number, number, number, number],\n size: [number, number, number, number]): void {\n let outOffset = 0;\n const beginI = begin[0];\n const beginJ =
 begin[1];\n const beginK = begin[2];\n const endI = beginI + size[0];\n const endJ = beginJ + size[1];\n const
 endK = beginK + size[2];\n const beginL = begin[3];\n\n for (let i = beginI; i < endI; i++) {\n for (let j = beginJ; j
 < endJ; j++) {\n for (let k = beginK; k < endK; k++) {\n const xOffset = i * xStride1 + j * xStride2 + k *
 xStride3 + beginL;\n outVals.set(xVals.subarray(xOffset, xOffset + size[3]), outOffset);\n outOffset +=
 size[3];\n }\n }\n }\n }\n\n export const sliceConfig: KernelConfig = {\n kernelName: Slice,\n backendName:
 'wasm',\n kernelFunc: slice as { } as KernelFunc,\n };\n}
```

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```

*@\n\nimport { backend_util, TensorInfo, util } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from
'../backend_wasm';\nimport { transpose } from '../Transpose';\n\n/**\n * Compute permutation axes and do a transpose
if necessary.\n *\n * Used by reduction ops.\n *\n * @param x input TensorInfo\n *\n * @param axis reduction axes\n *\n
* @param backend wasm backend instance\n *\n\nexport function permuteAxesAndTranspose(\n x: TensorInfo,
 axis: number|number[], backend: BackendWasm): {\n transposed: TensorInfo|null,\n axes: number[],\n
 originalAxes: number[],\n inputWasTransposed: boolean\n} {\n const xShape = x.shape;\n const xRank =
x.shape.length;\n\n const originalAxes = util.parseAxisParam(axis, xShape);\n let axes = originalAxes;\n const
permutedAxes = backend_util.getAxesPermutation(axes,
 xRank);\n let xTransposed = null;\n let inputWasTransposed = false;\n if (permutedAxes !== null) {\n const
newShape: number[] = new Array(xRank);\n for (let i = 0; i < newShape.length; i++) {\n newShape[i] =
xShape[permutedAxes[i]];\n }\n\n axes = backend_util.getInnerMostAxes(axes.length, xRank);\n xTransposed
=\n transpose({ inputs: { x }, attrs: { perm: permutedAxes }, backend});\n\n const xId =
backend.dataIdMap.get(x.dataId).id;\n const transposedId = backend.dataIdMap.get(xTransposed.dataId).id;\n if
(transposedId !== xId) {\n inputWasTransposed = true;\n }\n\n return { transposed: xTransposed,
originalAxes, axes, inputWasTransposed };\n }\n\n return {\n

```

```
* /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/kernel_utils.js.map
```

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```
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=====\n

```
*\n\nimport { KernelConfig, KernelFunc, TensorInfo, TopK, TopKAttrs, TopKInputs } from '@tensorflow/tfjs-
core';\n\nimport { BackendWasm } from './backend_wasm';\n\nimport { CppDType } from './types';\n\nlet wasmTopK:\n (\n xId: number, xShapeBytes: Uint8Array, xShapeLength: number,\n xDtype: CppDType, k: number, sorted:\n boolean, outValuesId: number,\n outIndicesId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmTopK = backend.wasm.cwrap(TopK, null /* void */, [\n 'number', // xId\n 'array', // x.shape\n 'number',\n // x.shape.length\n 'number', // x.dtype\n 'number', // k\n 'bool',\n // sorted\n 'number', // outValuesId\n 'number', // outIndicesId\n]);\n\n export const topk:\n (\n inputs: TopKInputs, backend: BackendWasm, attrs: TopKAttrs\n) =>\n TensorInfo[] | TensorInfo = ({ inputs,\n backend, attrs }) => {\n const { x } = inputs;\n const { k, sorted } = attrs;\n const xId =\n backend.dataIdMap.get(x.dataId).id;\n const xShapeBytes = new Uint8Array(new\n Int32Array(x.shape).buffer);\n const outputShape = x.shape.slice();\n outputShape[outputShape.length -\n 1] = k;\n const outValues = backend.makeOutput(outputShape, x.dtype);\n const outValuesId =\n backend.dataIdMap.get(outValues.dataId).id;\n const outIndices = backend.makeOutput(outputShape,\n 'int32');\n const outIndicesId = backend.dataIdMap.get(outIndices.dataId).id;\n\n wasmTopK(\n xId, xShapeBytes, x.shape.length, CppDType[x.dtype], k, sorted,\n outValuesId, outIndicesId);\n\n return [outValues, outIndices];\n };\n\n export const topKConfig: KernelConfig = {\n kernelName:\n TopK,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: topk as {\n } as KernelFunc,\n };
}
```

\* /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/TopK.js.map  
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[illegible]

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=====\n\n\*\n\nimport { \_FusedMatMul, \_FusedMatMulAttrs, \_FusedMatMulInputs, KernelConfig, KernelFunc } from  
'@tensorflow/tfjs-core';\n\nimport { BackendWasm } from '../backend\_wasm';\n\nimport { FusibleActivation } from  
 './types';\n\nlet wasmFusedMatMul: (\n aId: number, aShape: Uint8Array, aShapeSize: number, bId: number,\n bShape: Uint8Array, bShapeSize: number, transposeA: boolean,\n transposeB: boolean, activation: number,  
 biasId: number,\n preluActivationWeightsId: number, leakyreluAlpha:  
 number, outId: number) => (\n void;\n\nfunction setup(backend: BackendWasm) {\n wasmFusedMatMul =  
 backend.wasm.cwrap(\_FusedMatMul, null /\* void \*/, [\n 'number', // a\_id\n 'array', // a\_shape\n 'number', // a\_shape.length\n 'number', // b\_id\n 'array', // b\_shape\n 'number', // b\_shape.length\n 'number', // transpose\_a\n 'number', // transpose\_b\n 'number', // activation\n 'number', // biasId\n 'number', // preluActivationWeightsId\n 'number', // leakyreluAlpha\n 'number' // out\_id\n ]);\n\nfunction  
 fusedBatchMatMul(args: {\n inputs: \_FusedMatMulInputs,\n backend: BackendWasm,\n attrs:  
 \_FusedMatMulAttrs\n}) {\n const { inputs, backend, attrs } = args;\n const { a, b, bias, preluActivationWeights } =  
 inputs;\n\n if (a.dtype !== 'float32' || b.dtype !== 'float32') {\n throw new Error(\n ` \_FusedMatMul for non  
 non-float32 tensors not yet supported.`);\n }\n\n const { transposeA, transposeB, activation, leakyreluAlpha }  
 = attrs;\n const aId = backend.dataIdMap.get(a.dataId).id;\n const bId = backend.dataIdMap.get(b.dataId).id;\n\n let biasId = 0;\n if (bias !== null) {\n const biasData = backend.dataIdMap.get(bias.dataId);\n if  
 (biasData.shape.length !== 1) {\n throw new Error(\n ` \_FusedMatMul only supports rank-1 bias but got ` +  
 `rank \${biasData.shape.length}`);\n }\n biasId = biasData.id;\n }\n\n const preluActivationWeightsId =  
 preluActivationWeights == null ? 0 : backend.dataIdMap.get(preluActivationWeights.dataId).id;\n const  
 fusedActivation = (\n FusibleActivation[activation as { } as keyof typeof FusibleActivation];\n )\n if  
 (fusedActivation == null) {\n throw new Error(\n `\${activation} activation not yet supported for  
 FusedConv2D ` +  
 `in the wasm backend.`);\n }\n\n const leftDim = transposeA ? a.shape[2] : a.shape[1];\n const rightDim = transposeB ? b.shape[1] : b.shape[2];\n const batchDim = a.shape[0];\n\n const out = backend.makeOutput([batchDim, leftDim, rightDim], a.dtype);\n const outId =  
 backend.dataIdMap.get(out.dataId).id;\n\n const aShapeBytes = new Uint8Array(new  
 Int32Array(a.shape).buffer);\n const bShapeBytes = new Uint8Array(new Int32Array(b.shape).buffer);\n\n wasmFusedMatMul(\n aId, aShapeBytes, a.shape.length, bId, bShapeBytes, b.shape.length,\n transposeA, transposeB, fusedActivation, biasId, preluActivationWeightsId,\n leakyreluAlpha || 0, outId);\n\n return  
 out;\n}\n\nexport const fusedMatMulConfig: KernelConfig = {\n kernelName: \_FusedMatMul,\n backendName:  
 'wasm',\n setupFunc: setup,\n kernelFunc: fusedBatchMatMul as { } as KernelFunc\n};\n\n"]}

Found in path(s):

\* /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/\_FusedMatMul.js.map

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\*/

Found in path(s):

\* /tfjs-backend-wasm-zip/tfjs-backend-wasm/src/test\_node.ts

\* /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/test\_node.d.ts

\* /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/test\_node.js

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Found in path(s):

\* /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Relu.js.map

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```



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```
=====\n\n*\n\nimport { Add, KernelConfig } from '@tensorflow/tfjs-core';\nimport { createBinaryKernelConfig } from
'./binary_kernel';\n\nconst supportsFullBroadcast = true;\n\nexport const addConfig: KernelConfig =\n createBinaryKernelConfig(Add, supportsFullBroadcast);\n\n"]}
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Found in path(s):

\* /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Add.js.map

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```

```
=====\n
```

```

*\\n\\nimport { KernelConfig, KernelFunc, MirrorPad, MirrorPadAttrs, MirrorPadInputs } from '@tensorflow/tfjs-
core';\\n\\nimport { BackendWasm } from '../backend_wasm';\\n\\nimport { CppDType } from './types';\\n\\n// Must match
enum in MirrorPad.cc\\nenum MirrorPaddingMode {\\n reflect
= 0,\\n symmetric = 1\\n}\\n\\nlet wasmMirrorPad: (\\n xId: number, xShapeBytes: Uint8Array, xShapeLength:
number, xDtype: number,\\n prePaddingsBytes: Uint8Array, postPaddingsBytes: Uint8Array, mode: number,\\n
outId: number) => void;\\n\\nfunction setup(backend: BackendWasm) {\\n wasmMirrorPad =
backend.wasm.cwrap(MirrorPad, null /* void */, [\\n 'number', // xId\\n 'array', // x.shape\\n 'number', //
x.shape.length\\n 'number', // x.dtype\\n 'array', // pre-paddings\\n 'array', // post-paddings\\n 'number', //
mode\\n 'number', // outId\\n]);\\n}\\n\\nfunction mirrorPad(args: {\\n inputs: MirrorPadInputs,\\n backend:
BackendWasm,\\n attrs: MirrorPadAttrs\\n}) {\\n const {inputs: {x}, backend, attrs: {paddings, mode}} = args;\\n\\n
const outShape = paddings.map(\\n (p, i) => p[0] /* beforePad */ + x.shape[i] + p[1] /* afterPad */);\\n const xId =
backend.dataIdMap.get(x.dataId).id;\\n const out = backend.makeOutput(outShape, x.dtype);\\n const outId =
backend.dataIdMap.get(out.dataId).id;\\n const xShapeBytes = new Uint8Array(new
Int32Array(x.shape).buffer);\\n\\n const prePaddingsFlat = paddings.map(padTuple => padTuple[0]);\\n const
postPaddingsFlat = paddings.map(padTuple => padTuple[1]);\\n const prePaddingsBytes =\\n new
Uint8Array(new Int32Array(prePaddingsFlat).buffer);\\n const postPaddingsBytes =\\n new Uint8Array(new
Int32Array(postPaddingsFlat).buffer);\\n\\n wasmMirrorPad(\\n xId, xShapeBytes, x.shape.length,
CppDType[x.dtype], prePaddingsBytes,\\n postPaddingsBytes, MirrorPaddingMode[mode], outId);\\n return
out;\\n}\\n\\n\\nexport const mirrorPadConfig: KernelConfig = {\\n kernelName: MirrorPad,\\n backendName: 'wasm',\\n
kernelFunc: mirrorPad as { } as KernelFunc,\\n setupFunc: setup\\n};\\n"}

```

Found in path(s):

\* /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/MirrorPad.js.map

No license file was found, but licenses were detected in source scan.

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the License.\\n *
=====\\n
*\\n\\nimport { KernelConfig, KernelFunc, OnesLike, OnesLikeInputs } from '@tensorflow/tfjs-core';\\n\\nimport
{ BackendWasm } from '../backend_wasm';\\n\\nfunction onesLike(args: {inputs: OnesLikeInputs, backend:
BackendWasm}) {\\n const {inputs: {x}, backend} = args;\\n const out = backend.makeOutput(x.shape, x.dtype);\\n
const outVals = backend.typedArrayFromHeap(out);\\n outVals.fill(1);\\n return out;\\n}\\n\\n\\nexport const
onesLikeConfig: KernelConfig = {\\n kernelName: OnesLike,\\n backendName: 'wasm',\\n kernelFunc: onesLike as
{ } as KernelFunc,\\n};\\n"}

```

No license file was found, but licenses were detected in source scan.

```

=====\\n
*\\n\\nimport {ClipByValue, ClipByValueAttrs, ClipByValueInputs, KernelConfig, KernelFunc} from
'@tensorflow/tfjs-core';\\n\\nimport {BackendWasm}
from '../backend_wasm';\\n\\nlet wasmClip: (xId: number, min: number, max: number, outId: number) =>
void;\\n\\nfunction setup(backend: BackendWasm) {\\n wasmClip = backend.wasm.cwrap(ClipByValue, null /* void
*/, [\\n 'number', // x_id\\n 'number', // min\\n 'number', // max\\n 'number' // out_id\\n]);\\n}\\n\\nfunction
clip(args: {\\n inputs: ClipByValueInputs,\\n backend: BackendWasm,\\n attrs: ClipByValueAttrs\\n}) {\\n const
{inputs, backend, attrs} = args;\\n const {x} = inputs;\\n const {clipValueMin, clipValueMax} = attrs;\\n const xId =
backend.dataIdMap.get(x.dataId).id;\\n const out = backend.makeOutput(x.shape, x.dtype);\\n const outId =
backend.dataIdMap.get(out.dataId).id;\\n wasmClip(xId, clipValueMin, clipValueMax, outId);\\n return
out;\\n}\\n\\n\\nexport const clipByValueConfig: KernelConfig = {\\n kernelName: ClipByValue,\\n backendName:
'wasm',\\n setupFunc: setup,\\n kernelFunc: clip as {} as KernelFunc\\n};\\n"}

```

No license file was found, but licenses were detected in source scan.

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AAC,EAAC,GAAG,IAAI,CAAC;IACpC,MAAM,GAAG,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,CA
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```
=====\n*/\n\nimport { KernelConfig, KernelFunc, Sigmoid, SigmoidInputs, TensorInfo, util } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from './backend_wasm';\n\nlet wasmFunc:\n(xId: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n wasmFunc =\n backend.wasm.cwrap(Sigmoid, null /* void */, ['number', 'number']);\n\n function sigmoid(args: {\n backend: BackendWasm,\n inputs: SigmoidInputs\n }):\n TensorInfo {\n const { backend, inputs: { x } } = args;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const out = backend.makeOutput(x.shape, x.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n // Short-circuit zero-sized tensors.\n if (util.sizeFromShape(out.shape) === 0) {\n return out;\n }\n\n wasmFunc(xId, outId);\n return out;\n }\n\n export const sigmoidConfig:\n KernelConfig = {\n kernelName: 'Sigmoid',\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: sigmoid\n } as KernelFunc\n};\n"]}
```

Found in path(s):

\* /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Sigmoid.js.map

No license file was found, but licenses were detected in source scan.

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```
=====
*\n\nimport { KernelConfig, KernelFunc, OneHot, OneHotAttrs, OneHotInputs } from
 '@tensorflow/tfjs-core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nlet wasmOneHot: (\n indicesId:
number, depth: number, onValue: number, offValue: number,\n outId: number) => void;\n\nfunction
setup(backend: BackendWasm) {\n wasmOneHot = backend.wasm.cwrap(OneHot, null /* void */, [\n 'number',
// indices_id\n 'number', // depth,\n 'number', // onValue\n 'number', // offValue\n 'number' // out_id\n
]);\n}\n\nfunction oneHot(\n args: {inputs: OneHotInputs, attrs: OneHotAttrs, backend: BackendWasm}) {\n
const {inputs, backend, attrs} = args;\n const {indices} = inputs;\n const {depth, onValue, offValue} = attrs;\n
const out = backend.makeOutput([...indices.shape, depth], 'int32');\n const outId =
backend.dataIdMap.get(out.dataId).id;\n\n const indicesData = backend.dataIdMap.get(indices.dataId);\n const
indicesId = indicesData.id;\n\n wasmOneHot(indicesId, depth, onValue, offValue, outId);\n\n return
out;\n}\n\nexport const oneHotConfig:
 KernelConfig = {\n kernelName: OneHot,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: oneHot as
{} as KernelFunc,\n};\n\n}}
```

Found in path(s):

\* /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/OneHot.js.map

No license file was found, but licenses were detected in source scan.

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```

```
=====
*\n\nimport { Greater, KernelConfig } from '@tensorflow/tfjs-core';\n\nimport { createBinaryKernelConfig } from
 '../binary_kernel';\n\nconst supportsFullBroadcast = false;\n\nexport const greaterConfig: KernelConfig =\ncreateBinaryKernelConfig(Greater, supportsFullBroadcast, 'bool');\n\n}}
```

Found in path(s):

\* /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Greater.js.map

No license file was found, but licenses were detected in source scan.

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```
=====\n\n/*\n\nimport { FusedBatchNorm, FusedBatchNormAttrs, FusedBatchNormInputs, KernelConfig, KernelFunc, TensorInfo, util } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\n\nlet\nwasmBatchNorm: (\n xId: number, meanId: number, varianceId: number, offsetId: number,\n scaleId: number, varianceEpsilon: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n wasmBatchNorm = backend.wasm.cwrap(\n FusedBatchNorm, null /* void */,\n ['number', 'number', 'number', 'number', 'number', 'number', 'number']);\n\n function fusedBatchNorm(args: {\n backend: BackendWasm,\n inputs: FusedBatchNormInputs,\n attrs: FusedBatchNormAttrs\n }): TensorInfo {\n const { backend, inputs, attrs } = args;\n const { varianceEpsilon } = attrs;\n const { x, mean, variance, offset, scale } = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const meanId = backend.dataIdMap.get(mean.dataId).id;\n const varianceId = backend.dataIdMap.get(variance.dataId).id;\n const offsetId = offset != null ? backend.dataIdMap.get(offset.dataId).id : 0;\n const scaleId = scale != null ? backend.dataIdMap.get(scale.dataId).id : 0;\n\n const out = backend.makeOutput(x.shape, x.dtype);\n // Short-circuit zero-sized tensors.\n if (util.sizeFromShape(x.shape) === 0) {\n return out;\n }\n\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n wasmBatchNorm(\n xId, meanId, varianceId, offsetId, scaleId, varianceEpsilon, outId);\n\n return out;\n }\n\n export const fusedBatchNormConfig: KernelConfig = {\n kernelName: FusedBatchNorm,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: fusedBatchNorm as { } as KernelFunc\n };"}\n\n}
```

Found in path(s):

\* /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/FusedBatchNorm.js.map

No license file was found, but licenses were detected in source scan.

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```
=====\n\n*\\nimport {KernelConfig, LogicalAnd} from '@tensorflow/tfjs-core';\n\\nimport {createBinaryKernelConfig} from\n'./binary_kernel';\n\\nconst supportsFullBroadcast = false;\n\\nexport const logicalAndConfig: KernelConfig =\ncreateBinaryKernelConfig(LogicalAnd, supportsFullBroadcast, 'bool');\n\\n"]}
```

Found in path(s):

\* /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/LogicalAnd.js.map

No license file was found, but licenses were detected in source scan.

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```

```
=====\n\n*\\nimport {KernelConfig, Minimum} from '@tensorflow/tfjs-core';\n\\nimport {createBinaryKernelConfig} from\n'./binary_kernel';\n\\nconst supportsFullBroadcast = false;\n\\nexport const minimumConfig: KernelConfig =\ncreateBinaryKernelConfig(Minimum, supportsFullBroadcast);\n\\n"]}
```

Found in path(s):

\* /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Minimum.js.map

No license file was found, but licenses were detected in source scan.

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```

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Found in path(s):

No license file was found, but licenses were detected in source scan.

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```
=====\n*\n\nimport {backend_util, FusedConv2D, FusedConv2DAttrs, FusedConv2DInputs, KernelConfig, KernelFunc, Tensor4D} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nimport {FusableActivation} from './types';\n\nlet wasmFusedConv2d:\n (xId: number, batchSize: number, inputHeight: number, inputWidth: number,\n filterId: number, filterHeight: number, filterWidth: number,\n biasId: number, padTop: number, padRight: number, padBottom: number,\n padLeft: number, isSamePad: number, dilationHeight: number,\n dilationWidth: number, strideHeight: number, strideWidth: number,\n inputChannels: number, outputChannels: number, activation: number,\n preluActivationWeightsId: number, leakyreluAlpha: number, outId: number) =>\n void;\n\nfunction\n setup(backend: BackendWasm) {\n wasmFusedConv2d = backend.wasm.cwrap(FusedConv2D, null /* void */, [\n 'number', // xId\n 'number', // batchSize\n 'number', // inputHeight\n 'number', // inputWidth\n 'number', // filterId\n 'number', // filterHeight\n 'number', // filterWidth\n 'number', // biasId\n 'number', // padTop\n 'number', // padRight\n 'number', // padBottom\n 'number', // padLeft\n 'number', // isSamePad\n 'number', // dilationHeight\n 'number', // dilationWidth\n 'number', // strideHeight\n 'number', // strideWidth\n 'number', // inputChannels\n 'number', // outputChannels\n 'number', // activation\n 'number', // preluActivationWeightsId\n 'number', // leakyreluAlpha\n 'number', // outId\n]);\n\n function\n fusedConv2d(args: {\n inputs: FusedConv2DInputs,\n backend: BackendWasm,\n attrs: FusedConv2DAttrs\n }) {\n const {inputs, attrs, backend} = args;\n const {x, filter, bias, preluActivationWeights} = inputs;\n const {\n strides,\n pad,\n dilations,\n dataFormat,\n dimRoundingMode,\n activation,\n leakyreluAlpha\n } = attrs;\n\n const convInfo =\n backend_util.computeConv2DInfo(\n (x as Tensor4D).shape, (filter as Tensor4D).shape, strides, dilations,\n
```

```

pad, dimRoundingMode);\n\n const fusedActivation =\n FusableActivation[activation as { } as keyof typeof
FusableActivation];\n if (fusedActivation == null) {\n throw new Error(\n `${activation} activation not yet
supported for FusedConv2D` +\n `in the wasm backend.`);\n }\n\n const xId =
backend.dataIdMap.get(x.dataId).id;\n const filterId = backend.dataIdMap.get(filter.dataId).id;\n\n const
outputChannels = convInfo.outChannels;\n\n let biasId = 0;\n if (bias != null) {\n const biasData =
backend.dataIdMap.get(bias.dataId);\n if (biasData.shape.length !== 1) {\n throw new Error(\n
`FusedConv2D only supports rank-1 bias but
got ` +\n `rank ${biasData.shape.length}.`);\n }\n if (biasData.shape[0] !== outputChannels) {\n throw
new Error(\n `FusedConv2D bias shape (${biasData.shape}) does not ` +\n `match the number of output
channels (${outputChannels})`);\n }\n biasId = biasData.id;\n }\n\n const filterHeight =
convInfo.filterHeight;\n const filterWidth = convInfo.filterWidth;\n const padTop = convInfo.padInfo.top;\n const
padRight = convInfo.padInfo.right;\n const padBottom = convInfo.padInfo.bottom;\n const padLeft =
convInfo.padInfo.left;\n const dilationHeight = convInfo.dilationHeight;\n const dilationWidth =
convInfo.dilationWidth;\n const strideHeight = convInfo.strideHeight;\n const strideWidth =
convInfo.strideWidth;\n const inputChannels = convInfo.inChannels;\n const isSamePad = convInfo.padInfo.type
=== 'SAME' ? 1 : 0;\n const batchSize = convInfo.batchSize;\n const inHeight = convInfo.inHeight;\n const
inWidth = convInfo.inWidth;\n\n if (dataFormat !== 'NHWC') {\n throw new Error(\n `wasm backend FusedConv2D does not support
dataFormat:` +\n `${dataFormat}`. Please use 'NHWC'.`);\n }\n\n const out =
backend.makeOutput(convInfo.outShape, 'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n const
preluActivationWeightsId = preluActivationWeights == null ?\n 0 :\n backend.dataIdMap.get(preluActivationWeights.dataId).id;\n\n wasmFusedConv2d(\n xId, batchSize, inHeight,
inWidth, filterId, filterHeight, filterWidth,\n biasId, padTop, padRight, padBottom, padLeft, isSamePad,
dilationHeight,\n dilationWidth, strideHeight, strideWidth, inputChannels, outputChannels,\n fusedActivation,
preluActivationWeightsId, leakyreluAlpha || 0, outId);\n\n return out;\n}\n\n\nexport const fusedConv2DConfig:
KernelConfig = {\n kernelName: FusedConv2D,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc:
fusedConv2d as { } as KernelFunc\n};\n\n}}

```

Found in path(s):

\*

/tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/FusedConv2D.js.map

No license file was found, but licenses were detected in source scan.

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Version

```

```

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```

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 \*

Found in path(s):

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```
=====\\n
*/\\n\\nimport { CropAndResize, CropAndResizeAttrs, CropAndResizeInputs, KernelConfig, KernelFunc,
TensorInfo } from '@tensorflow/tfjs-core';\\n\\nimport { BackendWasm } from '../backend_wasm';\\n\\nimport { cast }
from './Cast';\\n\\n// Must match enum in CropAndResize.cc\\nenum InterpolationMethod {\\n bilinear = 0,\\n nearest
= 1\\n}\\n\\nlet wasmCropAndResize: (\\n imagesId: number, boxesId: number, boxIndId: number, numBoxes:
number,\\n imagesShape: Uint8Array, cropHeight: number, cropWidth: number,\\n method: number,
extrapolationValue: number, outId: number) => void;\\n\\nfunction setup(backend: BackendWasm): void {\\n
wasmCropAndResize = backend.wasm.cwrap(CropAndResize, null /*void*/, [\\n 'number', // imagesId\\n
'number', // boxesId\\n 'number', // boxIndId\\n 'number', // numBoxes\\n 'array', // images shape\\n 'number',
// cropHeight\\n 'number', // cropWidth\\n 'number', // method\\n 'number', // extrapolation value\\n
'number' // out id\\n]);\\n}\\n\\nfunction cropAndResize(args: {\\n backend: BackendWasm,\\n inputs:
CropAndResizeInputs,\\n attrs: CropAndResizeAttrs\\n}): TensorInfo {\\n const { backend, inputs, attrs } = args;\\n
const { method, extrapolationValue, cropSize } = attrs;\\n const { image, boxes, boxInd } = inputs;\\n\\n const
numBoxes = boxes.shape[0];\\n\\n const [cropHeight, cropWidth] = cropSize as [number, number];\\n const
outShape = [numBoxes, cropHeight, cropWidth, image.shape[3]];\\n\\n let imagesData =
backend.dataIdMap.get(image.dataId);\\n let castedData;\\n if (image.dtype !== 'float32') {\\n castedData =
cast({ backend, inputs: { x: image }, attrs: { dtype: 'float32' } });\\n imagesData =
backend.dataIdMap.get(castedData.dataId);\\n }\\n\\n const imagesId = imagesData.id;\\n const boxesId =
backend.dataIdMap.get(boxes.dataId).id;\\n const boxIndId = backend.dataIdMap.get(boxInd.dataId).id;\\n\\n const
out = backend.makeOutput(outShape, 'float32');\\n const outId = backend.dataIdMap.get(out.dataId).id;\\n\\n
const imagesShapeBytes = new Uint8Array(new Int32Array(image.shape).buffer);\\n\\n wasmCropAndResize(\\n
imagesId, boxesId, boxIndId, numBoxes, imagesShapeBytes, cropHeight,\\n cropWidth,\\n
InterpolationMethod[method as { } as keyof typeof InterpolationMethod],\\n extrapolationValue, outId);\\n\\n if
(castedData !== null) {\\n backend.disposeData(castedData.dataId);\\n }\\n\\n return out;\\n}\\n\\nexport const
cropAndResizeConfig: KernelConfig = {\\n kernelName: CropAndResize,\\n backendName: 'wasm',\\n setupFunc:
setup,\\n kernelFunc: cropAndResize as { } as KernelFunc\\n};\\n"}]
```

Found in path(s):

\* /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/CropAndResize.js.map

No license file was found, but licenses were detected in source scan.

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AC,CAAC", "sourcesContent": ["/*\n * @license\n * Copyright 2021 Google LLC. All Rights Reserved.\n *\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in
compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *\n * =====\\n
*/\n\nimport { KernelConfig, Round } from '@tensorflow/tfjs-core';\n\nimport { createUnaryKernelConfig } from
'./unary_kernel';\n\nexport const roundConfig: KernelConfig = createUnaryKernelConfig(Round);\n"}]
```

Found in path(s):

\* /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Round.js.map

No license file was found, but licenses were detected in source scan.

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the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY
KIND, either express or implied.\n * See the License for the specific language governing permissions and\n *
limitations under the License.\n
=====
\n
\nimport { env } from 'tensorflow/tfjs-core';\n\nconst ENV = env();\n\n/*\n * True if SIMD is supported.\n
\n// From: https://github.com/GoogleChromeLabs/wasm-feature-detect\nENV.registerFlag(\n // This typed array
passed in to WebAssembly.validate is WebAssembly binary\n // code. In this case it is a small program that
contains SIMD\n // instructions.\n 'WASM_HAS_SIMD_SUPPORT', async () => WebAssembly.validate(new
Uint8Array([\n 0, 97, 115, 109, 1, 0, 0, 0, 1, 4, 1, 96, 0, 0, 3,\n 2, 1, 0, 10, 9, 1, 7, 0, 65, 0, 253, 15, 26,
11\n])));\n\n/*\n * True if threads are supported.\n\n// From: https://github.com/GoogleChromeLabs/wasm-
feature-detect\nENV.registerFlag('WASM_HAS_MULTITHREAD_SUPPORT',
async () => {\n // TODO(annxingyuan): Enable node support once this is resolved:\n //
https://github.com/tensorflow/tfjs/issues/3830\n if (ENV.get('IS_NODE')) {\n return false;\n }\n\n try {\n //
Test for transferability of SABs (needed for Firefox)\n //
https://groups.google.com/forum/#!msg/mozilla.dev.platform/IHkBZIHETpA/dwsMNchWEQAJ\n new
MessageChannel().port1.postMessage(new SharedArrayBuffer(1));\n // This typed array is a WebAssembly
program containing threaded\n // instructions.\n return WebAssembly.validate(new Uint8Array([\n 0, 97,
115, 109, 1, 0, 0, 1, 4, 1, 96, 0, 0, 3, 2, 1, 0, 5,\n 4, 1, 3, 1, 1, 10, 11, 1, 9, 0, 65, 0, 254, 16, 2, 0, 26,
11\n])));\n } catch (e) {\n return false;\n }\n});\n"}] }
```

Found in path(s):



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```

*\n\nimport {backend_util, Concat, ConcatAttrs, ConcatInputs, KernelConfig, KernelFunc, util} from
'@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\nimport {concatImplCPU} from
'./kernel_utils/shared';\nimport {identity} from './Identity';\nimport {reshape} from './Reshape';\n\nexport function
concat(\n args: {inputs: ConcatInputs, backend: BackendWasm, attrs: ConcatAttrs}) {\n const {inputs,
 backend} = args;\n\n const axis = util.parseAxisParam(args.attrs.axis, inputs[0].shape)[0];\n\n let outShape =
 backend_util.computeOutShape(inputs.map(t => t.shape), axis);\n\n // Keep only non-empty tensors (ignore tensors
 with 0 in their shape).\n const $inputs = inputs.filter(t => util.sizeFromShape(t.shape) > 0);\n if ($inputs.length ===
 1) {\n return identity({inputs: {x: $inputs[0]}, backend});\n }\n\n const out = backend.makeOutput(outShape,
 inputs[0].dtype);\n\n if (util.sizeFromShape(outShape) === 0) {\n return out;\n }\n\n const shapes =
 $inputs.map(t => t.shape);\n backend_util.assertParamsConsistent(shapes, axis);\n\n if ($inputs[0].dtype ===
 'string') {\n // Any concat of n-dimensional tensors across any axis can be reduced to\n // a concatenation of two-
 dimensional tensors across the axis 1 by first\n // partitioning the axes of the original tensors into those less than
 the\n // axis to be concatenated and the rest. Then reshape the tensors\n
 // into a two-dimensional tensor by collapsing these two sets of axes and\n // concatenate the resulting matrices
 across the axis 1, finally reshaping\n // the result to have the proper shape.\n const inputs2D = $inputs.map(t =>
 {\n const innerSize = util.sizeFromShape(t.shape.slice(axis));\n const shape = [-1, innerSize];\n return
 reshape({inputs: {x: t}, backend, attrs: {shape}});\n });\n\n const inputsValShapes = inputs2D.map(t => {\n
 return {vals: backend.readSync(t.dataId), shape: t.shape};\n });\n\n // Concat 2d tensors along axis=1.\n
 outShape =\n backend_util.computeOutShape(inputs2D.map(t => t.shape), 1 /* axis */);\n const simplyConcat
 = inputs2D[0].shape[0] === 1;\n const outVals = concatImplCPU(\n inputsValShapes, outShape,
 inputs[0].dtype,\n simplyConcat) as string[];\n\n const finalOutShape =\n backend_util.computeOutShape($inputs.map(t => t.shape),
 axis);\n\n out.shape = finalOutShape;\n const outData = backend.dataIdMap.get(out.dataId);\n
 outData.stringBytes = backend_util.fromStringArrayToUint8(outVals);\n\n inputs2D.forEach(t =>
 backend.disposeData(t.dataId));\n\n return out;\n }\n\n const batchDim =
 util.sizeFromShape($inputs[0].shape.slice(0, axis));\n let sumInnerDims = 0;\n const innerDims =
 $inputs.map(input => {\n const innerDim = util.sizeFromShape(input.shape.slice(axis));\n sumInnerDims +=
 innerDim;\n return innerDim;\n });\n const inVals = $inputs.map(input =>
 backend.typedArrayFromHeap(input));\n const outVals = backend.typedArrayFromHeap(out);\n for (let b = 0; b <
 batchDim; b++) {\n let outOffset = b * sumInnerDims;\n for (let i = 0; i < inVals.length; i++) {\n const
 innerDim = innerDims[i];\n const inOffset = b * innerDim;\n const vals = inVals[i].subarray(inOffset,
 inOffset + innerDim);\n outVals.set(vals, outOffset);\n outOffset += innerDim;\n }\n
 }\n return out;\n }\n\n export const concatConfig: KernelConfig = {\n kernelName: Concat,\n backendName:
 'wasm',\n kernelFunc: concat as {} as KernelFunc,\n };

```

Found in path(s):

\* /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Concat.js.map

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/\*\*

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\* =====  
\*/

Found in path(s):

- \* /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/kernel\_utils.js
- \* /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/kernel\_utils.d.ts
- \* /tfjs-backend-wasm-zip/tfjs-backend-wasm/src/kernels/kernel\_utils.ts

No license file was found, but licenses were detected in source scan.

```
{ "version":3,"file":"NonMaxSuppressionV4.js","sourceRoot":"","sources":["../src/kernels/NonMaxSuppressionV4
.ts"],"names":[],"mappings":"AAAA;;;;;;;;;;;;;GAeG;AAEH,OAAO,EAA2B,mBAAmB,EAAkE,MAAM,uBAAB
,CAAC;AAIrJ,OAAO,EAAc,iBAAiB,EAAc,MAAM,0BAA0B,CAAC;AAE3D,IAAI,QAGsC,CAAC;AAE3C,SA
AS,KAAK,CAAC,OAAoB;IACjC,QAAQ,GAAG,OAAO,CAAC,IAAI,CAAC,KAAK,CACzB,mBAAmB,EACnB,
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MAAM;KACP,CAAC,CAAC;AACT,CAAC;AAED,SAAS,mBAAmB,CAAC,IAI5B;IACC,MAAM,EAAc,OAAO
,EAAE,MAAM,EAAE,KAAK,EAAc,GAAG,IAAI,CAAC;IACtC,MAAM,EAAc,YAAY,EAAE,aAAa,EAAE,cA
Ac,EAAE,kBAAkB,EAAc,GACnE,KAAK,CAAC;IACV,MAAM,EAAc,KAAK,EAAE,MAAM,EAAc,GAAG,M
AAM,CAAC;IAE/B,MAAM,OAAO,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,KAAK,CAAC,MAAM,C
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AAE,aAAa,EAAE,YAAY,EAAE,cAAc,EAC9D,kBAAkB,CAAC,CAAC;IAExB,MAAM,EAAc,gBAAGB,EAAE,
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AA4E;IAC5E,OAAO,CAAC,IAAI,CAAC,KAAK,CAAC,eAAe,CAAC,CAAC;IAEpC,MAAM,qBAABqB,GACvB,
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AE,mBAABuC;CACpD,CAAC","sourcesContent":["/**\n
```

```
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```

```
=====\n
*\n\nimport { KernelConfig, KernelFunc, NonMaxSuppressionV4, NonMaxSuppressionV4Attrs,
NonMaxSuppressionV4Inputs, TensorInfo } from '@tensorflow/tfjs-core';\n\nimport { BackendWasm } from
'./backend_wasm';\n\nimport { parseResultStruct } from './NonMaxSuppression_util';\n\nlet wasmFunc: (n
boxesId: number, scoresId: number, maxOutputSize: number,\n iouThreshold: number, scoreThreshold: number,\n
padToMaxOutputSize: boolean) => number;\n\nfunction setup(backend: BackendWasm): void {\n wasmFunc =
backend.wasm.cwrap(\n NonMaxSuppressionV4,\n 'number', // Result*\n [\n 'number', // boxesId\n
'number', // scoresId\n 'number', // maxOutputSize\n 'number', //
```

```

iouThreshold\n 'number', // scoreThreshold\n 'bool', // padToMaxOutputSize\n]);\n\nfunction
nonMaxSuppressionV4(args: {\n backend: BackendWasm,\n inputs: NonMaxSuppressionV4Inputs,\n attrs:
NonMaxSuppressionV4Attrs\n}): TensorInfo[] {\n const {backend, inputs, attrs} = args;\n const {iouThreshold,
maxOutputSize, scoreThreshold, padToMaxOutputSize} =\n attrs;\n const {boxes, scores} = inputs;\n\n const
boxesId = backend.dataIdMap.get(boxes.dataId).id;\n const scoresId =
backend.dataIdMap.get(scores.dataId).id;\n\n const resOffset = wasmFunc(\n boxesId, scoresId, maxOutputSize,
iouThreshold, scoreThreshold,\n padToMaxOutputSize);\n\n const {pSelectedIndices, selectedSize,
pSelectedScores, pValidOutputs} =\n parseResultStruct(backend, resOffset);\n\n // Since we are not using scores
for V4, we have to delete it from the heap.\n backend.wasm._free(pSelectedScores);\n\n const
selectedIndicesTensor =\n backend.makeOutput([selectedSize,\n 'int32', pSelectedIndices);\n\n const validOutputsTensor = backend.makeOutput([], 'int32', pValidOutputs);\n\n
return [selectedIndicesTensor, validOutputsTensor];\n}\n\nexport const nonMaxSuppressionV4Config:
KernelConfig = {\n kernelName: NonMaxSuppressionV4,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: nonMaxSuppressionV4 as {} as KernelFunc,\n};\n"}

```

Found in path(s):

\* /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/NonMaxSuppressionV4.js.map

No license file was found, but licenses were detected in source scan.

```

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M,0CAA0C,CAAC;AACnF,iDAAiD;AACjD,OAAO,EAAC,SAAS,IAAI,YAAY,EAAC,MAAM,0CAA0C,CAAC;
AAEnF,OAAO,EAAC,aAAa,EAAE,YAAY,EAAE,YAAY,EAAC,CAAC","sourcesContent":["/**\n * @license\n
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KIND, either express or implied.\n * See the License for the specific language governing permissions and\n *
limitations under the License.\n *
=====
*\n\n// Import shared functionality from tfjs-backend-cpu without triggering\n// side effects.\n// tslint:disable-next-
line: no-imports-from-dist\nimport {concatImpl as concatImplCPU} from '@tensorflow/tfjs-backend-
cpu/dist/shared';\n// tslint:disable-next-line: no-imports-from-dist\nimport {sliceImpl as sliceImplCPU} from
'@tensorflow/tfjs-backend-cpu/dist/shared';\n// tslint:disable-next-line: no-imports-from-dist\nimport {rangeImpl as
rangeImplCPU} from '@tensorflow/tfjs-backend-cpu/dist/shared';\n\nexport {concatImplCPU, rangeImplCPU,
sliceImplCPU};\n"}

```

Found in path(s):

\* /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernel\_utils/shared.js.map

No license file was found, but licenses were detected in source scan.

```

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S,CAAC;AAEjC,IAAI,OACI,CAAC;AAET,SAAS,KAAC,CAAC,OAAoB;IACjC,OAAO,GAAG,OAAO,CAAC,I
AAI,CAAC,KAAC,CAAC,GAAG,EAAE,IAAI,CAAC,QAAQ,EAAE;QAC/C,QAAQ;QACR,QAAQ;QACR,QAA

```

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 AAC;KACtB;IAED,OAAO,GAAG,CAAC;AACb,CAAC;AAED,MAAM,CAAC,MAAM,SAAS,GAAiB;IACrC,U  
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 ACpC,CAAC","sourcesContent":["/\*\*\n

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=====\n\n\*\n\nimport {backend\_util, KernelConfig, KernelFunc, Max, MaxAttrs, MaxInputs, TensorInfo, util} from  
 '@tensorflow/tfjs-core';\n\nimport  
 {BackendWasm} from '../backend\_wasm';\n\nimport {permuteAxesAndTranspose} from './kernel\_utils';\n\nimport  
 {CppType} from './types';\n\nlet wasmMax: (xId: number, dtype: number, reduceSize: number, outId: number)  
 =>\n void;\n\nfunction setup(backend: BackendWasm): void {\n wasmMax = backend.wasm.cwrap(Max, null  
 /\*void\*/, [\n 'number', // x\_id\n 'number', // dtype\n 'number', // reduce\_size\n 'number', // out\_id\n ]);\n\nfunction max(args: {backend: BackendWasm, inputs: MaxInputs, attrs: MaxAttrs}):  
 TensorInfo {\n const {backend, inputs, attrs} = args;\n const {reductionIndices: axis, keepDims} = attrs;\n const {x} = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n let inputId = xId;\n let input = x;\n\n const {transposed, axes,  
 originalAxes, inputWasTransposed} =\n permuteAxesAndTranspose(x, axis, backend);\n\n if  
 (inputWasTransposed) {\n const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n input  
 = transposed;\n inputId = transposedId;\n }\n\n const inputRank = input.shape.length;\n\n backend\_util.assertAxesAreInnerMostDims('max', axes, inputRank);\n const [outShape, reduceShape] =\n backend\_util.computeOutAndReduceShapes(input.shape, axes);\n const reduceSize =  
 util.sizeFromShape(reduceShape);\n\n const out = backend.makeOutput(outShape, x.dtype);\n\n if  
 (util.sizeFromShape(input.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmMax(inputId, CCppType[x.dtype], reduceSize, outId);\n }\n\n if (inputWasTransposed) {\n // dispose of the  
 transposed tensor.\n backend.disposeData(transposed.dataId);\n }\n\n if (keepDims) {\n // reshape\n const  
 newShape = backend\_util.expandShapeToKeepDim(out.shape, originalAxes);\n out.shape = newShape;\n }\n\n

```
return out;\n}\n\nexport const maxConfig: KernelConfig = {\n kernelName: Max,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: max as {} as KernelFunc\n};\n"]}
```

Found

in path(s):

\* /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Max.js.map

No license file was found, but licenses were detected in source scan.

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{ "version": 3, "file": "tf-backend-wasm.es2017.js", "sources": ["../src/kernels/types.ts", "../src/kernels/_FusedMatMul.ts", "../src/kernels/unary_kernel.ts", "../src/kernels/Abs.ts", "../src/kernels/binary_kernel.ts", "../src/kernels/Add.ts", "../src/kernels/AddN.ts", "../src/kernels/Identity.ts", "../src/kernels/Transpose.ts", "../src/kernels/kernel_utils.ts", "../src/kernels/All.ts", "../src/kernels/Any.ts", "../src/kernels/ArgMax.ts", "../src/kernels/AvgPool.ts", "../src/kernels/Reshape.ts", "../src/kernels/BatchMatMul.ts", "../node_modules/@tensorflow/tfjs-backend-cpu/dist/kernels/Concat_impl.js", "../node_modules/@tensorflow/tfjs-backend-cpu/dist/kernels/Range_impl.js", "../node_modules/@tensorflow/tfjs-backend-cpu/dist/kernels/Slice.js", "../src/kernels/Slice.ts", "../src/kernels/BatchToSpaceND.ts", "../src/kernels/Cast.ts", "../src/kernels/Ceil.ts", "../src/kernels/ClipByValue.ts", "../src/kernels/Concat.ts", "../src/kernels/Conv2D.ts", "../src/kernels/Conv2DBackpropInput.ts", "../src/kernels/Cos.ts", "../src/kernels/Cosh.ts", "../src/kernels/CropAndResize.ts", "../src/kernels/Cumsum.ts", "../src/kernels/DepthToSpace.ts", "../src/kernels/DepthwiseConv2dNative.ts", "../src/kernels/Elu.ts", "../src/kernels/Equal.ts", "../src/kernels/Exp.ts", "../src/kernels/ExpandDims.ts", "../src/kernels/Fill.ts", "../src/kernels/FlipLeftRight.ts", "../src/kernels/Floor.ts", "../src/kernels/FloorDiv.ts", "../src/kernels/FusedBatchNorm.ts", "../src/kernels/FusedConv2D.ts", "../src/kernels/FusedDepthwiseConv2D.ts", "../src/kernels/GatherNd.ts", "../src/kernels/GatherV2.ts", "../src/kernels/Greater.ts", "../src/kernels/GreaterEqual.ts", "../src/kernels/LeakyRelu.ts", "../src/kernels/Less.ts", "../src/kernels/LessEqual.ts", "../src/kernels/Log.ts", "../src/kernels/LogicalAnd.ts", "../src/kernels/Max.ts", "../src/kernels/Maximum.ts", "../src/kernels/MaxPool.ts", "../src/kernels/Mean.ts", "../src/kernels/Min.ts", "../src/kernels/Minimum.ts", "../src/kernels/MirrorPad.ts", "../src/kernels/Multiply.ts", "../src/kernels/Neg.ts", "../src/kernels/NonMaxSuppression_util.ts", "../src/kernels/NonMaxSuppressionV3.ts", "../src/kernels/NonMaxSuppressionV4.ts", "../src/kernels/NonMaxSuppressionV5.ts", "../src/kernels/NotEqual.ts", "../src/kernels/OneHot.ts", "../src/kernels/OnesLike.ts", "../src/kernels/Pack.ts", "../src/kernels/PadV2.ts", "../src/kernels/Pow.ts", "../src/kernels/Prelu.ts", "../src/kernels/Prod.ts", "../src/kernels/Range.ts", "../src/kernels/RealDiv.ts", "../src/kernels/Relu.ts", "../src/kernels/Relu6.ts", "../src/kernels/ResizeBilinear.ts", "../src/kernels/Reverse.ts", "../src/kernels/RotateWithOffset.ts", "../src/kernels/Round.ts", "../src/kernels/Rsqrt.ts", "../src/kernels/ScatterNd.ts", "../src/kernels/Select.ts", "../src/kernels/Sigmoid.ts", "../src/kernels/Sin.ts", "../src/kernels/Softmax.ts", "../src/kernels/SpaceToBatchND.ts", "../src/kernels/SplitV.ts", "../src/kernels/Sqrt.ts", "../src/kernels/Square.ts", "../src/kernels/SquaredDifference.ts", "../src/kernels/Step.ts", "../src/kernels/StridedSlice.ts", "../src/kernels/Sub.ts", "../src/kernels/Sum.ts", "../src/kernels/Tan.ts", "../src/kernels/Tanh.ts", "../src/kernels/Tile.ts", "../src/kernels/TopK.ts", "../src/kernels/Transform.ts", "../src/kernels/Unpack.ts", "../src/kernels/ZerosLike.ts", "../src/register_all_kernels.ts", "../src/flags_wasm.ts", "../wasm-out/tfjs-backend-wasm-threaded-simd.js", "../wasm-out/tfjs-backend-wasm-threaded-simd.worker.js", "../wasm-out/tfjs-backend-wasm.js", "../src/backend_wasm.ts", "../src/version.ts", "../src/base.ts"], "sourcesContent": ["/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n\n// This enum must align with the enum defined in cc/backend.h\nexport enum CppDType {\n float32 = 0,\n
```



```

*\\n\\nimport {DataType, KernelConfig, TensorInfo, UnaryInputs, util} from '@tensorflow/tfjs-core';\\n\\nimport
{BackendWasm} from './backend_wasm';\\n\\nimport {CppType} from './types';\\n\\nexport function
createUnaryKernelConfig(\\n kernelName: string, outType?: DataType): KernelConfig {\\n let wasmFunc: (xId:
number, dtype: number, outId: number) => void;\\n\\n function setupFunc(backend: BackendWasm): void {\\n
wasmFunc = backend.wasm.cwrap(kernelName, null /* void */, [\\n 'number', // x_id\\n 'number', // dtype\\n
'number', // out_id\\n]);\\n }\\n\\n function kernelFunc(args: {backend: BackendWasm, inputs: UnaryInputs}):\\n
TensorInfo {\\n const {backend, inputs: {x}} = args;\\n const xId = backend.dataIdMap.get(x.dataId).id;\\n
 const out = backend.makeOutput(x.shape, outType || x.dtype);\\n const outId =
backend.dataIdMap.get(out.dataId).id;\\n\\n // Short-circuit zero-sized tensors.\\n if (util.sizeFromShape(out.shape)
=== 0) {\\n return out;\\n }\\n\\n wasmFunc(xId, CppDType[x.dtype], outId);\\n return out;\\n }\\n\\n return
{kernelName, backendName: 'wasm', setupFunc, kernelFunc};\\n}\\n", /*\\n * @license\\n * Copyright 2019 Google
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and\\n * limitations under the License.\\n *
=====\\n
*\\nimport {Abs, KernelConfig} from '@tensorflow/tfjs-core';\\nimport {createUnaryKernelConfig} from
'./unary_kernel';\\n\\nexport const absConfig: KernelConfig = createUnaryKernelConfig(Abs);\\n", /*\\n * @license\\n
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the specific language governing permissions and\\n * limitations under the License.\\n *
=====\\n
*\\n\\nimport {backend_util, BinaryInputs, DataType, KernelConfig, TensorInfo, util} from '@tensorflow/tfjs-
core';\\n\\nimport {BackendWasm} from './backend_wasm';\\n\\nimport {CppType} from './types';\\n\\nexport
function createBinaryKernelConfig(\\n kernelName: string, supportsFullBroadcast: boolean,\\n dtype?:
DataType): KernelConfig {\\n let wasmFunc:\\n (aId: number, aShape: Uint8Array, aShapeLen: number, bId:
number,\\n bShape: Uint8Array, bShapeLen: number, dtype: number, outId: number) =>\\n void;\\n\\n
function setupFunc(backend: BackendWasm): void {\\n wasmFunc = backend.wasm.cwrap(kernelName, null /*
void */, [\\n 'number', // a_id,\\n 'array', // a_shape\\n 'number', // a_shape.length\\n 'number', // b_id\\n
'array', // b_shape\\n 'number', // b_shape.length\\n 'number', // dtype\\n 'number' // out_id\\n]);\\n }\\n\\n
function kernelFunc(args: {backend: BackendWasm, inputs:
BinaryInputs}):\\n TensorInfo {\\n const {backend, inputs} = args;\\n const {a, b} = inputs;\\n const aId =
backend.dataIdMap.get(a.dataId).id;\\n const bId = backend.dataIdMap.get(b.dataId).id;\\n\\n const outputType =
dtype != null ? dtype : a.dtype;\\n const newShape = backend_util.assertAndGetBroadcastShape(a.shape,
b.shape);\\n const out = backend.makeOutput(newShape, outputType);\\n\\n // Short-circuit zero-sized tensors.\\n
if (util.sizeFromShape(newShape) === 0) {\\n return out;\\n }\\n\\n const aShapeBytes = new Uint8Array(new
Int32Array(a.shape).buffer);\\n const bShapeBytes = new Uint8Array(new Int32Array(b.shape).buffer);\\n const
outId = backend.dataIdMap.get(out.dataId).id;\\n const kernelFunc = () => wasmFunc(\\n aId, aShapeBytes,
a.shape.length, bId, bShapeBytes, b.shape.length,\\n CppDType[a.dtype], outId);\\n\\n // Currently only some
float operations support full broadcast.\\n if (supportsFullBroadcast && a.dtype === 'float32')
{\\n kernelFunc();\\n return out;\\n }\\n\\n const aBroadcastDims = backend_util.getBroadcastDims(a.shape,
newShape);\\n const bBroadcastDims = backend_util.getBroadcastDims(b.shape, newShape);\\n const

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loopsOverAllOfA = aBroadcastDims.every((v, i) => v === i);\n const loopsOverAllOfB =
bBroadcastDims.every((v, i) => v === i);\n if (loopsOverAllOfA && loopsOverAllOfB) {\n kernelFunc();\n
return out;\n } else {\n throw new Error(\n `Broadcasting along outer dims is not yet ` +\n
`supported for ${a.dtype} ${kernelName}.`);\n }\n}\n\n return {kernelName, backendName: 'wasm', setupFunc,
kernelFunc};\n}\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
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required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an
\"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n *
* See the License for the specific language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {Add, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createBinaryKernelConfig} from
'./binary_kernel';\n\nconst supportsFullBroadcast = true;\n\nexport const addConfig: KernelConfig =\ncreateBinaryKernelConfig(Add, supportsFullBroadcast);\n", "/*\n * @license\n * Copyright 2019 Google LLC. All
Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by
applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\"
BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the
License for the specific language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {AddN, KernelConfig, KernelFunc, TensorInfo, util} from '@tensorflow/tfjs-core';\n\nimport
{BackendWasm} from './backend_wasm';\n\nimport {CppType} from './types';\n\nlet wasmFunc:\n (inputIds:
Uint8Array, inputIdsLen: number, dtype: number, outId: number) =>\n void;\n\nfunction setupFunc(backend:
BackendWasm): void {\n wasmFunc = backend.wasm.cwrap(AddN, null /* void */, [\n 'array', // input_ids\n
'number', // input_ids.length\n 'number', // dtype\n 'number', // out_id\n]);\n}\n\nfunction addn(args: {inputs:
TensorInfo[], backend: BackendWasm}) {\n const {inputs,
backend} = args;\n const out = backend.makeOutput(inputs[0].shape, inputs[0].dtype);\n\n // Short-circuit zero-
sized tensors.\n if (util.sizeFromShape(out.shape) === 0) {\n return out;\n }\n\n const inputIds = inputs.map(x
=> backend.dataIdMap.get(x.dataId).id);\n const inputIdsBytes = new Uint8Array(new
Int32Array(inputIds).buffer);\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmFunc(inputIdsBytes,
inputIds.length, CCppType[out.dtype], outId);\n\n return out;\n}\n\nexport const addNConfig: KernelConfig = {\n
kernelName: AddN,\n backendName: 'wasm',\n setupFunc,\n kernelFunc: addn as {\n as KernelFunc,\n }\n};\n", "/*\n *
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2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable
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agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {Identity, IdentityInputs, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';\n\nimport
{TensorInfo} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from './backend_wasm';\n\nexport function
identity(args: {inputs: IdentityInputs, backend: BackendWasm}): \n TensorInfo {\n const {inputs: {x}, backend} =
args;\n const out = backend.makeOutput(x.shape, x.dtype);\n const inVals = backend.typedArrayFromHeap(x);\n
const outVals = backend.typedArrayFromHeap(out);\n outVals.set(inVals);\n return out;\n}\n\nexport const
identityConfig: KernelConfig = {\n kernelName: Identity,\n backendName: 'wasm',\n

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kernelFunc: identity as { } as KernelFunc;\n);\n", "/\*\n \* @license\n \* Copyright 2019 Google LLC. All Rights Reserved.\n \* Licensed under the Apache License, Version 2.0 (the \"License\");\n \* you may not use this file except in compliance with the License.\n \* You may obtain a copy of the License at\n \* \n \* http://www.apache.org/licenses/LICENSE-2.0\n \* \n \* Unless required by applicable law or agreed to in writing, software\n \* distributed under the License is distributed on an \"AS IS\" BASIS,\n \* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*

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*\n\nimport { KernelConfig, KernelFunc, TensorInfo, Transpose, TransposeAttrs, TransposeInputs } from
 '@tensorflow/tfjs-core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nimport { identity } from
 './Identity';\n\nimport { CppDType }
 from './types';\n\nlet wasmTranspose: (\n xId: number, xShape: Uint8Array, xShapeLength: number, dtype:
 CppDType,\n outId: number, perm: Uint8Array, permLength: number) => void;\n\nfunction setup(backend:
 BackendWasm) {\n wasmTranspose = backend.wasm.cwrap(Transpose, null /* void */, [\n 'number', // xId\n 'array', // x.shape\n 'number', // x.shape.length\n 'number', // dtype\n 'number', // outId\n 'array', // perm\n 'number', // perm.length\n]);\n\n export function transpose(\n args: {\n inputs: TransposeInputs, backend:
 BackendWasm, attrs: TransposeAttrs\n }):\n TensorInfo {\n const { inputs, backend, attrs } = args;\n // Reduce any
 dimensions with size one. Lower-rank transpose kernel performs\n // better due to simpler memory access pattern.\n const [reducedShape, perm] = removeOneSizeDims(inputs.x.shape, attrs.perm);\n\n let permIsNoOp = true;\n for
 (let i = 0; i < perm.length; i++) {\n if (perm[i] !== i) {\n permIsNoOp
 = false;\n }\n }\n const outShape = computeOutShape(inputs.x.shape, attrs.perm);\n const x = {\n dataId:
 inputs.x.dataId,\n shape: reducedShape,\n dtype: inputs.x.dtype\n };\n\n if (permIsNoOp) {\n const cloned =
 identity({ inputs, backend });\n cloned.shape = outShape;\n return cloned;\n }\n\n const out =
 backend.makeOutput(outShape, x.dtype);\n const xId = backend.dataIdMap.get(x.dataId).id;\n const outId =
 backend.dataIdMap.get(out.dataId).id;\n const permBytes = new Uint8Array(new Int32Array(perm).buffer);\n const xShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);\n\n wasmTranspose(\n xId,
 xShapeBytes, x.shape.length, CppDType[x.dtype], outId, permBytes,\n perm.length);\n return
 out;\n }\n\n function computeOutShape(inShape: number[], perm: number[]): number[] {\n const outShape = new
 Array(inShape.length);\n for (let i = 0; i < outShape.length; i++) {\n outShape[i] = inShape[perm[i]];\n }\n return outShape;\n }\n\n function
 removeOneSizeDims(\n shape: number[], perm: number[]): [number[], number[]] {\n const newShape: number[]
 = [];\n const newPerm: number[] = [];\n for (let i = 0; i < shape.length; ++i) {\n if (shape[i] !== 1) {\n newShape.push(shape[i]);\n }\n if (shape[perm[i]] !== 1) {\n newPerm.push(perm[i]);\n }\n }\n for (let i = 0; i < newPerm.length; ++i) {\n let minValIdx = -1;\n for (let j = 0; j < newPerm.length; ++j) {\n if
 (newPerm[j] >= i &&\n (minValIdx === -1 || newPerm[minValIdx] > newPerm[j])) {\n minValIdx = j;\n }\n }\n newPerm[minValIdx] = i;\n }\n return [newShape, newPerm];\n }\n\n export const transposeConfig:
 KernelConfig = {\n kernelName: Transpose,\n backendName: 'wasm',\n kernelFunc: transpose as { } as
 KernelFunc,\n setupFunc: setup,\n };\n\n", "/*\n * @license\n * Copyright 2020 Google Inc. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this
 file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
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*\n\nimport { backend_util, TensorInfo, util } from '@tensorflow/tfjs-core';\n\nimport { BackendWasm } from
 '../backend_wasm';\n\nimport { transpose } from './Transpose';\n\n/*\n * Compute permutation axes and do a transpose
 if necessary.\n * \n * Used by reduction ops.\n * \n * @param x input TensorInfo\n * \n * @param axis reduction axes\n *
```



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@param backend wasm backend instance\n * \nexport function permuteAxesAndTranspose(\n x: TensorInfo,
axis: number|number[],
 backend: BackendWasm): {\n transposed: TensorInfo|null,\n axes: number[],\n originalAxes: number[],\n inputWasTransposed: boolean\n} {\n const xShape = x.shape;\n const xRank = x.shape.length;\n\n const
originalAxes = util.parseAxisParam(axis, xShape);\n let axes = originalAxes;\n const permutedAxes =
backend_util.getAxesPermutation(axes, xRank);\n let xTransposed = null;\n let inputWasTransposed = false;\n if
(permutedAxes != null) {\n const newShape: number[] = new Array(xRank);\n for (let i = 0; i <
newShape.length; i++) {\n newShape[i] = xShape[permutedAxes[i]];\n }\n\n axes =
backend_util.getInnerMostAxes(axes.length, xRank);\n xTransposed =\n transpose({inputs: {x}, attrs: {perm:
permutedAxes}, backend});\n\n const xId = backend.dataIdMap.get(x.dataId).id;\n const transposedId =
backend.dataIdMap.get(xTransposed.dataId).id;\n if (transposedId !== xId) {\n inputWasTransposed = true;\n
 }\n }\n\n return {transposed:
xTransposed, originalAxes, axes, inputWasTransposed};\n}\n", "/*\n * @license\n * Copyright 2021 Google LLC.
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software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
===== \n
*\n\nimport { All, AllAttrs, AllInputs, backend_util, KernelConfig, KernelFunc, TensorInfo, util } from
'@tensorflow/tfjs-core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nimport
{ permuteAxesAndTranspose } from
'./kernel_utils';\n\nlet wasmAll: (xId: number, reduceSize: number, outId: number) => void;\n\nfunction
setup(backend: BackendWasm): void {\n wasmAll = backend.wasm.cwrap(All, null /*void*/, ['number, number,
number']);\n}\n\nfunction all(args: { backend: BackendWasm, inputs: AllInputs, attrs: AllAttrs }):\n TensorInfo {\n
const { backend, inputs, attrs } = args;\n const { axis, keepDims } = attrs;\n const { x } = inputs;\n const xId =
backend.dataIdMap.get(x.dataId).id;\n let inputId = xId;\n let input = x;\n\n const { transposed, axes, originalAxes,
inputWasTransposed } =\n permuteAxesAndTranspose(x, axis, backend);\n\n if (inputWasTransposed) {\n
const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n input = transposed;\n inputId =
transposedId;\n }\n\n const inputRank = input.shape.length;\n backend_util.assertAxesAreInnerMostDims('all',
axes, inputRank);\n const [outShape, reduceShape] =\n backend_util.computeOutAndReduceShapes(input.shape, axes);\n
 const reduceSize = util.sizeFromShape(reduceShape);\n\n const out = backend.makeOutput(outShape, x.dtype);\n
 if (util.sizeFromShape(input.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n
 wasmAll(inputId, reduceSize, outId);\n }\n\n if (inputWasTransposed) {\n // dispose of the transposed tensor.\n
 backend.disposeData(transposed.dataId);\n }\n\n if (keepDims) {\n // reshape\n const newShape =
backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n out.shape = newShape;\n }\n\n return
out;\n}\n\nexport const allConfig: KernelConfig = {\n kernelName: All,\n backendName: 'wasm',\n setupFunc:
setup,\n kernelFunc: all as {} as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2021 Google LLC. All Rights
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either express or implied.\n * See the License for the specific language governing permissions and\n * limitations
under the License.\n *
===== \n

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*\\n\\nimport { Any, AnyAttrs, AnyInputs, backend_util, KernelConfig, KernelFunc, TensorInfo, util } from
'@tensorflow/tfjs-core';\\n\\nimport { BackendWasm } from './backend_wasm';\\n\\nimport
{ permuteAxesAndTranspose } from './kernel_utils';\\n\\nlet wasmAny: (xId: number, reduceSize: number, outId:
number) => void;\\n\\nfunction setup(backend: BackendWasm): void {\\n wasmAny = backend.wasm.cwrap(Any,
null /*void*/, ['number, number, number']);\\n}\\n\\nfunction any(args: { backend: BackendWasm, inputs: AnyInputs,
attrs: AnyAttrs }):\\n TensorInfo {\\n const { backend, inputs,
 attrs } = args;\\n const { axis, keepDims } = attrs;\\n const { x } = inputs;\\n const xId =
backend.dataIdMap.get(x.dataId).id;\\n let inputId = xId;\\n let input = x;\\n\\n const { transposed, axes, originalAxes,
inputWasTransposed } =\\n permuteAxesAndTranspose(x, axis, backend);\\n\\n if (inputWasTransposed) {\\n
const transposedId = backend.dataIdMap.get(transposed.dataId).id;\\n input = transposed;\\n inputId =
transposedId;\\n }\\n\\n const inputRank = input.shape.length;\\n backend_util.assertAxesAreInnerMostDims('any',
axes, inputRank);\\n const [outShape, reduceShape] =\\n
backend_util.computeOutAndReduceShapes(input.shape, axes);\\n const reduceSize =
util.sizeFromShape(reduceShape);\\n\\n const out = backend.makeOutput(outShape, x.dtype);\\n if
(util.sizeFromShape(input.shape) !== 0) {\\n const outId = backend.dataIdMap.get(out.dataId).id;\\n
wasmAny(inputId, reduceSize, outId);\\n }\\n\\n if (inputWasTransposed) {\\n // dispose of the transposed tensor.\\n
backend.disposeData(transposed.dataId);\\n }\\n\\n if (keepDims) {\\n // reshape\\n const newShape =
backend_util.expandShapeToKeepDim(out.shape, originalAxes);\\n out.shape = newShape;\\n }\\n\\n return
out;\\n}\\n\\nexport const anyConfig: KernelConfig = {\\n kernelName: Any,\\n backendName: 'wasm',\\n setupFunc:
setup,\\n kernelFunc: any as { } as KernelFunc\\n};\\n", "/*\\n * @license\\n * Copyright 2019 Google LLC. All Rights
Reserved.\\n * Licensed under the Apache License, Version 2.0 (the \"License\");\\n * you may not use this file
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OR CONDITIONS OF ANY KIND, either express or implied.\\n * See the License for the specific language
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* =====\\n
*\\n\\nimport { ArgMax, ArgMaxAttrs, ArgMaxInputs, KernelConfig, KernelFunc, util } from '@tensorflow/tfjs-
core';\\n\\nimport { BackendWasm } from './backend_wasm';\\n\\nimport { permuteAxesAndTranspose } from
'./kernel_utils';\\n\\nimport { CppDType } from './types';\\n\\nlet wasmFunc: (\\n xId: number, dtype: number, outerSize:
number, innerSize: number,\\n outId: number) => void;\\n\\nfunction setup(backend: BackendWasm) {\\n
wasmFunc = backend.wasm.cwrap(ArgMax, null /* void */, [\\n 'number', // x_id\\n 'number', // dtype\\n
'number', // outer_size\\n 'number', // inner_size\\n 'number' // out_id\\n]);\\n}\\n\\nfunction argmax(\\n args:
{ inputs: ArgMaxInputs, backend: BackendWasm, attrs: ArgMaxAttrs }) {\\n const { backend, inputs, attrs } = args;\\n
const { axis } = attrs as { } as ArgMaxAttrs;\\n const { x } = inputs as { } as ArgMaxInputs;\\n const xId =
backend.dataIdMap.get(x.dataId).id;\\n let
 inputId = xId;\\n let input = x;\\n\\n const { transposed, axes, inputWasTransposed } =\\n
permuteAxesAndTranspose(x, axis, backend);\\n\\n if (inputWasTransposed) {\\n const transposedId =
backend.dataIdMap.get(transposed.dataId).id;\\n if (transposedId !== xId) {\\n // transpose was not a no-op. We
will need to dispose of this\\n // once we are done.\\n input = transposed;\\n inputId = transposedId;\\n }\\n
}\\n\\n const outShape = input.shape.slice(0, -1);\\n const out = backend.makeOutput(outShape, 'int32');\\n const
outId = backend.dataIdMap.get(out.dataId).id;\\n const outerSize = util.sizeFromShape(out.shape);\\n const
innerSize = input.shape[axes[0]];\\n wasmFunc(inputId, CppDType[input.dtype], outerSize, innerSize, outId);\\n\\n if
(inputWasTransposed) {\\n // dispose of the transposed tensor.\\n backend.disposeData(transposed.dataId);\\n
}\\n\\n return out;\\n}\\n\\nexport const argMaxConfig: KernelConfig = {\\n kernelName: ArgMax,\\n backendName:
'wasm',\\n
 kernelFunc: argmax as { } as KernelFunc,\\n setupFunc: setup\\n};\\n", "/*\\n * @license\\n * Copyright 2019 Google
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OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language  
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*\n\nimport { AvgPool, AvgPoolAttrs, AvgPoolInputs, backend_util, KernelConfig, KernelFunc, Tensor4D } from
'@tensorflow/tfjs-core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nlet wasmAvgPool: (\n xId:
 number, batchSize: number, inputHeight: number, inputWidth: number,\n filterHeight: number, filterWidth:
 number, padTop: number, padRight: number,\n padBottom: number, padLeft: number, strideHeight: number,\n strideWidth: number, channels: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n
 wasmAvgPool = backend.wasm.cwrap(AvgPool, null /* void */, [\n 'number', // xId\n 'number', // batchSize\n 'number', // inputHeight\n 'number', // inputWidth\n 'number', // filterHeight\n 'number', // filterWidth\n 'number', // padTop\n 'number', // padRight\n 'number', // padBottom\n 'number', // padLeft\n 'number', // strideHeight\n 'number', // strideWidth\n 'number', // channels\n 'number', // outId\n]);\n}\n\nfunction
avgPool(\n args: { inputs: AvgPoolInputs, backend: BackendWasm, attrs: AvgPoolAttrs }) {\n const { inputs, attrs,
 backend } = args;\n\n const x = inputs.x as Tensor4D;\n const xId = backend.dataIdMap.get(x.dataId).id;\n\n const { filterSize, strides, pad, dimRoundingMode } = attrs;\n const convInfo =
 backend_util.computePool2DInfo(\n x.shape, filterSize, strides, 1 /* dilations */, pad, dimRoundingMode);\n\n const filterHeight = convInfo.filterHeight;\n const filterWidth = convInfo.filterWidth;\n const padTop =
 convInfo.padInfo.top;\n const padRight = convInfo.padInfo.right;\n const padBottom = convInfo.padInfo.bottom;\n const padLeft = convInfo.padInfo.left;\n const strideHeight = convInfo.strideHeight;\n const strideWidth =
 convInfo.strideWidth;\n const channels = convInfo.inChannels;\n\n if (convInfo.dataFormat !== 'channelsLast') {\n
 throw new Error(\n `wasm backend does not support dataFormat: "${convInfo.dataFormat}". Please
 use 'channelsLast'.`);\n }\n\n if (convInfo.dilationWidth !== 1 || convInfo.dilationHeight !== 1) {\n
 throw new Error(\n `was backend only supports average pooling with dilation = [1, 1], `
 +\n `got [${convInfo.dilationHeight}, ${convInfo.dilationWidth}].`);\n }\n\n const out =
 backend.makeOutput(convInfo.outShape, 'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n wasmAvgPool(\n xId, x.shape[0], x.shape[1], x.shape[2], filterHeight, filterWidth,\n padTop, padRight,
 padBottom, padLeft, strideHeight, strideWidth, channels,\n outId);\n return out;\n}\n\nexport const
avgPoolConfig: KernelConfig = {\n kernelName: AvgPool,\n backendName: 'wasm',\n setupFunc: setup,\n
 kernelFunc: avgPool as { } as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights
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implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the  
License.\n \*

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=====
*\n\nimport { KernelConfig, KernelFunc, Reshape, ReshapeAttrs, ReshapeInputs, util } from '@tensorflow/tfjs-
core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nexport function reshape(\n args: { inputs:
 ReshapeInputs, attrs: ReshapeAttrs, backend: BackendWasm }) {\n const { inputs, attrs } = args;\n const { x } =
 inputs;\n const { shape } = attrs;\n\n const xSize = util.sizeFromShape(x.shape);\n const $shape =
 util.inferFromImplicitShape(shape, xSize);\n\n util.assert(\n xSize === util.sizeFromShape($shape),\n () =>
 `new shape: ${$shape}, old shape: ${x.shape}. New shape and old ` +\n `shape must have the same number of
 elements.`);\n\n // Backend needs to track refCount
```

```

for the dataId for reshape op\n args.backend.incRef(x.dataId);\n return {dataId: x.dataId, shape: $shape, dtype:
x.dtype};\n}\n\nexport const reshapeConfig: KernelConfig = {\n kernelName: Reshape,\n backendName: 'wasm',\n kernelFunc: reshape as { } as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====

```

```

*/\n\nimport

```

```

{BatchMatMul, BatchMatMulAttrs, BatchMatMulInputs, KernelConfig, KernelFunc, util} from '@tensorflow/tfjs-
core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport {reshape} from './Reshape';\n\nlet
wasmBatchMatMul: (\n aId: number, aShape: Uint8Array, aShapeSize: number, bId: number,\n bShape:
Uint8Array, bShapeSize: number, transposeA: boolean,\n transposeB: boolean, outId: number) =>
void;\n\nfunction setup(backend: BackendWasm) {\n wasmBatchMatMul = backend.wasm.cwrap(BatchMatMul,
null /* void */, [\n 'number', // a_id\n 'array', // a_shape\n 'number', // a_shape.length\n 'number', // b_id\n 'array', // b_shape\n 'number', // b_shape.length\n 'number', // transpose_a\n 'number', // transpose_b\n 'number' // out_id\n]);\n\n function batchMatMul(args: {\n inputs: BatchMatMulInputs,\n backend:
BackendWasm,\n attrs: BatchMatMulAttrs\n }) {\n const {inputs, backend, attrs} = args;\n const {a, b} = inputs;\n const
\n {transposeA, transposeB} = attrs;\n\n if (a.dtype !== 'float32' || b.dtype !== 'float32') {\n throw new Error(\n
`BatchMatMul for non non-float32 tensors not yet supported.`);\n }\n\n const aRank = a.shape.length;\n const
bRank = b.shape.length;\n\n const innerShapeA = transposeA ? a.shape[aRank - 2] : a.shape[aRank - 1];\n const
innerShapeB = transposeB ? b.shape[bRank - 1] : b.shape[bRank - 2];\n\n const outerShapeA = transposeA ?
a.shape[aRank - 1] : a.shape[aRank - 2];\n const outerShapeB = transposeB ? b.shape[bRank - 2] : b.shape[bRank -
1];\n\n const outerDimsA = a.shape.slice(0, -2);\n const outerDimsB = b.shape.slice(0, -2);\n\n const batchDimA =
util.sizeFromShape(outerDimsA);\n const batchDimB = util.sizeFromShape(outerDimsB);\n\n const
batchDimsCompatible =\n batchDimA === batchDimB || batchDimA === 1 || batchDimB === 1;\n\n util.assert(\n
 aRank >= 2 && bRank >= 2 && batchDimsCompatible,\n () => `Error in matMul: the input
batch dimensions
 must either be the ` +\n `same or at least one input batch dimension must be 1. Got input ` +\n `batch
dimensions of (${outerDimsA}) and (${outerDimsB}).`);\n\n const outShapeOuterDims =\n batchDimA >
batchDimB ? a.shape.slice(0, -2) : b.shape.slice(0, -2);\n const outShape =
outShapeOuterDims.concat([outerShapeA, outerShapeB]);\n\n util.assert(\n innerShapeA === innerShapeB,\n () => `Error in matMul: inner shapes (${innerShapeA}) and (` +\n ` ${innerShapeB}) of Tensors with shapes
${a.shape} and ` +\n ` ${b.shape} and transposeA=${transposeA}` +\n ` and transposeB=${transposeB}
must match.`);\n\n const a3dShape = transposeA ? [batchDimA, innerShapeA, outerShapeA] :\n [batchDimA, outerShapeA, innerShapeA];\n const b3dShape = transposeB ? [batchDimB, outerShapeB,
innerShapeB] :\n [batchDimB, innerShapeB, outerShapeB];\n\n // The rest of the
implementation
\n is designed to operate on rank-3 tensors\n const a3d = reshape({inputs: {x: a}, backend, attrs: {shape:
a3dShape}});\n const b3d = reshape({inputs: {x: b}, backend, attrs: {shape: b3dShape}});\n\n const a3dId =
backend.dataIdMap.get(a3d.dataId).id;\n const b3dId = backend.dataIdMap.get(b3d.dataId).id;\n const leftDim =
transposeA ? a3d.shape[2] : a3d.shape[1];\n const rightDim = transposeB ? b3d.shape[1] : b3d.shape[2];\n const
batchDim = Math.max(batchDimA, batchDimB);\n\n const out = backend.makeOutput([batchDim, leftDim,
rightDim], a3d.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n const aShapeBytes = new
Uint8Array(new Int32Array(a3d.shape).buffer);\n const bShapeBytes = new Uint8Array(new

```

[illegible]



[illegible]

[illegible]



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REYXRhKTtcbiAgY29uc3Qgb3V0QnVmID0gYnVmZmVyKHNPemUsIGR0eXB1KTtcbiAgZm9yIChsZXQgaSA  
9IDA7IGkgPCBvdXRcdWYuc2l6ZTsgKypKSB7XG4gICAgY29uc3Qgb3V0TG9jID0gb3V0QnVmLmluZGV4V  
G9Mb2MoaSk7XG4gICAgY29uc3QgaW5Mb2MgPSBvdXRmb2MubWFWKChpZHG6IG51bWJlciwgaiKgPT4ga  
WR4ICsgYmVnaW5bal0pO1xuICAgIG91dEJ1Zi5zZXQoaW5CdWYuZ2V0KC4uLmluTG9jKSwgLi4ub3V0TG9j  
KTtcbiAgfVxuXG4gIGlmIChkdHlwZSA9PT0gJ3N0cmZlZycpIHtcbiAgICByZXRlcm4gYmFja2VuZl91dGlsLm  
Zyb2lTdHJpbmdBcnJheVRvVWludDgob3V0QnVmLnZhbHVlcYBhcyBzdHJpbmdBcXSk7XG4gIH1cbiAgcmV0d  
XJuIG91dEJ1Zi52YWx1ZXMGYXMGVHlwZWRCbnJheTtcbn1cb1xuZXhwb3J0IGZlbnN0aW9uIHNSaWNlKFxu  
ICAgIGFyZ3M6IHtpbnB1dHM6IFNSaWNlSW5wdXRzLCBiYWNRZW5kOiBNYXR0QmFja2VuZENQVSwgYX  
R0cnM6IFNSaWNlQXR0cnN9KTpcbiAgICBUZW5zb3JJbmZvIHtcbiAgY29uc3Qge2lucHV0cywgYmFja2VuZC  
wgYXR0cnN9ID0gYXJncztcbiAgY29uc3Qge3h9ID0gaW5wdXRzO1xuICBjb25zdCB7YmVnaW4sIHNPemV9ID  
0gYXR0cnM7XG5cbiAgYXNzZXJ0Tm90Q29tcGxleCh4LCAnc2xpY2UnKTtcb1xuICBjb25zdCBbJGJlZ2luLCAk  
c2l6ZV0gPSBzbGljZV91dGlsLnBhcnNIU2xpY2VQYXJhbXMOeCwgYmVnaW4sIHNPemUpO1xuICBzbGljZV9  
1dGlsLmFzc2VydFBhcmFtc1ZhbGlkKHgsICRiZWdpbiwgJHNpemUpO1xuXG4gIGNvbnN0IHZhbHMgPSBiYW  
NRZW5kLmRhdGEuZ2V0KHguZGF0YUlkKS52YWx1ZXM7XG4gIGNvbnN0IG91dFZhbHMgPSBzbGljZUlteG  
wodmFscywGJlZ2luLCAkc2l6ZSwgeC5zaGFwZSwgeC5kdHlwZSk7XG4gIHJldHVybiBiYWNRZW5kLm1ha2  
VUZW5zb3JJbmZvKCRzaXplLCB4LmR0eXBILCBvdXRWYWxzKTtcbn1cb1xuZXhwb3J0IGNvbnN0IHNSaWN  
lQ29uZmlnOiBLZXJuZWxDb25maWcgPSB7XG4gIGtcm5lbE5hbWU6IFNSaWNlFxuICBiYWNRZW5kTmFtZ  
TogJ2NwdScsXG4gIGtcm5lbEZ1bmM6IHNSaWNlIGFzIHt9IGFzIEtcm5lbEZ1bmNcbn07XG4iXX0=", "/\*\n  
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for the specific language governing permissions and\n \* limitations under the License.\n \*

```
=====\n\n* \n\nimport { backend_util, KernelConfig, KernelFunc, Slice, slice_util, SliceAttrs, SliceInputs, TypedArray, util }
from '@tensorflow/tfjs-core';\nimport { BackendWasm } from './backend_wasm';\nimport { sliceImplCPU } from
 './kernel_utils/shared';\n\nexport function slice(\n args: { inputs: SliceInputs, attrs: SliceAttrs, backend:
BackendWasm }) {\n const { inputs: { x }, attrs: { begin, size }, backend } = args;\n const [begin_, size_] =
slice_util.parseSliceParams(x, begin, size);\n const isContinuous = slice_util.isSliceContinuous(x.shape, begin_,
size_);\n const xVals = backend.readSync(x.dataId);\n const out = backend.makeOutput(size_, x.dtype);\n const
xStrides = util.computeStrides(x.shape);\n const outData = backend.dataIdMap.get(out.dataId);\n \n if (isContinuous) {\n const flatOffset = slice_util.computeFlatOffset(begin_, xStrides);\n \n if (x.dtype ===
'string') {\n outData.stringBytes =\n (xVals as Uint8Array[]).slice(flatOffset, flatOffset +
util.sizeFromShape(size_));\n } else {\n const outVals = backend.typedArrayFromHeap(out);\n outVals.set(\n (xVals as TypedArray).subarray(flatOffset, flatOffset +
util.sizeFromShape(size_)),\n);\n \n return out;\n }\n \n if (x.dtype === 'string') {\n const res =
sliceImplCPU(xVals, begin_, size_, x.shape, x.dtype);\n outData.stringBytes = res as Uint8Array[];\n return
out;\n }\n \n const outVals = backend.typedArrayFromHeap(out);\n const rank = x.shape.length;\n if (rank === 2)
{\n slice2d(\n xVals as TypedArray, xStrides[0], outVals, begin_ as [number, number],\n size_ as [number, number]);\n } else if (rank === 3) {\n slice3d(\n xVals
as TypedArray, xStrides[0], xStrides[1], outVals,\n begin_ as [number, number, number], size_ as [number,
number, number]);\n } else if (rank === 4) {\n slice4d(\n xVals as TypedArray, xStrides[0], xStrides[1],
xStrides[2], outVals,\n begin_ as [number, number, number, number],\n size_ as [number, number, number, number]);\n } else {\n const res =\n sliceImplCPU(xVals, begin_, size_, x.shape, x.dtype) as TypedArray;\n outVals.set(res);\n }\n \n return out;\n }\n \n function slice2d(\n xVals: backend_util.TypedArray, xStride:
number,\n outVals: backend_util.TypedArray, begin: [number, number],\n size: [number, number]): void {\n let
outOffset = 0;\n const beginI = begin[0];\n const beginJ = begin[1];\n const endI = beginI + size[0];\n for (let i =
```

```
beginI; i < endI; i++) {\n const xOffset = i * xStride + beginJ;\n outVals.set(xVals.subarray(xOffset, xOffset + size[1]),\n outOffset);\n outOffset += size[1];\n }\n}\n\nfunction slice3d(\n xVals: backend_util.TypedArray,\n xStride1: number,\n xStride2: number,\n outVals:\n backend_util.TypedArray,\n begin: [number, number, number],\n size: [number, number, number]): void {\n let outOffset = 0;\n const beginI = begin[0];\n const beginJ = begin[1];\n const beginK = begin[2];\n const endI = beginI + size[0];\n const endJ = beginJ + size[1];\n for (let i = beginI; i < endI; i++) {\n for (let j = beginJ; j < endJ; j++) {\n const xOffset = i * xStride1 + j * xStride2 + beginK;\n outVals.set(xVals.subarray(xOffset,\n xOffset + size[2]),\n outOffset);\n outOffset += size[2];\n }\n }\n}\n\nfunction slice4d(\n xVals:\n backend_util.TypedArray,\n xStride1: number,\n xStride2: number,\n xStride3: number,\n outVals:\n backend_util.TypedArray,\n begin: [number, number, number, number],\n size: [number, number, number,\n number]): void {\n let outOffset = 0;\n const beginI = begin[0];\n const beginJ = begin[1];\n const beginK = begin[2];\n const endI = beginI + size[0];\n const endJ = beginJ + size[1];\n const endK = beginK + size[2];\n const beginL = begin[3];\n for (let i = beginI; i < endI; i++) {\n for (let j = beginJ; j < endJ; j++) {\n for (let k = beginK; k < endK; k++) {\n const xOffset = i * xStride1 + j * xStride2 + k * xStride3 + beginL;\n outVals.set(xVals.subarray(xOffset,\n xOffset + size[3]),\n outOffset);\n outOffset += size[3];\n }\n }\n }\n}\n\nexport const sliceConfig: KernelConfig = {\n kernelName: Slice,\n backendName: 'wasm',\n kernelFunc: slice as {} as KernelFunc,\n};\n\n"/**\n * @license\n * Copyright 2021 Google LLC. All Rights Reserved.\n *\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,\n * software\n *\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND,\n * either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n\n=====\n\nimport {backend_util, BatchToSpaceND, BatchToSpaceNDAattrs,\n BatchToSpaceNDInputs, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nimport {reshape} from './Reshape';\nimport {slice} from './Slice';\nimport {transpose} from './Transpose';\n\nfunction batchToSpaceND(args: {\n inputs: BatchToSpaceNDInputs,\n backend: BackendWasm,\n attrs: BatchToSpaceNDAattrs\n}) {\n const {inputs, backend, attrs} = args;\n const {x} = inputs;\n const {blockShape, crops} = attrs;\n const prod = blockShape.reduce((a, b) => a * b);\n const reshaped = backend_util.getReshaped(x.shape, blockShape, prod);\n const permuted = backend_util.getPermuted(reshaped.length, blockShape.length);\n const reshapedPermuted = backend_util.getReshapedPermuted(x.shape, blockShape, prod);\n const sliceBeginCoords = backend_util.getSliceBeginCoords(crops, blockShape.length);\n const sliceSize = backend_util.getSliceSize(reshapedPermuted, crops, blockShape.length);\n const xReshaped = reshape({inputs: {x}, backend, attrs: {shape: reshaped}});\n const xTransposed = transpose({inputs: {x: xReshaped}, backend, attrs: {perm: permuted}});\n const xTransposedReshaped = reshape({inputs: {x: xTransposed}, backend, attrs: {shape: reshapedPermuted}});\n const result = slice({inputs: {x: xTransposedReshaped}, backend, attrs: {begin: sliceBeginCoords, size: sliceSize}});\n backend.disposeData(xReshaped.dataId);\n backend.disposeData(xTransposed.dataId);\n backend.disposeData(xReshaped.dataId);\n return result;\n}\n\nexport const batchToSpaceNDConfig: KernelConfig = {\n kernelName: BatchToSpaceND,\n backendName: 'wasm',\n kernelFunc: batchToSpaceND as {} as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n *\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n *\n * distributed under the License is distributed
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```
=====\n\n*\n\nimport {Cast, CastAttrs, CastInputs, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';\nimport\n{TensorInfo} from '@tensorflow/tfjs-core';\n\nimport\n{BackendWasm} from '../backend_wasm';\n\nexport function cast(\n args: {inputs: CastInputs, attrs: CastAttrs,\n backend: BackendWasm});\n TensorInfo {\n const {inputs: {x}, attrs: {dtype}, backend} = args;\n const out =\n backend.makeOutput(x.shape, dtype);\n const inVals = backend.toArrayFromHeap(x);\n const outVals =\n backend.toArrayFromHeap(out);\n outVals.set(inVals);\n return out;\n }\n\nexport const castConfig:\nKernelConfig = {\n kernelName: Cast,\n backendName: 'wasm',\n kernelFunc: cast as { } as\nKernelFunc,\n};\n\n"/**\n * @license\n * Copyright 2021 Google LLC. All Rights Reserved.\n * Licensed under the\nApache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the\nLicense.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed\non an \"AS IS\" BASIS,\n\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License\nfor the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n\n*\n\nimport {KernelConfig, Ceil} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from\n'./unary_kernel';\n\nexport const ceilConfig: KernelConfig = createUnaryKernelConfig(Ceil);\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version\n2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a\n copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable\nlaw or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n\n*\n\nimport {ClipByValue, ClipByValueAttrs, ClipByValueInputs, KernelConfig, KernelFunc} from\n'@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\n\nlet wasmClip: (xId: number, min:\nnumber, max: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmClip =\n backend.wasm.cwrap(ClipByValue, null /* void */, [\n 'number', // x_id\n 'number', // min\n 'number', //\nmax\n 'number' // out_id\n]);\n\n function clip(args: {\n inputs: ClipByValueInputs,\n backend:\nBackendWasm,\n attrs: ClipByValueAttrs\n }) {\n const {inputs, backend, attrs} = args;\n const {x} = inputs;\n const {clipValueMin, clipValueMax} = attrs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const out =\n backend.makeOutput(x.shape, x.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n wasmClip(xId, clipValueMin, clipValueMax, outId);\n return out;\n }\n\n export const clipByValueConfig:\nKernelConfig = {\n kernelName: ClipByValue,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: clip\nas { } as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed\nunder the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the\nLicense.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed\non an \"AS IS\" BASIS,\n\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or\nimplied.\n * See the License for the specific language governing permissions and\n * limitations under the\nLicense.\n *
```

```
=====\n\n*\n\nimport {backend_util, Concat, ConcatAttrs, ConcatInputs, KernelConfig, KernelFunc, util} from\n'@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nimport {concatImplCPU} from
```

```

'./kernel_utils/shared';\nimport {identity} from './Identity';\nimport {reshape} from './Reshape';\n\nexport function
concat(\n args: {inputs: ConcatInputs, backend: BackendWasm, attrs: ConcatAttrs}) {\n const {inputs, backend}
= args;\n\n const axis = util.parseAxisParam(args.attrs.axis, inputs[0].shape)[0];\n\n let outShape =
backend_util.computeOutShape(inputs.map(t => t.shape), axis);\n\n // Keep only non-empty tensors (ignore tensors
with 0 in their shape).\n const $inputs = inputs.filter(t => util.sizeFromShape(t.shape) > 0);\n if ($inputs.length ===
1) {\n return identity({inputs: {x: $inputs[0]}, backend});\n }\n\n const out = backend.makeOutput(outShape,
inputs[0].dtype);\n\n if (util.sizeFromShape(outShape) === 0) {\n return out;\n }\n\n const shapes =
$inputs.map(t
=> t.shape);\n backend_util.assertParamsConsistent(shapes, axis);\n\n if ($inputs[0].dtype === 'string') {\n //
Any concat of n-dimensional tensors across any axis can be reduced to\n // a concatenation of two-dimensional
tensors across the axis 1 by first\n // partitioning the axes of the original tensors into those less than the\n // axis
to be concatenated and the rest. Then reshape the tensors\n // into a two-dimensional tensor by collapsing these
two sets of axes and\n // concatenate the resulting matrices across the axis 1, finally reshaping\n // the result to
have the proper shape.\n const inputs2D = $inputs.map(t => {\n const innerSize =
util.sizeFromShape(t.shape.slice(axis));\n const shape = [-1, innerSize];\n return reshape({inputs: {x: t},
backend, attrs: {shape}});\n });\n\n const inputsValShapes = inputs2D.map(t => {\n return {vals:
backend.readSync(t.dataId), shape: t.shape};\n });\n\n // Concat 2d tensors
along axis=1.\n outShape =\n backend_util.computeOutShape(inputs2D.map(t => t.shape), 1 /* axis */);\n\n const simplyConcat = inputs2D[0].shape[0] === 1;\n const outVals = concatImplCPU(\n
inputsValShapes, outShape, inputs[0].dtype,\n simplyConcat) as string[];\n\n const finalOutShape
=\n backend_util.computeOutShape($inputs.map(t => t.shape), axis);\n\n out.shape = finalOutShape;\n\n const outData = backend.dataIdMap.get(out.dataId);\n outData.stringBytes =
backend_util.fromStringArrayToUint8(outVals);\n\n inputs2D.forEach(t => backend.disposeData(t.dataId));\n\n return out;\n }\n\n const batchDim = util.sizeFromShape($inputs[0].shape.slice(0, axis));\n let sumInnerDims =
0;\n const innerDims = $inputs.map(input => {\n const innerDim = util.sizeFromShape(input.shape.slice(axis));\n
sumInnerDims += innerDim;\n return innerDim;\n });\n const inVals = $inputs.map(input =>
backend.typedArrayFromHeap(input));\n\n const outVals = backend.typedArrayFromHeap(out);\n for (let b = 0; b < batchDim; b++) {\n let outOffset = b *
sumInnerDims;\n for (let i = 0; i < inVals.length; i++) {\n const innerDim = innerDims[i];\n const inOffset =
b * innerDim;\n const vals = inVals[i].subarray(inOffset, inOffset + innerDim);\n outVals.set(vals,
outOffset);\n outOffset += innerDim;\n }\n return out;\n }\n\n export const concatConfig: KernelConfig =
{\n kernelName: Concat,\n backendName: 'wasm',\n kernelFunc: concat as { } as KernelFunc,\n }; \n /**\n *
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2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
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express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n *
===== \n
*\n\nimport {backend_util, Conv2D, Conv2DAttrs, Conv2DInputs, KernelConfig, KernelFunc, Tensor4D} from
'@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nlet wasmConv2d: (\n xId:
number, batchSize: number, inputHeight: number, inputWidth: number,\n filterId: number, filterHeight: number,
filterWidth: number, padTop: number,\n padRight: number, padBottom: number, padLeft: number, isSamePad:
number,\n dilationHeight: number, dilationWidth: number, strideHeight: number,\n strideWidth: number,
inputChannels: number, outputChannels: number,\n outId: number) => void;\n\nfunction setup(backend:
BackendWasm) {\n wasmConv2d = backend.wasm.cwrap(Conv2D,

```

```

null /* void */, [n 'number', // xId\n 'number', // batchSize\n 'number', // inputHeight\n 'number', //
inputWidth\n 'number', // filterId\n 'number', // filterHeight\n 'number', // filterWidth\n 'number', //
padTop\n 'number', // padRight\n 'number', // padBottom\n 'number', // padLeft\n 'number', // isSamePad\n
'number', // dilationHeight\n 'number', // dilationWidth\n 'number', // strideHeight\n 'number', //
strideWidth\n 'number', // inputChannels\n 'number', // outputChannels\n 'number', // outId\n
]);\n}\n\nfunction conv2d(\n args: {inputs: Conv2DInputs, backend: BackendWasm, attrs: Conv2DAttrs}) {\n
const {inputs, attrs, backend} = args;\n\n const {x, filter} = inputs;\n const xId =
backend.dataIdMap.get(x.dataId).id;\n const filterId = backend.dataIdMap.get(filter.dataId).id;\n\n const {strides,
dilations, pad, dimRoundingMode, dataFormat} = attrs;\n const $dataFormat =
backend_util.convertConv2DDataFormat(dataFormat);\n
 const convInfo = backend_util.computeConv2DInfo(\n (x as Tensor4D).shape, (filter as Tensor4D).shape,
strides, dilations,\n pad, dimRoundingMode, false, $dataFormat);\n\n const filterHeight =
convInfo.filterHeight;\n const filterWidth = convInfo.filterWidth;\n const padTop = convInfo.padInfo.top;\n const
padRight = convInfo.padInfo.right;\n const padBottom = convInfo.padInfo.bottom;\n const padLeft =
convInfo.padInfo.left;\n const dilationHeight = convInfo.dilationHeight;\n const dilationWidth =
convInfo.dilationWidth;\n const strideHeight = convInfo.strideHeight;\n const strideWidth =
convInfo.strideWidth;\n const inputChannels = convInfo.inChannels;\n const outputChannels =
convInfo.outChannels;\n const isSamePad = convInfo.padInfo.type === 'SAME' ? 1 : 0;\n\n if
(convInfo.dataFormat !== 'channelsLast') {\n throw new Error(\n `wasm backend Conv2D does not support
dataFormat:` +\n `${convInfo.dataFormat}`. Please
 use 'channelsLast'.`);\n }\n\n const out = backend.makeOutput(convInfo.outShape, 'float32');\n const outId =
backend.dataIdMap.get(out.dataId).id;\n wasmConv2d(\n xId, x.shape[0], x.shape[1], x.shape[2], filterId,
filterHeight,\n filterWidth, padTop, padRight, padBottom, padLeft, isSamePad,\n dilationHeight,
dilationWidth, strideHeight, strideWidth, inputChannels,\n outputChannels, outId);\n return out;\n}\n\nexport
const conv2DConfig: KernelConfig = {\n kernelName: Conv2D,\n backendName: 'wasm',\n setupFunc: setup,\n
kernelFunc: conv2d as { } as KernelFunc\n};\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed
under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF
ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n *
limitations under the License.\n *
=====
*\n\nimport {backend_util, Conv2DBackpropInput, Conv2DBackpropInputAttrs, Conv2DBackpropInputInputs,
KernelConfig, KernelFunc, TensorInfo, util} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from
'./backend_wasm';\n\nlet wasmConv2DBackpropInput: (\n dyId: number, filterId: number, batchSize: number,
filterHeight: number,\n filterWidth: number, inHeight: number, inWidth: number, inChannels: number,\n
outHeight: number, outWidth: number, outChannels: number,\n strideHeight: number, strideWidth: number,
topPad: number, leftPad: number,\n fltS0: number, fltS1: number, fltS2: number, xBatchStride: number,\n
xRowStride: number, xColStride: number,
xChannelStride: number,\n yBatchStride: number, yRowStride: number, yColStride: number,\n yChannelStride:
number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n
 wasmConv2DBackpropInput = backend.wasm.cwrap(Conv2DBackpropInput, null, [n 'number', // dyId\n
'number', // filterId\n 'number', // batchSize\n 'number', // filterHeight\n 'number', // filterWidth\n
'number', // inHeight\n 'number', // inWidth\n 'number', // inChannels\n 'number', // outHeight\n
'number', // outWidth\n 'number', // outChannels\n 'number', // strideHeight\n 'number', // strideWidth\n
'number', // topPad\n 'number', // leftPad\n 'number', // fltS0\n 'number', // fltS1\n 'number', // fltS2\n
'number', //

```

```

xBatchStride\n 'number', // xRowStride\n 'number', // xColStride\n 'number', // xChannelStride\n 'number',
// yBatchStride\n 'number', // yRowStride\n 'number', // yColStride\n
'number', // yChannelStride\n 'number', // outId\n]);\n\nfunction conv2DBackpropInput(args: {\n backend:
BackendWasm,\n inputs: Conv2DBackpropInputInputs,\n attrs: Conv2DBackpropInputAttrs\n}): TensorInfo {\n
const {backend, inputs, attrs} = args;\n const {dy, filter} = inputs;\n const {strides, pad, dataFormat,
dimRoundingMode, inputShape} = attrs;\n\n const dilations = 1;\n\n const $dataFormat =
backend_util.convertConv2DDataFormat(dataFormat);\n const convInfo = backend_util.computeConv2DInfo(\n
inputShape, filter.shape as [number, number, number, number], strides,\n dilations, pad, dimRoundingMode,
false /* depthwise */, $dataFormat);\n const {\n batchSize,\n filterHeight,\n filterWidth,\n inChannels,\n
inHeight,\n inWidth,\n outChannels,\n outHeight,\n outWidth,\n strideHeight,\n strideWidth\n } =
convInfo;\n\n const topPad = filterHeight - 1 - convInfo.padInfo.top;\n const leftPad = filterWidth - 1 -
convInfo.padInfo.left;\n\n
const isChannelsLast = convInfo.dataFormat === 'channelsLast';\n const dxStrides =
util.computeStrides(convInfo.inShape);\n const dyStrides = util.computeStrides(dy.shape);\n const [fltS0, fltS1,
fltS2] = util.computeStrides(filter.shape);\n const xBatchStride = dxStrides[0];\n const xRowStride =
isChannelsLast ? dxStrides[1] : dxStrides[2];\n const xColStride = isChannelsLast ? dxStrides[2] : 1;\n const
xChannelStride = isChannelsLast ? 1 : dxStrides[1];\n const yBatchStride = dyStrides[0];\n const yRowStride =
isChannelsLast ? dyStrides[1] : dyStrides[2];\n const yColStride = isChannelsLast ? dyStrides[2] : 1;\n const
yChannelStride = isChannelsLast ? 1 : dyStrides[1];\n\n const out = backend.makeOutput(convInfo.inShape,
'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n const dyId =
backend.dataIdMap.get(dy.dataId).id;\n const filterId = backend.dataIdMap.get(filter.dataId).id;\n\n
wasmConv2DBackpropInput(\n dyId, filterId, batchSize,
filterHeight, filterWidth, inHeight, inWidth,\n inChannels, outHeight, outWidth, outChannels, strideHeight,
strideWidth,\n topPad, leftPad, fltS0, fltS1, fltS2, xBatchStride, xRowStride,\n xColStride, xChannelStride,
yBatchStride, yRowStride, yColStride,\n yChannelStride, outId);\n return out;\n}\n\nexport const
conv2DBackpropInputConfig: KernelConfig = {\n kernelName: Conv2DBackpropInput,\n backendName:
'wasm',\n setupFunc: setup,\n kernelFunc: conv2DBackpropInput as {} as KernelFunc\n};\n\n"/**\n * @license\n *
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WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
\n
*/\n\nimport {Cos, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from
'/unary_kernel';\n\nexport const cosConfig: KernelConfig = createUnaryKernelConfig(Cos);\n\n"/**\n * @license\n *
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\"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the
the
specific language governing permissions and\n * limitations under the License.\n *
=====
\n
*/\n\nimport {Cosh, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from
'/unary_kernel';\n\nexport const coshConfig: KernelConfig = createUnaryKernelConfig(Cosh);\n\n"/**\n *
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```

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```
* =====\n*\nimport {CropAndResize, CropAndResizeAttrs, CropAndResizeInputs, KernelConfig, KernelFunc, TensorInfo} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nimport {cast} from './Cast';\n\n// Must match enum in CropAndResize.cc\nenum InterpolationMethod {\n bilinear = 0,\n nearest = 1\n}\n\nlet wasmCropAndResize: (\n imagesId: number, boxesId: number, boxIndId: number, numBoxes: number,\n imagesShape: Uint8Array, cropHeight: number, cropWidth: number, method: number, extrapolationValue: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n wasmCropAndResize = backend.wasm.cwrap(CropAndResize, null /*void*/, [\n 'number', // imagesId\n 'number', // boxesId\n 'number', // boxIndId\n 'array', // images shape\n 'number', // cropHeight\n 'number', // cropWidth\n 'number', // method\n 'number', // extrapolation value\n 'number' // out id\n]);\n\n function cropAndResize(args: {\n backend: BackendWasm,\n inputs: CropAndResizeInputs,\n attrs: CropAndResizeAttrs\n }): TensorInfo {\n const {backend, inputs, attrs} = args;\n const {method, extrapolationValue, cropSize} = attrs;\n const {image, boxes, boxInd} = inputs;\n const numBoxes = boxes.shape[0];\n const [cropHeight, cropWidth] = cropSize as [number, number];\n const outShape = [numBoxes, cropHeight, cropWidth, image.shape[3]];\n let imagesData = backend.dataIdMap.get(image.dataId);\n let castedData;\n if (image.dtype !== 'float32') {\n castedData = cast({backend, inputs: {x: image}, attrs: {dtype: 'float32'}});\n imagesData = backend.dataIdMap.get(castedData.dataId);\n }\n const imagesId = imagesData.id;\n const boxesId = backend.dataIdMap.get(boxes.dataId).id;\n const boxIndId = backend.dataIdMap.get(boxInd.dataId).id;\n const out = backend.makeOutput(outShape, 'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n const imagesShapeBytes = new Uint8Array(new Int32Array(image.shape).buffer);\n wasmCropAndResize(imagesId, boxesId, boxIndId, numBoxes, imagesShapeBytes, cropHeight, cropWidth, InterpolationMethod[method as {}] as keyof typeof InterpolationMethod, extrapolationValue, outId);\n if (castedData !== null) {\n backend.disposeData(castedData.dataId);\n }\n return out;\n }\n\n export const cropAndResizeConfig: KernelConfig = {\n kernelName: CropAndResize,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: cropAndResize as {} as KernelFunc\n };\n /**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License"); you may not use this file except in compliance with the License. You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0 Unless required by applicable law or agreed to in writing, software distributed under the License is distributed on an "AS IS" BASIS, WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied. See the License for the specific language governing permissions and limitations under the License.\n */\n}
```

```
* =====\n*\nimport {backend_util, KernelConfig, KernelFunc, Cumsum, CumsumAttrs, CumsumInputs, TensorInfo, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nimport {CppType} from './types';\nimport {transpose} from './Transpose';\n\nlet wasmCumsum: (xId: number, exclusive: number, reverse: number, finalDim: number, outId: number, dtype: CCppType) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmCumsum = backend.wasm.cwrap(Cumsum, null /*void*/, [\n 'number', // x_id\n 'number', // exclusive\n 'number', // reverse\n 'number', // final_dim\n 'number', // out_id\n 'number' // dtype\n]);\n\n export function cumsum(\n args: {\n inputs: CumsumInputs,\n backend: BackendWasm, attrs: CumsumAttrs\n }): TensorInfo {\n const {inputs, backend, attrs} = args;\n const {x} = inputs;\n const {axis, exclusive, reverse} = attrs;\n const xRank = x.shape.length;\n util.assert(x.dtype ===
```



```
'float32' || x.dtype === 'int32',\n () => `cumsum does not support ${x.dtype} tensors in the WASM backend`);\n //
permute required axis to inner most axis\n const permutation = backend_util.getAxesPermutation([axis], xRank);\n let permutedX = x;\n if (permutation !== null) {\n permutedX = transpose({ inputs: { x }, attrs: { perm:
permutation }, backend});\n }\n const permutedAxis = backend_util.getInnerMostAxes(1, xRank)[0];\n backend_util.assertAxesAreInnerMostDims('cumsum', [permutedAxis], xRank);\n\n const permutedOut =
backend.makeOutput(permutedX.shape, permutedX.dtype);\n const finalDim = permutedX.shape[permutedAxis];\n const

 permutedXId = backend.dataIdMap.get(permutedX.dataId).id;\n const permutedOutId =
backend.dataIdMap.get(permutedOut.dataId).id;\n wasmCumsum(permutedXId, exclusive ? 1 : 0, reverse ? 1 : 0,
finalDim,\n permutedOutId, CppDType[x.dtype]);\n\n // transpose data back if permuted\n let out =
permutedOut;\n if (permutation !== null) {\n const undoPermutation =
backend_util.getUndoAxesPermutation(permutation);\n out = transpose(\n { inputs: { x: permutedOut }, attrs:
{ perm: undoPermutation }, backend});\n backend.disposeData(permutedX.dataId);\n
backend.disposeData(permutedOut.dataId);\n }\n return out;\n}\n\nexport const cumsumConfig: KernelConfig =
{\n kernelName: Cumsum,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: cumsum as { } as
KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the
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the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n
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distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n */

=====
*\n\nimport {DepthToSpace, DepthToSpaceAttrs, DepthToSpaceInputs, KernelConfig, KernelFunc, TensorInfo,
util} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nlet wasmDepthToSpace:
(\n xId: number, blockSize: number, channelsLast: number, xStrides: Uint8Array,\n xStridesLength: number,
outputShape: Uint8Array, outputStrides: Uint8Array,\n outSize: number, outId: number) => void;\n\nfunction
setup(backend: BackendWasm): void {\n wasmDepthToSpace
= backend.wasm.cwrap(DepthToSpace, null /*void*/, [\n 'number', // xId\n 'number', // blockSize\n 'number',
// channelsLast\n 'array', // xStrides\n 'number', // xStridesLength\n 'array', // outputShape\n 'array', //
outputStrides\n 'number', // outSize\n 'number', // outId\n]);\n\n export function depthToSpace(args: {\n
backend: BackendWasm,\n inputs: DepthToSpaceInputs,\n attrs: DepthToSpaceAttrs\n}): TensorInfo {\n const
{backend, inputs, attrs} = args;\n const {x} = inputs;\n const {blockSize, dataFormat} = attrs;\n\n const batchSize
= x.shape[0];\n const inputHeight = (dataFormat === 'NHWC') ? x.shape[1] : x.shape[2];\n const inputWidth =
(dataFormat === 'NHWC') ? x.shape[2] : x.shape[3];\n const inputDepth = (dataFormat === 'NHWC') ? x.shape[3]
: x.shape[1];\n\n const outputHeight = inputHeight * blockSize;\n const outputWidth = inputWidth * blockSize;\n
const outputDepth = inputDepth / (blockSize * blockSize);\n\n const outputShape = (dataFormat === 'NHWC') ?\n [batchSize, outputHeight, outputWidth, outputDepth] :\n [batchSize, outputDepth, outputHeight, outputWidth];\n\n const out = backend.makeOutput(outputShape,
'float32');\n\n const xData = backend.dataIdMap.get(x.dataId);\n const xId = xData.id;\n const xStridesBytes =\n new Uint8Array(new Int32Array(util.computeStrides(x.shape)).buffer);\n\n const outputShapeBytes = new
Uint8Array(new Int32Array(outputShape).buffer);\n const outStridesBytes =\n new Uint8Array(new
Int32Array(util.computeStrides(outputShape)).buffer);\n\n const outId = backend.dataIdMap.get(out.dataId).id;\n
const channelsLast = dataFormat === 'NHWC' ? 1 : 0;\n wasmDepthToSpace(\n xId, blockSize, channelsLast,
xStridesBytes, x.shape.length - 1,\n outputShapeBytes, outStridesBytes, outputShape.length, outId);\n\n return
out;\n }\n\n export const depthToSpaceConfig: KernelConfig = {\n kernelName: DepthToSpace,\n backendName:
'wasm',\n
```

setupFunc: setup,\n kernelFunc: depthToSpace as { } as KernelFunc\n};\n", "/\*\n \* @license\n \* Copyright 2019 Google LLC. All Rights Reserved.\n \* Licensed under the Apache License, Version 2.0 (the \"License\");\n \* you may not use this file except in compliance with the License.\n \* You may obtain a copy of the License at\n \* http://www.apache.org/licenses/LICENSE-2.0\n \* Unless required by applicable law or agreed to in writing, software\n \* distributed under the License is distributed on an \"AS IS\" BASIS,\n \* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*

```
=====
*\n\nimport {backend_util, DepthwiseConv2dNative, DepthwiseConv2dNativeAttrs,
DepthwiseConv2dNativeInputs, KernelConfig, KernelFunc, Tensor4D} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from
'../backend_wasm';\n\nlet wasmDepthwiseConv2d: (\n xId: number, batchSize: number, inputHeight: number,
inputWidth: number,\n filterId: number, filterHeight: number, filterWidth: number, padTop: number,\n padRight: number, padBottom: number, padLeft: number, isSamePad: number,\n dilationHeight: number,
dilationWidth: number, strideHeight: number,\n strideWidth: number, inputChannels: number, outputChannels:
number,\n outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmDepthwiseConv2d =\n backend.wasm.cwrap(DepthwiseConv2dNative, null /* void */, [\n 'number', // xId\n 'number', //
batchSize\n 'number', // inputHeight\n 'number', // inputWidth\n 'number', // filterId\n 'number', //
filterHeight\n 'number', // filterWidth\n 'number', // padTop\n 'number', // padRight\n 'number', //
padBottom\n 'number', // padLeft\n 'number', // isSamePad\n 'number', // dilationHeight\n 'number', // dilationWidth\n 'number', // strideHeight\n 'number', //
strideWidth\n 'number', // inputChannels\n 'number', // outputChannels\n 'number', // outId\n]);\n\n function depthwiseConv2d(args: {\n inputs: DepthwiseConv2dNativeInputs,\n backend:
BackendWasm,\n attrs: DepthwiseConv2dNativeAttrs\n }) {\n const {inputs, attrs, backend} = args;\n\n const {x,
filter} = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const filterId =
backend.dataIdMap.get(filter.dataId).id;\n\n const {strides, dilations, pad, dimRoundingMode} = attrs;\n\n const
$dilations = dilations == null ? [1, 1] : dilations;\n\n const convInfo = backend_util.computeConv2DInfo(\n (x as
Tensor4D).shape, (filter as Tensor4D).shape, strides,\n ($dilations as number | [number, number]), pad,
dimRoundingMode,\n true /* depthwise */);\n\n const filterHeight = convInfo.filterHeight;\n const filterWidth =
convInfo.filterWidth;\n const padTop = convInfo.padInfo.top;\n const padRight = convInfo.padInfo.right;\n const
padBottom = convInfo.padInfo.bottom;\n const padLeft = convInfo.padInfo.left;\n const dilationHeight =
convInfo.dilationHeight;\n const dilationWidth = convInfo.dilationWidth;\n const strideHeight =
convInfo.strideHeight;\n const strideWidth = convInfo.strideWidth;\n const inputChannels =
convInfo.inChannels;\n const outputChannels = convInfo.outChannels;\n const isSamePad = convInfo.padInfo.type
=== 'SAME' ? 1 : 0;\n\n if (convInfo.dataFormat !== 'channelsLast') {\n throw new Error(\n `wasm backend
DepthwiseConv2dNative does not support dataFormat:` +\n `${convInfo.dataFormat}`. Please use
'channelsLast'.`);\n }\n\n const out = backend.makeOutput(convInfo.outShape, 'float32');\n const outId =
backend.dataIdMap.get(out.dataId).id;\n\n wasmDepthwiseConv2d(\n xId, x.shape[0], x.shape[1], x.shape[2],
filterId, filterHeight,\n filterWidth,\n padTop, padRight, padBottom, padLeft, isSamePad,\n dilationHeight, dilationWidth, strideHeight, strideWidth,\n inputChannels,\n outputChannels, outId);\n return out;\n }\n\n export const depthwiseConv2dNativeConfig:
KernelConfig = {\n kernelName: DepthwiseConv2dNative,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: depthwiseConv2d as { } as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2021 Google LLC. All
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file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
```

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under the License.\n \*

```
=====\n\n *\\nimport {Elu, KernelConfig} from '@tensorflow/tfjs-core';\\n\\nimport {createUnaryKernelConfig} from\n './unary_kernel';\\n\\nexport const eluConfig: KernelConfig = createUnaryKernelConfig(Elu);\\n", "/*\\n * @license\\n\n * Copyright 2020 Google LLC. All Rights Reserved.\\n * Licensed under the Apache License, Version 2.0 (the\n \\\"License\\");\\n * you may not use this file except in compliance with the License.\\n * You may obtain a copy of the\n License at\\n *\\n * http://www.apache.org/licenses/LICENSE-2.0\\n *\\n * Unless required by applicable law or\n agreed to in writing, software\\n * distributed under the License is distributed on an \\\"AS IS\\\" BASIS,\\n *\n WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\\n * See the License for\n the specific language governing permissions and\\n * limitations under the License.\\n *\n=====\n
```

```
=====\n\n *\\nimport {Equal, KernelConfig} from '@tensorflow/tfjs-core';\\n\\nimport {createBinaryKernelConfig} from\n './binary_kernel';\\n\\nconst supportsFullBroadcast = false;\\nexport const equalConfig: KernelConfig =\\n createBinaryKernelConfig(Equal, supportsFullBroadcast, 'bool');\\n", "/*\\n * @license\\n\n * Copyright 2019 Google\n LLC. All Rights Reserved.\\n * Licensed under the Apache License, Version 2.0 (the \\\"License\\");\\n * you may not\n use this file except in compliance with the License.\\n * You may obtain a copy of the License at\\n *\\n *\n http://www.apache.org/licenses/LICENSE-2.0\\n *\\n * Unless required by applicable law or agreed to in writing,\n software\\n * distributed under the License is distributed on an \\\"AS IS\\\" BASIS,\\n *\n WITHOUT WARRANTIES\n OR CONDITIONS OF ANY KIND, either express or implied.\\n * See the License for the specific language\n governing permissions and\\n * limitations under the License.\\n *\n=====\n
```

```
=====\n\n *\\nimport {Exp, KernelConfig} from '@tensorflow/tfjs-core';\\n\\nimport {createUnaryKernelConfig} from\n './unary_kernel';\\n\\nexport const expConfig: KernelConfig = createUnaryKernelConfig(Exp, 'float32');\\n", "/*\\n *\n @license\\n\n * Copyright 2019 Google LLC. All Rights Reserved.\\n * Licensed under the Apache License, Version\n 2.0 (the \\\"License\\");\\n * you may not use this file except in compliance with the License.\\n * You may obtain a\n copy of the License at\\n *\\n * http://www.apache.org/licenses/LICENSE-2.0\\n *\\n * Unless required by applicable\n law or agreed to in writing, software\\n * distributed under the License is distributed on an \\\"AS IS\\\" BASIS,\\n *\n WITHOUT WARRANTIES\n OR CONDITIONS OF ANY KIND, either express or implied.\\n * See the License for\n the specific language governing permissions and\\n * limitations under the License.\\n *\n=====\n
```

```
=====\n\n *\\n\\nimport {ExpandDims, ExpandDimsAttrs, ExpandDimsInputs,\n KernelConfig, KernelFunc, util} from '@tensorflow/tfjs-core';\\n\\nimport {BackendWasm} from\n './backend_wasm';\\nimport {reshape} from './Reshape';\\n\\nexport function expandDims(args: {\\n inputs:\n ExpandDimsInputs,\\n attrs: ExpandDimsAttrs,\\n backend: BackendWasm\\n}) {\\n const {inputs, attrs, backend} =\n args;\\n const {input} = inputs;\\n const {dim} = attrs;\\n\\n const inputRank = input.shape.length;\\n const newShape\n = input.shape.slice();\\n let $dim = dim;\\n if (dim < 0) {\\n // Negative value is counted from the tail of rank.\\n\n util.assert(\\n -(inputRank + 1) <= dim,\\n () => `Axis must be in the interval [${- (inputRank + 1)}, ${\\n\n inputRank}]`);\\n $dim = inputRank + dim + 1;\\n }\\n newShape.splice($dim, 0, 1);\\n\\n return reshape({inputs:\n {x: input}, backend, attrs: {shape: newShape}});\\n}\\n\\n\\nexport const expandDimsConfig: KernelConfig = {\\n\n kernelName: ExpandDims,\\n backendName: 'wasm',\\n kernelFunc: expandDims as {} as KernelFunc,\\n};\\n", "/*\\n *\n @license\\n\n * Copyright 2020 Google LLC. All Rights Reserved.\\n * Licensed under the Apache License, Version\n 2.0 (the \\\"License\\");\\n * you may not use this file except in compliance with the License.\\n * You may obtain a\n copy of the License at\\n *\\n * http://www.apache.org/licenses/LICENSE-2.0\\n *\\n * Unless required by applicable\n law or agreed to in writing, software\\n * distributed under the License is distributed on an \\\"AS IS\\\" BASIS,\\n *\n WITHOUT WARRANTIES\n OR CONDITIONS OF ANY KIND, either express or implied.\\n * See the License for\n the specific language governing permissions and\\n * limitations under the License.\\n *\n=====\n
```

```

*\\n\\nimport { KernelConfig, KernelFunc } from '@tensorflow/tfjs-core';\\nimport { Fill, FillAttrs } from
 '@tensorflow/tfjs-core';\\n\\nimport { BackendWasm } from '../backend_wasm';\\n\\nexport function fill(args: { attrs:
 FillAttrs, backend: BackendWasm }) {\\n const { attrs: { shape,
 value, dtype }, backend } = args;\\n const out = backend.makeOutput(shape, dtype);\\n const outVals =
 backend.toArrayFromHeap(out);\\n outVals.fill(value as number);\\n return out;\\n}\\n\\nexport const fillConfig:
 KernelConfig = {\\n kernelName: Fill,\\n backendName: 'wasm',\\n kernelFunc: fill as { } as
 KernelFunc,\\n};\\n", "/*\\n * @license\\n * Copyright 2019 Google LLC. All Rights Reserved.\\n * Licensed under the
 Apache License, Version 2.0 (the 'License');\\n * you may not use this file except in compliance with the
 License.\\n * You may obtain a copy of the License at\\n * http://www.apache.org/licenses/LICENSE-2.0\\n *\\n *
 Unless required by applicable law or agreed to in writing, software\\n * distributed under the License is distributed
 on an 'AS IS' BASIS,\\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
 implied.\\n * See the License for the specific language governing permissions and\\n * limitations under the
 License.\\n *

```

```

=====\\n
*\\n\\nimport { FlipLeftRight, FlipLeftRightInputs, KernelConfig, KernelFunc, TensorInfo } from '@tensorflow/tfjs-
core';\\n\\nimport { BackendWasm } from '../backend_wasm';\\n\\nlet wasmFlipLeftRight: (\\n xId: number, batch:
 number, imageHeight: number, imageWidth: number,\\n numChannels: number, outId: number) =>
 void;\\n\\nfunction setup(backend: BackendWasm) {\\n wasmFlipLeftRight = backend.wasm.cwrap(FlipLeftRight,
 null /* void */, [\\n 'number', // xId\\n 'number', // batch\\n 'number', // imageHeight\\n 'number', //
 imageWidth\\n 'number', // numChannels\\n 'number', // outId\\n]);\\n}\\n\\nexport function flipLeftRight(\\n
 args: { inputs: FlipLeftRightInputs, backend: BackendWasm }): TensorInfo {\\n const { inputs, backend } = args;\\n
 const { image } = inputs;\\n const out = backend.makeOutput(image.shape, image.dtype);\\n const imageId =
 backend.dataIdMap.get(image.dataId).id;\\n const outId = backend.dataIdMap.get(out.dataId).id;\\n \\n
 const [batch, imageHeight, imageWidth, numChannels] = image.shape;\\n \\n wasmFlipLeftRight(\\n imageId,
 batch, imageHeight, imageWidth, numChannels, outId);\\n return out;\\n}\\n\\nexport const flipLeftRightConfig:
 KernelConfig = {\\n kernelName: FlipLeftRight,\\n backendName: 'wasm',\\n kernelFunc: flipLeftRight as { } as
 KernelFunc,\\n setupFunc: setup\\n};\\n", "/*\\n * @license\\n * Copyright 2020 Google LLC. All Rights Reserved.\\n *
 Licensed under the Apache License, Version 2.0 (the 'License');\\n * you may not use this file except in
 compliance with the License.\\n * You may obtain a copy of the License at\\n * http://www.apache.org/licenses/
LICENSE-2.0\\n *\\n * Unless required by applicable law or agreed to in writing,
 software\\n * distributed under the License is distributed on an 'AS IS' BASIS,\\n * WITHOUT WARRANTIES
 OR CONDITIONS OF ANY KIND, either express or implied.\\n * See the License for the specific language
 governing permissions and\\n * limitations under
 the License.\\n *

```

```

=====\\n
*\\n\\nimport { Floor, KernelConfig } from '@tensorflow/tfjs-core';\\n\\nimport { createUnaryKernelConfig } from
 './unary_kernel';\\n\\nexport const floorConfig: KernelConfig = createUnaryKernelConfig(Floor);\\n", "/*\\n *
 @license\\n * Copyright 2019 Google LLC. All Rights Reserved.\\n * Licensed under the Apache License, Version
 2.0 (the 'License');\\n * you may not use this file except in compliance with the License.\\n * You may obtain a
 copy of the License at\\n * http://www.apache.org/licenses/LICENSE-2.0\\n *\\n * Unless required by applicable
 law or agreed to in writing, software\\n * distributed under the License is distributed on an 'AS IS' BASIS,\\n *
 WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\\n * See the License for the specific
 language governing permissions and\\n * limitations under the License.\\n *

```

```

=====\\n
*\\n\\nimport { FloorDiv, KernelConfig } from '@tensorflow/tfjs-core';\\n\\nimport { createBinaryKernelConfig } from
 './binary_kernel';\\n\\nconst supportsFullBroadcast = false;\\n\\nexport const floorDivConfig: KernelConfig =\\n
 createBinaryKernelConfig(FloorDiv, supportsFullBroadcast);\\n", "/*\\n * @license\\n * Copyright 2019 Google
 LLC. All Rights Reserved.\\n * Licensed under the Apache License, Version 2.0 (the 'License');\\n * you may not

```

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software\n \* distributed under the License is distributed on an \"AS IS\" BASIS,\n \* WITHOUT WARRANTIES  
OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language  
governing permissions and\n \* limitations under the License.\n \*

```
=====\n\n*\n\nimport {FusedBatchNorm, FusedBatchNormAttrs, FusedBatchNormInputs, KernelConfig, KernelFunc,
TensorInfo, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nlet
wasmBatchNorm: (\n xId: number, meanId: number, varianceId: number, offsetId: number,\n scaleId: number,
varianceEpsilon: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n wasmBatchNorm = backend.wasm.cwrap(\n FusedBatchNorm, null /* void */,\n ['number', 'number',
'number', 'number', 'number', 'number', 'number']);\n\n function fusedBatchNorm(args: {\n backend:
BackendWasm,\n inputs: FusedBatchNormInputs,\n attrs: FusedBatchNormAttrs\n }): TensorInfo {\n const
{backend, inputs, attrs} = args;\n const {varianceEpsilon} = attrs;\n const {x, mean, variance, offset, scale} =
inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const meanId =
backend.dataIdMap.get(mean.dataId).id;\n const varianceId = backend.dataIdMap.get(variance.dataId).id;\n const offsetId = offset != null ? backend.dataIdMap.get(offset.dataId).id : 0;\n const scaleId = scale != null ?
backend.dataIdMap.get(scale.dataId).id : 0;\n\n const out = backend.makeOutput(x.shape, x.dtype);\n // Short-
circuit zero-sized tensors.\n if (util.sizeFromShape(x.shape) === 0) {\n return out;\n }\n\n const outId =
backend.dataIdMap.get(out.dataId).id;\n\n wasmBatchNorm(\n xId, meanId, varianceId, offsetId, scaleId,
varianceEpsilon, outId);\n return out;\n }\n\n export const fusedBatchNormConfig: KernelConfig = {\n kernelName:
FusedBatchNorm,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: fusedBatchNorm as {} as
KernelFunc\n };
}\n\n/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is
distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n */
```

```
=====\n\n*\n\nimport {backend_util, FusedConv2D, FusedConv2DAttrs, FusedConv2DInputs, KernelConfig, KernelFunc,
Tensor4D} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nimport
{FusableActivation} from './types';\nlet wasmFusedConv2d: (\n xId: number, batchSize: number, inputHeight:
number, inputWidth: number,\n filterId: number, filterHeight: number, filterWidth: number,\n biasId: number,
padTop: number, padRight: number, padBottom: number,\n padLeft: number, isSamePad: number,
dilationHeight: number,\n dilationWidth:
number, strideHeight: number, strideWidth: number,\n inputChannels: number, outputChannels: number,
activation: number,\n preluActivationWeightsId: number, leakyreluAlpha: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmFusedConv2d = backend.wasm.cwrap(FusedConv2D,
null /* void */, [\n 'number', // xId\n 'number', // batchSize\n 'number', // inputHeight\n 'number', //
inputWidth\n 'number', // filterId\n 'number', // filterHeight\n 'number', // filterWidth\n 'number', // biasId\n 'number', // padTop\n 'number', // padRight\n 'number', // padBottom\n 'number', // padLeft\n 'number', //
isSamePad\n 'number', // dilationHeight\n 'number', // dilationWidth\n 'number', // strideHeight\n 'number', //
strideWidth\n 'number', // inputChannels\n 'number', // outputChannels\n 'number', // activation\n 'number', // preluActivationWeightsId\n 'number', //
leakyreluAlpha\n 'number', // outId\n]);\n\n function fusedConv2d(args: {\n inputs: FusedConv2DInputs,\n backend: BackendWasm,\n attrs: FusedConv2DAttrs\n }) {\n const {inputs, attrs, backend} = args;\n const {x,
filter, bias, preluActivationWeights} = inputs;\n const {\n strides,\n pad,\n dilations,\n dataFormat,\n
```

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dimRoundingMode,\n activation,\n leakyreluAlpha\n } = attrs;\n\n const convInfo =
backend_util.computeConv2DInfo(\n (x as Tensor4D).shape, (filter as Tensor4D).shape, strides, dilations,\n pad, dimRoundingMode);\n\n const fusedActivation =\n FusableActivation[activation as {}] as keyof typeof
FusableActivation);\n if (fusedActivation == null) {\n throw new Error(\n `${activation} activation not yet
supported for FusedConv2D` +\n `in the wasm backend.`);\n }\n\n const xId =
backend.dataIdMap.get(x.dataId).id;\n const filterId = backend.dataIdMap.get(filter.dataId).id;\n\n const
outputChannels = convInfo.outChannels;\n\n let biasId = 0;\n if (bias != null) {\n const biasData = backend.dataIdMap.get(bias.dataId);\n if
(biasData.shape.length !== 1) {\n throw new Error(\n `FusedConv2D only supports rank-1 bias but got `
+\n `rank ${biasData.shape.length}`);\n }\n if (biasData.shape[0] !== outputChannels) {\n throw new
Error(\n `FusedConv2D bias shape (${biasData.shape}) does not ` +\n `match the number of output
channels (${outputChannels})`);\n }\n biasId = biasData.id;\n }\n\n const filterHeight =
convInfo.filterHeight;\n const filterWidth = convInfo.filterWidth;\n const padTop = convInfo.padInfo.top;\n const
padRight = convInfo.padInfo.right;\n const padBottom = convInfo.padInfo.bottom;\n const padLeft =
convInfo.padInfo.left;\n const dilationHeight = convInfo.dilationHeight;\n const dilationWidth =
convInfo.dilationWidth;\n const strideHeight = convInfo.strideHeight;\n const strideWidth =
convInfo.strideWidth;\n\n const inputChannels = convInfo.inChannels;\n const isSamePad = convInfo.padInfo.type === 'SAME' ? 1 : 0;\n
const batchSize = convInfo.batchSize;\n const inHeight = convInfo.inHeight;\n const inWidth =
convInfo.inWidth;\n\n if (dataFormat !== 'NHWC') {\n throw new Error(\n `wasm backend FusedConv2D
does not support dataFormat:` +\n `${dataFormat}`. Please use 'NHWC'.);\n }\n\n const out =
backend.makeOutput(convInfo.outShape, 'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n const
preluActivationWeightsId = preluActivationWeights == null ?\n 0 :\n backend.dataIdMap.get(preluActivationWeights.dataId).id;\n\n wasmFusedConv2d(\n xId, batchSize, inHeight,
inWidth, filterId, filterHeight, filterWidth,\n biasId, padTop, padRight, padBottom, padLeft, isSamePad,
dilationHeight,\n dilationWidth, strideHeight, strideWidth, inputChannels, outputChannels,\n fusedActivation,
preluActivationWeightsId, leakyreluAlpha
 || 0, outId);\n\n return out;\n}\n\n\nexport const fusedConv2DConfig: KernelConfig = {\n kernelName:
FusedConv2D,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: fusedConv2d as {} as
KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n */
=====
*/\n\nimport { backend_util, FusedDepthwiseConv2D, FusedDepthwiseConv2DAttrs,
FusedDepthwiseConv2DInputs, KernelConfig, KernelFunc, Tensor4D } from '@tensorflow/tfjs-core';\n\nimport
{ BackendWasm } from '../backend_wasm';\n\nimport { FusableActivation } from './types';\n\nlet
wasmFusedDepthwiseConv2d:\n (xId: number, batchSize: number, inputHeight: number, inputWidth: number,\n filterId: number, filterHeight: number, filterWidth: number,\n biasId: number, padTop: number, padRight:
number, padBottom: number,\n padLeft: number, isSamePad: number, dilationHeight: number,\n dilationWidth: number, strideHeight: number, strideWidth: number,\n inputChannels: number, outputChannels:
number, activation: number,\n preluActivationWeightsId: number, leakyreluAlpha: number, outId: number) =>\n
 void;\n\nfunction setup(backend: BackendWasm) {\n wasmFusedDepthwiseConv2d =\n backend.wasm.cwrap(FusedDepthwiseConv2D, null /* void */, [\n 'number', // xId\n 'number', //
batchSize\n 'number', // inputHeight\n

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'number', // inputWidth\n 'number', // filterId\n 'number', // filterHeight\n 'number', // filterWidth\n 'number', // biasId\n 'number', // padTop\n 'number', // padRight\n 'number', // padBottom\n 'number', // padLeft\n 'number', // isSamePad\n 'number', // dilationHeight\n 'number', // dilationWidth\n 'number', // strideHeight\n 'number', // strideWidth\n 'number', // inputChannels\n 'number', // outputChannels\n 'number', // activation\n 'number', // preluActivationWeightsId\n 'number', // leakyreluAlpha\n 'number', // outId\n]);\n\nfunction fusedDepthwiseConv2d(args: {\n inputs: FusedDepthwiseConv2DInputs,\n backend: BackendWasm,\n attrs: FusedDepthwiseConv2DAttrs\n}) {\n const {inputs, attrs, backend} = args;\n const {x, filter, bias, preluActivationWeights} = inputs;\n const {\n strides,\n pad,\n dilations,\n dataFormat,\n dimRoundingMode,\n activation,\n leakyreluAlpha\n } = attrs;\n\n const convInfo = backend_util.computeConv2DInfo(\n (x as Tensor4D).shape, (filter as Tensor4D).shape, strides, dilations,\n pad, dimRoundingMode, true /* depthwise */);\n\n const fusedActivation =\n FusableActivation[activation as {\n as keyof typeof FusableActivation\n }];\n if (fusedActivation == null) {\n throw new Error(\n `${activation}\n activation not yet supported for FusedDepthwiseConv2D`\n);\n }\n\n const xId = backend.dataIdMap.get(x.dataId).id;\n const filterId = backend.dataIdMap.get(filter.dataId).id;\n const\n outputChannels = convInfo.outChannels;\n\n let biasId = 0;\n if (bias != null) {\n const biasData =\n backend.dataIdMap.get(bias.dataId);\n if (biasData.shape.length !== 1) {\n throw new Error(\n `FusedDepthwiseConv2D only supports rank-1 bias but got`\n `${biasData.shape.length}`);\n }\n if (biasData.shape[0] !== outputChannels) {\n throw new Error(\n `FusedDepthwiseConv2D bias\n shape (${biasData.shape}) does not`\n `${outputChannels}`);\n }\n biasId = biasData.id;\n }\n\n const filterHeight = convInfo.filterHeight;\n const filterWidth =\n convInfo.filterWidth;\n const padTop = convInfo.padInfo.top;\n const padRight = convInfo.padInfo.right;\n const\n padBottom = convInfo.padInfo.bottom;\n const padLeft = convInfo.padInfo.left;\n const dilationHeight =\n convInfo.dilationHeight;\n const dilationWidth = convInfo.dilationWidth;\n const strideHeight =\n convInfo.strideHeight;\n const strideWidth = convInfo.strideWidth;\n const inputChannels =\n convInfo.inChannels;\n const isSamePad = convInfo.padInfo.type === 'SAME' ? 1 : 0;\n const batchSize =\n convInfo.batchSize;\n const inHeight = convInfo.inHeight;\n const inWidth = convInfo.inWidth;\n\n if\n (dataFormat !== 'NHWC') {\n throw new Error(\n `wasm backend FusedDepthwiseConv2D does not support dataFormat:`\n `${dataFormat}`. Please use 'NHWC'.);\n }\n\n const out = backend.makeOutput(convInfo.outShape, 'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n const preluActivationWeightsId = preluActivationWeights\n == null ?\n 0 : backend.dataIdMap.get(preluActivationWeights.dataId).id;\n\n wasmFusedDepthwiseConv2d(\n xId, batchSize, inHeight, inWidth, filterId, filterHeight, filterWidth,\n biasId, padTop, padRight, padBottom, padLeft, isSamePad, dilationHeight,\n dilationWidth, strideHeight,\n strideWidth, inputChannels, outputChannels,\n fusedActivation, preluActivationWeightsId, leakyreluAlpha || 0,\n outId);\n\n return out;\n}\n\nexport const fusedDepthwiseConv2DConfig: KernelConfig = {\n kernelName:\n FusedDepthwiseConv2D,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: fusedDepthwiseConv2d as\n {\n as KernelFunc\n };\n};\n\n/*\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\n * License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or\n * agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n * the specific language governing permissions and\n * limitations under the License.\n */\n\n\n\nimport {gather_util, GatherNd, GatherNdInputs, KernelConfig, TensorInfo} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nimport {CppType} from '../types';\n\nlet\n wasmGatherNd: (\n xId: number, dtype: CppDType, indicesId: number, numSlices: number,\n
```

```

 sliceRank: number, sliceSize: number, strides: Uint8Array, outId: number) => \n void;\n\nfunction
setup(backend: BackendWasm): void {\n wasmGatherNd = backend.wasm.cwrap(GatherNd, null /*void*/, [\n
'number', // xId\n 'number', // dtype\n 'number', // indicesId\n 'number', // numSlices\n 'number', //
sliceRank\n 'number', // sliceSize\n 'array', // strides\n 'number' // outId\n]);\n}\n\nfunction gatherNd(args:
{backend: BackendWasm, inputs: GatherNdInputs}): \n TensorInfo {\n const {backend, inputs} = args;\n const
{params, indices} = inputs;\n const [resultShape, numSlices, sliceSize, strides] = \n
gather_util.prepareAndValidate(params, indices);\n const out = backend.makeOutput(resultShape,
params.dtype);\n if (numSlices === 0) {\n return out;\n }\n const indicesShape = indices.shape;\n const
sliceRank = indicesShape[indicesShape.length - 1];\n const xData = backend.dataIdMap.get(params.dataId);\n
const xId = xData.id;\n
 const indicesData = backend.dataIdMap.get(indices.dataId);\n const indicesId = indicesData.id;\n const
stridesBytes = new Uint8Array(new Int32Array(strides).buffer);\n const outId =
backend.dataIdMap.get(out.dataId).id;\n wasmGatherNd(\n xId, CppDType[params.dtype], indicesId,
numSlices, sliceRank, sliceSize,\n stridesBytes, outId);\n return out;\n}\n\nexport const gatherNdConfig:
KernelConfig = {\n kernelName: GatherNd,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc:
gatherNd\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
===== \n
*/\n\nimport {backend_util, GatherV2, GatherV2Attrs, GatherV2Inputs, KernelConfig, KernelFunc, Tensor,
TensorInfo, TypedArray, util} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from
'./backend_wasm';\n\nimport {reshape} from './Reshape';\nimport {CppType} from './types';\n\nlet wasmGather:
(\n xId: number, dtype: CppDType, xStrides: Uint8Array, stridesSize: number,\n indicesId: number, batchSize:
number, outStrides: Uint8Array,\n outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n
 wasmGather = backend.wasm.cwrap('Gather', null /*void*/, [\n 'number', // xId\n 'number', // dtype\n 'array',
// xStrides\n 'number', // stridesSize\n 'number', // indicesId\n 'number', // batchSize\n 'array', // outStrides\n 'number' // outId\n]);\n}\n\nfunction gatherV2(\n args: {backend: BackendWasm,
inputs: GatherV2Inputs, attrs: GatherV2Attrs}): \n TensorInfo {\n const {backend, inputs, attrs} = args;\n const
{x, indices} = inputs;\n const {axis, batchDims} = attrs;\n // Throw error when any index is out of bound.\n
const parsedAxis = util.parseAxisParam(axis, x.shape)[0];\n const indicesVals = backend.readSync(indices.dataId)
as TypedArray;\n const axisDim = x.shape[parsedAxis];\n for (let i = 0; i < indicesVals.length; ++i) {\n const
index = indicesVals[i];\n util.assert(\n index <= axisDim - 1 && index >= 0,\n () => \n `GatherV2:
the index value ${index} is not in [0, ${axisDim - 1}]\n `);\n }\n const shapeInfo =
backend_util.segment_util.collectGatherOpShapeInfo(\n x as Tensor, indices as Tensor, parsedAxis,
batchDims);\n const flattenX = reshape({\n inputs: {x},\n attrs: {\n shape: [\n
shapeInfo.batchSize, shapeInfo.outerSize, shapeInfo.dimSize,\n shapeInfo.sliceSize\n],\n
backend\n });\n const indicesSize = util.sizeFromShape(indices.shape);\n const flattenIndex = reshape({\n
inputs: {x: indices},\n attrs: {shape: [shapeInfo.batchSize, indicesSize / shapeInfo.batchSize]},\n backend\n
});\n const flattenOutputShape = [\n shapeInfo.batchSize, shapeInfo.outerSize, indicesSize /
shapeInfo.batchSize,\n shapeInfo.sliceSize\n];\n const out = backend.makeOutput(flattenOutputShape,
x.dtype);\n if (util.sizeFromShape(x.shape) === 0) {\n return out;\n }\n const stridesSize = flattenX.shape.length
- 1;\n const xData = backend.dataIdMap.get(flattenX.dataId);\n const xId = xData.id;\n const indicesData =
backend.dataIdMap.get(flattenIndex.dataId);\n const indicesId = indicesData.id;\n const outId =
backend.dataIdMap.get(out.dataId).id;\n const xStridesBytes = new Uint8Array(\n new

```



```

Int32Array(util.computeStrides(flattenX.shape)).buffer);\n
 const outStridesBytes = new Uint8Array(\n new
Int32Array(util.computeStrides(flattenOutputShape)).buffer);\n\n wasmGather(\n xId, CppDType[x.dtype],
xStridesBytes, stridesSize, indicesId,\n shapeInfo.batchSize, outStridesBytes, outId);\n\n backend.disposeData(flattenX.dataId);\n backend.disposeData(flattenIndex.dataId);\n\n // reshape\n out.shape =
shapeInfo.outputShape;\n return out;\n}\n\nexport const gatherV2Config: KernelConfig = {\n kernelName:
GatherV2,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: gatherV2 as { } as KernelFunc\n};\n\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version
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CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing
permissions and\n * limitations under the License.\n *
=====\\n
*\nimport { Greater, KernelConfig } from '@tensorflow/tfjs-core';\nimport { createBinaryKernelConfig } from
'/binary_kernel';\n\nconst supportsFullBroadcast = false;\nexport const greaterConfig: KernelConfig =\ncreateBinaryKernelConfig(Greater, supportsFullBroadcast, 'bool');\n\n", "/*\n * @license\n * Copyright 2019 Google
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use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
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CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing
permissions and\n * limitations under the License.\n *
=====\\n
*\nimport { GreaterEqual, KernelConfig } from '@tensorflow/tfjs-core';\nimport { createBinaryKernelConfig }
from '/binary_kernel';\n\nconst supportsFullBroadcast = false;\nexport const greaterEqualConfig: KernelConfig =\ncreateBinaryKernelConfig(GreaterEqual, supportsFullBroadcast, 'bool');\n\n", "/*\n * @license\n * Copyright 2019
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WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific
language governing permissions and\n * limitations under the License.\n *
=====\\n
*\n\nimport { KernelConfig, KernelFunc, LeakyRelu, LeakyReluAttrs, LeakyReluInputs, TensorInfo, util } from
'@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nimport { CppDType } from
'./types';\n\nlet wasmFunc: (\n xId: number, dtype: number, leakyreluAlpha: number, outId: number) =>
void;\n\nfunction setupFunc(backend: BackendWasm): void {\n wasmFunc = backend.wasm.cwrap(LeakyRelu,
null /* void */, [\n 'number', // x_id\n 'number', // dtype\n 'number', // leakyrelu_alpha\n 'number', //
out_id\n]);\n\n export function leakyRelu(\n args: {\n inputs: LeakyReluInputs, attrs: LeakyReluAttrs,
backend: BackendWasm\n }) {\n const { inputs: { x }, attrs: { alpha }, backend } = args;\n\n const xId =
backend.dataIdMap.get(x.dataId).id;\n // According to TF API, LeakyRelu returns float32 when input is either
float32\n // or int32.\n const out = backend.makeOutput(x.shape, 'float32');\n\n if (util.sizeFromShape(x.shape)
!== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmFunc(xId, CppDType[x.dtype], alpha,
outId);\n }\n\n return out;\n }\n\n export const leakyReluConfig: KernelConfig = {\n kernelName: LeakyRelu,\n backendName: 'wasm',\n setupFunc,\n kernelFunc: leakyRelu as { } as KernelFunc,\n };\n\n", "/*\n * @license\n *

```

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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for  
the specific language governing permissions and\n \* limitations under the License.\n \*

```
=====\n\n *\\nimport {KernelConfig, Less} from '@tensorflow/tfjs-core';\\n\\nimport {createBinaryKernelConfig} from
 './binary_kernel';\\nconst supportsFullBroadcast = false;\\nexport const lessConfig: KernelConfig =\\n
createBinaryKernelConfig(Less, supportsFullBroadcast, 'bool');\\n\", \"/*\\n * @license\\n * Copyright 2019 Google
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 WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\\n * See the License for
 the specific language governing permissions and\\n * limitations under the License.\\n *
```

```
=====\n\n *\\n\\nimport {KernelConfig, LessEqual} from '@tensorflow/tfjs-core';\\n\\nimport {createBinaryKernelConfig} from
 './binary_kernel';\\nconst supportsFullBroadcast = false;\\nexport const lessEqualConfig: KernelConfig =\\n
createBinaryKernelConfig(LessEqual, supportsFullBroadcast, 'bool');\\n\", \"/*\\n * @license\\n * Copyright 2019
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 WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\\n * See the License for
 the specific language governing permissions and\\n * limitations under the License.\\n *
```

```
=====\n\n *\\nimport {KernelConfig, Log} from '@tensorflow/tfjs-core';\\n\\nimport {createUnaryKernelConfig} from
 './unary_kernel';\\nexport const logConfig: KernelConfig = createUnaryKernelConfig(Log);\\n\", \"/*\\n * @license\\n *
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 implied.\\n * See the License for the specific language governing permissions and\\n * limitations under the
 License.\\n *
```

```
=====\n\n *\\nimport {KernelConfig, LogicalAnd} from '@tensorflow/tfjs-core';\\n\\nimport {createBinaryKernelConfig} from
 './binary_kernel';\\nconst supportsFullBroadcast = false;\\nexport const logicalAndConfig: KernelConfig =\\n
createBinaryKernelConfig(LogicalAnd, supportsFullBroadcast, 'bool');\\n\", \"/*\\n * @license\\n * Copyright 2019
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 http://www.apache.org/licenses/LICENSE-2.0\\n * Unless required by applicable law or agreed to in writing,
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 express or implied.\\n * See the License for the specific language governing permissions and\\n * limitations under
 the License.\\n *
```

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=====\n\n
```

```

*\n\nimport {backend_util, KernelConfig, KernelFunc, Max, MaxAttrs, MaxInputs, TensorInfo, util} from
'@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport
{permuteAxesAndTranspose} from './kernel_utils';\nimport {CppType} from './types';\n\nlet wasmMax: (xId:
number, dtype: number, reduceSize: number, outId: number) =>\n void;\n\nfunction setup(backend:
BackendWasm): void {\n wasmMax = backend.wasm.cwrap(Max, null /*void*/, [\n 'number', // x_id\n 'number', // dtype\n 'number', // reduce_size\n 'number', // out_id\n]);\n}\n\nfunction max(args: {backend:
BackendWasm, inputs: MaxInputs, attrs: MaxAttrs}): \n TensorInfo {\n const
{backend, inputs, attrs} = args;\n const {reductionIndices: axis, keepDims} = attrs;\n const {x} = inputs;\n const
xId = backend.dataIdMap.get(x.dataId).id;\n let inputId = xId;\n let input = x;\n const {transposed, axes,
originalAxes, inputWasTransposed} =\n permuteAxesAndTranspose(x, axis, backend);\n if
(inputWasTransposed) {\n const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n input =
transposed;\n inputId = transposedId;\n }\n const inputRank = input.shape.length;\n backend_util.assertAxesAreInnerMostDims('max', axes, inputRank);\n const [outShape, reduceShape] =\n backend_util.computeOutAndReduceShapes(input.shape, axes);\n const reduceSize =
util.sizeFromShape(reduceShape);\n const out = backend.makeOutput(outShape, x.dtype);\n if
(util.sizeFromShape(input.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmMax(inputId, CppDType[x.dtype], reduceSize, outId);\n }\n if (inputWasTransposed)
{\n // dispose of the transposed tensor.\n backend.disposeData(transposed.dataId);\n }\n if (keepDims) {\n
// reshape\n const newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n out.shape =
newShape;\n }\n return out;\n}\n\nexport const maxConfig: KernelConfig = {\n kernelName: Max,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: max as {} as KernelFunc\n};\n\n"/**\n * @license\n *
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
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permissions and\n * limitations under the License.\n *
=====
*\n\nimport {KernelConfig, Maximum} from '@tensorflow/tfjs-core';\n\nimport {createBinaryKernelConfig} from
'./binary_kernel';\n\nconst supportsFullBroadcast = false;\n\nexport const maximumConfig: KernelConfig =\n createBinaryKernelConfig(Maximum, supportsFullBroadcast);\n\n"/**\n * @license\n * Copyright 2019 Google
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
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permissions and\n * limitations under the License.\n *
=====
*\n\nimport {backend_util, KernelConfig, KernelFunc, MaxPool, MaxPoolAttrs, MaxPoolInputs, Tensor4D, util}
from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nlet wasmMaxPool: (\n xId:
number, batchSize: number, inputHeight: number, inputWidth: number,\n filterHeight: number, filterWidth:
number, padTop: number, padRight: number,\n padBottom: number, padLeft: number, dilationHeight: number,\n
dilationWidth: number, strideHeight: number, strideWidth: number,\n inputChannels: number, outputChannels:
number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmMaxPool =
backend.wasm.cwrap(MaxPool, null /* void */, [\n 'number', // xId\n 'number', // batchSize\n 'number', // inputHeight\n 'number', // inputWidth\n 'number', // filterHeight\n 'number', // filterWidth\n]

```

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'number', // padTop\n 'number', // padRight\n 'number', // padBottom\n 'number', // padLeft\n 'number',
// dilationHeight\n 'number', // dilationWidth\n 'number', // strideHeight\n 'number', // strideWidth\n
'number', // inputChannels\n 'number', // outputChannels\n 'number', // outId\n]);\n\nfunction maxPool(\n
args: {inputs: MaxPoolInputs, backend: BackendWasm, attrs: MaxPoolAttrs}) {\n const {inputs, attrs, backend} =
args;\n\n const x = inputs.x as Tensor4D;\n const xId = backend.dataIdMap.get(x.dataId).id;\n\n // TF API
supports int32 input. CPU and WebGL backend also support int32\n // input. WASM backend doesn't support it
because it uses xnnpack which only\n // supports float32.\n /\n // Add the following assert only for the WASM
backend instead of at core op\n // level.\n /\n // TODO: add support for int32 input.\n util.assert(\n x.dtype
=== 'float32',\n () =>\n `Error in MaxPool: only float32
input is supported. Got ${x.dtype}.`);\n\n const {filterSize, strides, pad, dimRoundingMode} = attrs;\n const
convInfo = backend_util.computePool2DInfo(\n x.shape, filterSize, strides, 1 /* dilations */, pad,
dimRoundingMode);\n\n const filterHeight = convInfo.filterHeight;\n const filterWidth = convInfo.filterWidth;\n
const padTop = convInfo.padInfo.top;\n const padRight = convInfo.padInfo.right;\n const padBottom =
convInfo.padInfo.bottom;\n const padLeft = convInfo.padInfo.left;\n const dilationHeight =
convInfo.dilationHeight;\n const dilationWidth = convInfo.dilationWidth;\n const strideHeight =
convInfo.strideHeight;\n const strideWidth = convInfo.strideWidth;\n const inputChannels =
convInfo.inChannels;\n const outputChannels = convInfo.outChannels;\n\n if (convInfo.dataFormat !==
'channelsLast') {\n throw new Error(\n `wasm backend does not support dataFormat: "` +\n
`${convInfo.dataFormat}`. Please use 'channelsLast'.`);\n }\n\n const out
= backend.makeOutput(convInfo.outShape, 'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n
wasmMaxPool(\n xId, x.shape[0], x.shape[1], x.shape[2], filterHeight, filterWidth,\n padTop, padRight,
padBottom, padLeft, dilationHeight, dilationWidth,\n strideHeight, strideWidth, inputChannels, outputChannels,
outId);\n return out;\n}\n\nexport const maxPoolConfig: KernelConfig = {\n kernelName: MaxPool,\n
backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: maxPool as { } as KernelFunc\n};\n\n"/**\n * @license\n
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WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
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=====
*\n\nimport {backend_util, KernelConfig, KernelFunc, Mean, MeanAttrs, MeanInputs, TensorInfo, util} from
'@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport {cast} from './Cast';\n\nimport
{permuteAxesAndTranspose} from './kernel_utils';\n\nlet wasmMean: (xId: number, reduceSize: number, outId:
number) => void;\n\nfunction setup(backend: BackendWasm): void {\n wasmMean =\n
backend.wasm.cwrap(Mean, null /*void*/, ['number, number, number']);\n}\n\nexport function mean(\n args:
{backend: BackendWasm, inputs: MeanInputs, attrs: MeanAttrs}): TensorInfo {\n const {backend, inputs,
attrs} = args;\n const {axis, keepDims} = attrs;\n const {x} = inputs;\n const xId =
backend.dataIdMap.get(x.dataId).id;\n
let inputId = xId;\n let input = x;\n\n const {transposed, axes, originalAxes, inputWasTransposed} =\n
permuteAxesAndTranspose(x, axis, backend);\n\n let reductionAxes = axes;\n if (inputWasTransposed) {\n const
transposedId = backend.dataIdMap.get(transposed.dataId).id;\n if (transposedId !== xId) {\n // transpose was
not a no-op. We will need to dispose of this\n // once we are done.\n input = transposed;\n inputId =
transposedId;\n reductionAxes = backend_util.getInnerMostAxes(\n reductionAxes.length,
input.shape.length);\n }\n }\n\n backend_util.assertAxesAreInnerMostDims(\n 'mean', reductionAxes,
input.shape.length);\n const [outShape, reduceShape] =\n
backend_util.computeOutAndReduceShapes(input.shape, reductionAxes);\n const reduceSize =

```



```
./binary_kernel';\nconst supportsFullBroadcast = false;\nextport const minimumConfig: KernelConfig =\ncreateBinaryKernelConfig(Minimum, supportsFullBroadcast);\n","/*\n * @license\n * Copyright 2021 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n *\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an\n * \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n *\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n=====\n*\nimport { KernelConfig, KernelFunc, MirrorPad, MirrorPadAttrs, MirrorPadInputs } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nimport { CppDType } from './types';\n\n// Must match enum in MirrorPad.cc\nenum MirrorPaddingMode {\n reflect = 0,\n symmetric = 1\n}\n\nlet wasmMirrorPad: (\n xId: number, xShapeBytes: Uint8Array, xShapeLength: number, xDtype: number,\n prePaddingsBytes: Uint8Array, postPaddingsBytes: Uint8Array, mode: number,\n outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmMirrorPad = backend.wasm.cwrap(MirrorPad, null /* void */, [\n 'number', // xId\n 'array', // x.shape\n 'number', // x.shape.length\n 'array', // x.dtype\n 'array', // pre-paddings\n 'array', // post-paddings\n 'number', // mode\n 'number', // outId\n]);\n\n function mirrorPad(args: {\n inputs: MirrorPadInputs,\n backend: BackendWasm,\n attrs: MirrorPadAttrs\n }) {\n const {inputs: {x}, backend, attrs: {paddings, mode}} = args;\n const outShape = paddings.map((p, i) => p[0] /* beforePad */ + x.shape[i] + p[1] /* afterPad */);\n const xId = backend.dataIdMap.get(x.dataId).id;\n const out = backend.makeOutput(outShape, x.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n const xShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);\n const prePaddingsFlat = paddings.map(padTuple => padTuple[0]);\n const postPaddingsFlat = paddings.map(padTuple => padTuple[1]);\n const prePaddingsBytes = new Uint8Array(new Int32Array(prePaddingsFlat).buffer);\n const postPaddingsBytes = new Uint8Array(new Int32Array(postPaddingsFlat).buffer);\n\n wasmMirrorPad(\n xId, xShapeBytes, x.shape.length, CppDType[x.dtype], prePaddingsBytes,\n postPaddingsBytes, MirrorPaddingMode[mode], outId);\n return out;\n }\n\n nextport const mirrorPadConfig:\n KernelConfig = {\n kernelName: MirrorPad,\n backendName: 'wasm',\n kernelFunc: mirrorPad as {} as KernelFunc,\n setupFunc: setup\n }; \n ,"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n *\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an\n * \"AS IS\"\n * BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n *\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n=====\n*\nimport { KernelConfig, Multiply } from '@tensorflow/tfjs-core';\nimport { createBinaryKernelConfig } from './binary_kernel';\n\nconst supportsFullBroadcast = true;\nextport const multiplyConfig: KernelConfig =\ncreateBinaryKernelConfig(Multiply, supportsFullBroadcast);\n","/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n *\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an\n * \"AS IS\"\n * BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n *\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n=====\n*\nimport { KernelConfig, Neg } from '@tensorflow/tfjs-core';\nimport { createUnaryKernelConfig } from
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to in writing, software\n \* distributed under the License is distributed on an \"AS IS\" BASIS,\n \* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*

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*\n\nimport { KernelConfig, KernelFunc, NonMaxSuppressionV4, NonMaxSuppressionV4Attrs,
NonMaxSuppressionV4Inputs, TensorInfo } from '@tensorflow/tfjs-core';\n\nimport { BackendWasm } from
'./backend_wasm';\n\nimport { parseResultStruct } from './NonMaxSuppression_util';\n\nlet wasmFunc: (\n
boxesId: number, scoresId: number, maxOutputSize: number,\n iouThreshold: number, scoreThreshold: number,\n padToMaxOutputSize: boolean) => number;\n\nfunction setup(backend: BackendWasm): void {\n wasmFunc =
backend.wasm.cwrap(\n NonMaxSuppressionV4,\n 'number', // Result*\n [\n 'number', // boxesId\n
 'number', // scoresId\n 'number', // maxOutputSize\n 'number', // iouThreshold\n 'number', //
scoreThreshold\n 'bool', // padToMaxOutputSize\n]);\n\n function nonMaxSuppressionV4(args: {\n
backend: BackendWasm,\n inputs: NonMaxSuppressionV4Inputs,\n attrs: NonMaxSuppressionV4Attrs\n}):
TensorInfo[] {\n const { backend, inputs, attrs } = args;\n const { iouThreshold, maxOutputSize, scoreThreshold,
padToMaxOutputSize } =\n attrs;\n const { boxes, scores } = inputs;\n\n const boxesId =
backend.dataIdMap.get(boxes.dataId).id;\n const scoresId = backend.dataIdMap.get(scores.dataId).id;\n\n const
resOffset = wasmFunc(\n boxesId, scoresId, maxOutputSize, iouThreshold, scoreThreshold,\n padToMaxOutputSize);\n\n const { pSelectedIndices, selectedSize, pSelectedScores, pValidOutputs } =\n parseResultStruct(backend, resOffset);\n\n // Since we are not using scores for V4, we have to delete it from the
heap.\n backend.wasm._free(pSelectedScores);\n\n const selectedIndicesTensor =\n backend.makeOutput([selectedSize], 'int32', pSelectedIndices);\n\n const
validOutputsTensor = backend.makeOutput([], 'int32', pValidOutputs);\n\n return [selectedIndicesTensor,
validOutputsTensor];\n }\n\n export const nonMaxSuppressionV4Config: KernelConfig = {\n kernelName:
NonMaxSuppressionV4,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: nonMaxSuppressionV4 as {\n
as KernelFunc,\n };,\n },\n);\n\n /**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under
the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless
required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See
the License for the specific language governing permissions and\n * limitations under the License.\n */\n }
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*\n\nimport { KernelConfig, KernelFunc, NonMaxSuppressionV5, NonMaxSuppressionV5Attrs,
NonMaxSuppressionV5Inputs, TensorInfo } from '@tensorflow/tfjs-core';\n\nimport { BackendWasm } from
'./backend_wasm';\n\nimport { parseResultStruct } from './NonMaxSuppression_util';\n\nlet wasmFunc:\n
(boxesId: number, scoresId: number, maxOutputSize: number,\n iouThreshold: number, scoreThreshold: number,\n softNmsSigma: number) =>\n number;\n\nfunction setup(backend: BackendWasm): void {\n wasmFunc =
backend.wasm.cwrap(\n NonMaxSuppressionV5,\n 'number', // Result*\n [\n 'number', // boxesId\n
 'number', // scoresId\n 'number', // maxOutputSize\n 'number', // iouThreshold\n 'number', //
scoreThreshold\n 'number', // softNmsSigma\n]);\n\n function\n kernelFunc(args: {\n backend: BackendWasm,\n inputs: NonMaxSuppressionV5Inputs,\n attrs:
NonMaxSuppressionV5Attrs\n }): TensorInfo[] {\n const { backend, inputs, attrs } = args;\n const { iouThreshold,
maxOutputSize, scoreThreshold, softNmsSigma } = attrs;\n const { boxes, scores } = inputs;\n\n const boxesId =
backend.dataIdMap.get(boxes.dataId).id;\n const scoresId = backend.dataIdMap.get(scores.dataId).id;\n\n const
resOffset = wasmFunc(\n boxesId, scoresId, maxOutputSize, iouThreshold, scoreThreshold,\n softNmsSigma);\n\n const { pSelectedIndices, selectedSize, pSelectedScores, pValidOutputs } =\n parseResultStruct(backend, resOffset);\n\n // Since we are not using validOutputs for V5, we have to delete it from
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the\n // heap.\n backend.wasm._free(pValidOutputs);\n\n const selectedIndicesTensor =\n backend.makeOutput([selectedSize], 'int32', pSelectedIndices);\n const selectedScoresTensor =\n backend.makeOutput([selectedSize], 'float32', pSelectedScores);\n\n return [selectedIndicesTensor, selectedScoresTensor];\n}\n\nexport const nonMaxSuppressionV5Config:\n KernelConfig = {\n kernelName: NonMaxSuppressionV5,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: kernelFunc as { } as KernelFunc,\n};\n\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *\n *=====\n\n*/\n\nimport\n {KernelConfig, NotEqual} from '@tensorflow/tfjs-core';\n\nimport {createBinaryKernelConfig} from\n './binary_kernel';\n\nconst supportsFullBroadcast = false;\n\nexport const notEqualConfig: KernelConfig =\n createBinaryKernelConfig(NotEqual, supportsFullBroadcast, 'bool');\n\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *\n *=====\n\n*/\n\nimport\n {KernelConfig, KernelFunc, OneHot, OneHotAttrs, OneHotInputs} from '@tensorflow/tfjs-core';\n\nimport\n {BackendWasm} from '../backend_wasm';\n\nlet wasmOneHot: (\n indicesId: number, depth: number, onValue: number, offValue: number,\n outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmOneHot = backend.wasm.cwrap(OneHot, null /* void */, [\n 'number', // indices_id\n 'number', // depth,\n 'number', // onValue\n 'number', // offValue\n 'number' // out_id\n]);\n\nfunction oneHot(\n args: {inputs: OneHotInputs, attrs: OneHotAttrs, backend: BackendWasm}) {\n const {inputs, backend, attrs} = args;\n const {indices} = inputs;\n const {depth, onValue, offValue} = attrs;\n\n const out =\n backend.makeOutput([...indices.shape, depth], 'int32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n const indicesData = backend.dataIdMap.get(indices.dataId);\n const indicesId = indicesData.id;\n\n wasmOneHot(indicesId, depth,\n onValue, offValue, outId);\n\n return out;\n}\n\nexport const oneHotConfig: KernelConfig = {\n kernelName: OneHot,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: oneHot as { } as KernelFunc,\n};\n\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *\n *=====\n\n*/\n\nimport {KernelConfig, KernelFunc, OnesLike, OnesLikeInputs}\n from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nfunction onesLike(args: {inputs: OnesLikeInputs, backend: BackendWasm}) {\n const {inputs: [x], backend} = args;\n const out =\n backend.makeOutput(x.shape, x.dtype);\n const outVals = backend.typedArrayFromHeap(out);\n outVals.fill(1);\n}

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return out;\n}\n\nexport const onesLikeConfig: KernelConfig = {\n kernelName: OnesLike,\n backendName:
'wasm',\n kernelFunc: onesLike as { } as KernelFunc,\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC.
All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express
or implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
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*\n\nimport { KernelConfig, KernelFunc, Pack, PackAttrs, PackInputs, TensorInfo, util } from '@tensorflow/tfjs-
core';\nimport { BackendWasm } from '../backend_wasm';\nimport { concat } from './Concat';\nimport
{ expandDims } from './ExpandDims';\n\nexport function pack(\n args: { inputs: PackInputs, backend:
BackendWasm, attrs: PackAttrs }):\n TensorInfo {\n const { inputs, backend, attrs } = args;\n const { axis } =
attrs;\n\n if (inputs.length === 1) {\n return expandDims(\n { inputs: { input: inputs[0] }, backend, attrs: { dim:
axis } });\n }\n\n const shape = inputs[0].shape;\n const dtype = inputs[0].dtype;\n\n inputs.forEach(t => {\n util.assertShapesMatch(\n shape, t.shape,\n 'All tensors passed to stack must have matching shapes');\n util.assert(\n
 dtype === t.dtype,\n () => 'All tensors passed to stack must have matching dtypes');\n });\n\n const
intermediateTensorInfos: TensorInfo[] = [];\n const expandedTensors = inputs.map(t => {\n const expandedT =\n expandDims({ inputs: { input: t }, backend, attrs: { dim: axis } });\n intermediateTensorInfos.push(expandedT);\n });\n\n const result = concat({ inputs: expandedTensors, backend, attrs: { axis } });\n\n intermediateTensorInfos.forEach(t => backend.disposeData(t.dataId));\n\n return result;\n }\n\n export const
packConfig: KernelConfig = {\n kernelName: Pack,\n backendName: 'wasm',\n kernelFunc: pack as { } as
KernelFunc\n };\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
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* Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
=====
*\n\nimport { KernelConfig, KernelFunc, PadV2, PadV2Attrs, PadV2Inputs, util } from '@tensorflow/tfjs-
core';\nimport { BackendWasm } from '../backend_wasm';\nimport { fill } from './Fill';\nimport { CppDType }
from './types';\n\nlet wasmPadV2: (\n xId: number, xShapeBytes: Uint8Array, xShapeLength: number, xDtype:
number,\n prePaddingsBytes: Uint8Array, postPaddingsBytes: Uint8Array,\n constantValue: number, outId:
number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmPadV2 = backend.wasm.cwrap(PadV2, null
/* void */, [\n 'number', // xId\n 'array', //
x.shape\n 'number', // x.shape.length\n 'number', // x.dtype\n 'array', // pre-paddings\n 'array', // post-
paddings\n 'number', // constantValue\n 'number', // outId\n]);\n\n function pad(\n args: { inputs:
PadV2Inputs, backend: BackendWasm, attrs: PadV2Attrs }) {\n const { inputs: { x }, backend, attrs: { paddings,
constantValue } } = args;\n\n const outShape = paddings.map((p, i) => p[0] /* beforePad */ + x.shape[i] + p[1]
/* afterPad */);\n\n if (util.sizeFromShape(x.shape) === 0) {\n // Short-circuit the computation, since x doesn't
have value, only\n // the shape is used to compute output shape to pad.\n return fill({\n backend,\n attrs:
{ shape: outShape, value: constantValue, dtype: x.dtype }\n });\n }\n\n const xId =
backend.dataIdMap.get(x.dataId).id;\n const out = backend.makeOutput(outShape, x.dtype);\n const
outTensorData = backend.dataIdMap.get(out.dataId);\n const outId = outTensorData.id;\n\n const xShapeBytes

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= new Uint8Array(new Int32Array(x.shape).buffer);\n\n const prePaddingsFlat = paddings.map(padTuple =>
padTuple[0]);\n const postPaddingsFlat = paddings.map(padTuple => padTuple[1]);\n const prePaddingsBytes =\n new Uint8Array(new Int32Array(prePaddingsFlat).buffer);\n const postPaddingsBytes =\n new
Uint8Array(new Int32Array(postPaddingsFlat).buffer);\n\n wasmPadV2(\n xId, xShapeBytes, x.shape.length,
CppDType[x.dtype], prePaddingsBytes,\n postPaddingsBytes, constantValue, outId);\n return out;\n}\n\nexport
const padV2Config: KernelConfig = {\n kernelName: PadV2,\n backendName: 'wasm',\n kernelFunc: pad as {} as
KernelFunc,\n setupFunc: setup\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n
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* Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n */
=====
*\nimport {KernelConfig, Pow} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from
'./binary_kernel';\nconst supportsFullBroadcast = false;\nexport const powConfig: KernelConfig =\ncreateBinaryKernelConfig(Pow, supportsFullBroadcast);\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All
Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this
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http://www.apache.org/licenses/LICENSE-2.0\n *\n
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BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the
License for the specific language governing permissions and\n * limitations under the License.\n */
=====
*\n\nimport {KernelConfig, KernelFunc, Prelu, PreluInputs} from '@tensorflow/tfjs-core';\nimport
{BackendWasm} from './backend_wasm';\nimport {cast} from './Cast';\n\nlet wasmPrelu: (xId: number,
weightsId: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmPrelu =
backend.wasm.cwrap(Prelu, null /* void */, [\n 'number', // x_id\n 'number', // weights_id\n 'number' //
out_id\n]);\n\nfunction prelu(args: {inputs: PreluInputs, backend: BackendWasm}) {\n const {inputs, backend}
= args;\n const {x, alpha} = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n
const weightsId = backend.dataIdMap.get(alpha.dataId).id;\n\n let inputId = xId;\n const input = x;\n let
castedInput = input;\n if (input.dtype !== 'float32') {\n castedInput = cast({backend, inputs: {x}, attrs: {dtype:
'float32'}});\n inputId = backend.dataIdMap.get(castedInput.dataId).id;\n }\n\n const out =
backend.makeOutput(x.shape, 'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n
wasmPrelu(inputId, weightsId, outId);\n\n if (input.dtype !== 'float32') {\n
backend.disposeData(castedInput.dataId);\n }\n\n return out;\n}\n\nexport const preluConfig: KernelConfig = {\n
kernelName: Prelu,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: prelu as {} as
KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
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*\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n
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writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT
WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific
language governing permissions and\n * limitations under the License.\n */
=====
*\n\nimport {backend_util, KernelConfig, KernelFunc, Prod, ProdAttrs, ProdInputs, TensorInfo, util} from
'@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nimport

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{permuteAxesAndTranspose} from './kernel_utils';\n\nimport {CppType} from './types';\n\nlet wasmProd: (\n xId: number, reduceSize: number,\n dtype: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n wasmProd = backend.wasm.cwrap(Prod, null /*void*/, [\n 'number',\n 'number',\n 'number',\n 'number'\n]);\n\n function prod(args: {\n backend: BackendWasm,\n inputs: ProdInputs,\n attrs: ProdAttrs\n }): TensorInfo {\n const {backend, inputs, attrs} = args;\n const {axis, keepDims} = attrs;\n const {x} = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n let inputId = xId;\n let input = x;\n\n const {transposed, axes, originalAxes, inputWasTransposed} =\n permuteAxesAndTranspose(x, axis, backend);\n\n let reductionAxes = axes;\n if (inputWasTransposed) {\n const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n if (transposedId !== xId) {\n // transpose was not a no-op. We will need to dispose of this\n // once we are done.\n input = transposed;\n inputId = transposedId;\n reductionAxes =\n backend_util.getInnerMostAxes(\n reductionAxes.length, input.shape.length);\n }\n }\n\n backend_util.assertAxesAreInnerMostDims(\n 'prod', reductionAxes, input.shape.length);\n const [outShape, reduceShape]\n =\n backend_util.computeOutAndReduceShapes(input.shape, reductionAxes);\n const reduceSize =\n util.sizeFromShape(reduceShape);\n\n const out = backend.makeOutput(outShape, input.dtype);\n if (util.sizeFromShape(input.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmProd(inputId, reduceSize, CCppType[out.dtype], outId);\n }\n\n if (inputWasTransposed) {\n // dispose of the transposed tensor.\n backend.disposeData(transposed.dataId);\n }\n\n if (keepDims) {\n // reshape\n const newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n out.shape = newShape;\n }\n\n return out;\n }\n\n export const prodConfig: KernelConfig = {\n kernelName: Prod,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: prod as { } as KernelFunc\n }; \n /**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in\n * compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n =====\n *\n import {KernelConfig, KernelFunc, Range, RangeAttrs, TensorInfo} from '@tensorflow/tfjs-core';\n import {BackendWasm} from './backend_wasm';\n import {rangeImplCPU} from './kernel_utils/shared';\n\n export const range =\n (args: {backend: BackendWasm, attrs: RangeAttrs}): TensorInfo => {\n const {backend, attrs} = args;\n const {start, stop, step, dtype} = attrs;\n const values = rangeImplCPU(start, stop, step, dtype);\n\n const\n out = backend.makeOutput([values.length], dtype);\n const outVals = backend.typedArrayFromHeap(out);\n outVals.set(values);\n return out;\n };\n\n export const rangeConfig: KernelConfig = {\n kernelName: Range,\n backendName: 'wasm',\n kernelFunc: range as { } as KernelFunc\n }; \n /**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n =====\n *\n import {KernelConfig, RealDiv} from '@tensorflow/tfjs-core';\n import {createBinaryKernelConfig} from './binary_kernel';\n\n const supportsFullBroadcast = true;\n export const realDivConfig: KernelConfig =\n createBinaryKernelConfig(RealDiv, supportsFullBroadcast);\n /**\n * @license\n * Copyright 2019 Google LLC.

```



backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: resizeBilinear as {} as KernelFunc\n);\n", "/\*\n \* @license\n \* Copyright 2020 Google LLC. All Rights Reserved.\n \* Licensed under the Apache License, Version 2.0 (the \"License\");\n \* you may not use this file except in compliance with the License.\n \* You may obtain a copy of the License at\n \* http://www.apache.org/licenses/LICENSE-2.0\n \* Unless required by applicable law or agreed to in writing, software\n \* distributed under the License is distributed on an \"AS IS\" BASIS,\n \* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*/

```
=====\n*\n\nimport { KernelConfig, KernelFunc, Reverse, ReverseAttrs, ReverseInputs, TensorInfo, util } from\n '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nimport\n { identity } from './Identity';\nimport { reshape } from './Reshape';\n\nlet wasmReverse: (\n xId: number, axes:\n Uint8Array, axesLength: number, outShape: Uint8Array,\n outShapeLength: number, outId: number) =>\n void;\n\nfunction setup(backend: BackendWasm) {\n wasmReverse = backend.wasm.cwrap(Reverse, null, [\n 'number', // x_id\n 'array', // axes\n 'number', // axes_length\n 'array', // out_shape\n 'number', //\n out_shape_length\n 'number' // out_id\n]);\n\n export function reverse(\n args: { inputs: ReverseInputs,\n backend: BackendWasm, attrs: ReverseAttrs }):\n TensorInfo {\n const { inputs, backend, attrs } = args;\n const { x } = inputs;\n const { dims } = attrs;\n const axes = util.parseAxisParam(dims, x.shape);\n if (x.shape.length\n === 0) {\n return identity({ inputs: { x }, backend });\n }\n const out = backend.makeOutput(x.shape, x.dtype);\n const xId = backend.dataIdMap.get(x.dataId).id;\n const outId = backend.dataIdMap.get(out.dataId).id;\n const axesBytes = new Uint8Array(new Int32Array(axes).buffer);\n const outShapeBytes = new Uint8Array(new\n Int32Array(x.shape).buffer);\n wasmReverse(\n xId, axesBytes, axes.length, outShapeBytes, x.shape.length,\n outId);\n const reshaped =\n reshape({ inputs: { x: out }, attrs: { shape: x.shape }, backend });\n backend.disposeData(out.dataId);\n return reshaped;\n }\n\n export const reverseConfig: KernelConfig = {\n kernelName: Reverse,\n backendName: 'wasm',\n kernelFunc: reverse as {} as KernelFunc,\n setupFunc:\n setup\n }; \n "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the\n * Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the\n * License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed\n * on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or\n * implied.\n * See the License for the specific language governing permissions and\n * limitations under the\n * License.\n */
```

```
=====\n*\n\nimport { KernelConfig, KernelFunc, RotateWithOffset, RotateWithOffsetAttrs, RotateWithOffsetInputs,\n TensorInfo } from '@tensorflow/tfjs-core';\nimport { backend_util } from '@tensorflow/tfjs-core';\nimport\n { BackendWasm } from '../backend_wasm';\n\nlet wasmRotate: (\n xId: number, batch: number, imageHeight:\n number, imageWidth: number,\n numChannels: number, radians: number, centerX: number, centerY: number,\n fillBytes: Uint8Array, fillLength: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmRotate = backend.wasm.cwrap(RotateWithOffset, null /* void */, [\n 'number', // xId\n 'number', //\n batch\n 'number', // imageHeight\n 'number', // imageWidth\n 'number', // numChannels\n 'number', // radians\n 'number', // centerX\n 'number', // centerY\n 'array', //\n fillBytes\n 'number', // fillLength\n 'number', // outId\n]);\n\n export function rotateWithOffset(args: {\n inputs: RotateWithOffsetInputs,\n backend: BackendWasm,\n attrs: RotateWithOffsetAttrs\n }): TensorInfo {\n const { inputs, backend, attrs } = args;\n const { image } = inputs;\n const { radians, fillValue, center } = attrs;\n const out = backend.makeOutput(image.shape, image.dtype);\n const imageId =\n backend.dataIdMap.get(image.dataId).id;\n const outId = backend.dataIdMap.get(out.dataId).id;\n const [batch,\n imageHeight, imageWidth, numChannels] = image.shape;\n const [centerX, centerY] =\n backend_util.getImageCenter(center, imageHeight, imageWidth);\n const fillIsBlack = fillValue === 0;\n const\n fullOpacityValue = 255;\n const fillValues = typeof fillValue === 'number' ?\n [fillValue, fillValue, fillValue,
```







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```
=====\n\n*\n\nimport {KernelConfig, Sin} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from\n\n'./unary_kernel';\n\nexport const sinConfig: KernelConfig = createUnaryKernelConfig(Sin);\n\n"/**\n\n * @license\n\n * Copyright 2020 Google LLC. All Rights Reserved.\n\n * Licensed under the Apache License, Version 2.0 (the\n\n'License');\n\n * you may not use this file except in compliance with the License.\n\n * You may obtain a copy of the\n\nLicense at\n\n *\n
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```

```
=====\n\n*\n\n\nimport {KernelConfig, KernelFunc, Softmax, SoftmaxAttrs, SoftmaxInputs, TensorInfo, util} from\n\n'@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\n\nlet wasmFunc: (xId: number, outId:\n\nnumber, channels: number, batch: number) =>\n\n void;\n\n\nfunction setup(backend: BackendWasm): void {\n\n\nwasmFunc = backend.wasm.cwrap(Softmax, null /* void */, [\n\n 'number', // xId\n\n 'number', // outId\n\n'number', // channels\n\n 'number' // batch\n\n]);\n\n\n\nfunction softmax(\n\n args: {backend: BackendWasm,\n\n inputs: SoftmaxInputs, attrs: SoftmaxAttrs}): \n\nTensorInfo {\n\n const {backend, inputs: {logits}, attrs: {dim}} =\n\nargs;\n\n const xId = backend.dataIdMap.get(logits.dataId).id;\n\n const out = backend.makeOutput(logits.shape,\n\n logits.dtype);\n\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n const channels = logits.shape[dim];\n\n const batch = util.sizeFromShape(logits.shape) / channels;\n\n\n // Short-circuit zero-sized tensors.\n\n if\n\n(util.sizeFromShape(out.shape) === 0) {\n\n return out;\n\n }\n\n\nwasmFunc(xId, outId, channels, batch);\n\n return\n\nout;\n\n}\n\n\nexport const softmaxConfig: KernelConfig = {\n\n kernelName: Softmax,\n\n backendName: 'wasm',\n\n setupFunc: setup,\n\n kernelFunc: softmax as {\n\n} as KernelFunc\n\n};\n\n"/**\n\n * @license\n\n * Copyright 2021 Google\n\nLLC. All Rights Reserved.\n\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n\n * you may not\n\nuse this file except in compliance with the License.\n\n * You may obtain a copy of the License at\n\n *\n
```

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```

```
=====\n\n*\n\n\nimport {backend_util, KernelConfig, KernelFunc, ReshapeAttrs, ReshapeInputs, SpaceToBatchND,\n\nSpaceToBatchNDAttrs, SpaceToBatchNDInputs, TensorInfo, TransposeAttrs, TransposeInputs, util} from\n\n'@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\n\nimport {padV2Config} from\n\n'./PadV2';\n\nimport {reshape} from './Reshape';\n\nimport {transpose} from './Transpose';\n\n\nfunction\n\nspaceToBatchND(args: {\n\n inputs: SpaceToBatchNDInputs,\n\n backend: BackendWasm,\n\n attrs:\n\nSpaceToBatchNDAttrs\n\n}) {\n\n const {inputs, backend,\n\n attrs} = args;\n\n const {x} = inputs;\n\n const {blockShape, paddings} = attrs;\n\n\n const prod =\n\nutil.sizeFromShape(blockShape);\n\n const completePaddings: Array<[number, number]> = [[0, 0]];\n\n completePaddings.push(...(paddings as Array<[number, number]>));\n\n\n for (let i = 1 + blockShape.length; i <\n\nx.shape.length; ++i) {\n\n completePaddings.push([0, 0]);\n\n }\n\n\n const paddedX = padV2Config.kernelFunc({\n\n inputs: {x},\n\n backend,\n\n attrs: {paddings: completePaddings, constantValue: 0}\n\n}) as TensorInfo;\n\n\n const\n\nreshapedPaddedShape =\n\n backend_util.getReshaped(paddedX.shape, blockShape, prod, false);\n\n\n const\n\npermutedReshapedPaddedPermutation = backend_util.getPermuted(\n\n reshapedPaddedShape.length,\n\nblockShape.length, false);\n\n\n const flattenShape =\n\n backend_util.getReshapedPermuted(paddedX.shape,\n\nblockShape, prod, false);\n\n\n const reshapeInputs: ReshapeInputs = {x: paddedX};\n\n const reshapeAttrs:\n\nReshapeAttrs = {shape: reshapedPaddedShape};\n\n
```

```

const paddedXReshaped =\n reshape({inputs: reshapeInputs, backend, attrs: reshapeAttrs});\n\n const
transposeInputs: TransposeInputs = {x: paddedXReshaped};\n const transposeAttrs:\n TransposeAttrs = {perm:
permutedReshapedPaddedPermutation};\n const paddedXT =\n transpose({inputs: transposeInputs, backend,
attrs: transposeAttrs});\n\n const resultReshapeInputs: ReshapeInputs = {x: paddedXT};\n const
resultReshapeAttrs: ReshapeAttrs = {shape: flattenShape};\n const result = reshape(\n {inputs:
resultReshapeInputs, backend, attrs: resultReshapeAttrs});\n\n backend.disposeData(paddedX.dataId);\n
backend.disposeData(paddedXReshaped.dataId);\n backend.disposeData(paddedXT.dataId);\n\n return
result;\n}\n\nexport const spaceToBatchNDConfig: KernelConfig = {\n kernelName: SpaceToBatchND,\n backendName: 'wasm',\n kernelFunc: spaceToBatchND as { } as KernelFunc\n};\n\n"/**\n * @license\n *
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the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
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Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n */
=====
\n
*/\n\nimport {KernelConfig, KernelFunc, SplitV, SplitVAttrs, SplitVInputs, util} from '@tensorflow/tfjs-
core';\nimport {backend_util} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from
'./backend_wasm';\n\nimport {slice} from './Slice';\n\nexport function splitV(\n args: {inputs: SplitVInputs, attrs:
SplitVAttrs, backend: BackendWasm}) {\n const {inputs,
attrs, backend} = args;\n const {x} = inputs;\n const {numOrSizeSplits, axis} = attrs;\n\n const $axis =
util.parseAxisParam(axis, x.shape)[0];\n\n const splitSizes = backend_util.prepareSplitSize(x, numOrSizeSplits,
$axis);\n const begin = new Array(x.shape.length).fill(0);\n const size = x.shape.slice();\n return splitSizes.map(s
=> {\n const xSliceSize = [...size];\n xSliceSize[$axis] = s;\n const xSlice =\n slice({inputs: {x}, attrs:
{begin, size: xSliceSize}, backend});\n begin[$axis] += s;\n return xSlice;\n });\n}\n\nexport const
splitVConfig: KernelConfig = {\n kernelName: SplitV,\n backendName: 'wasm',\n kernelFunc: splitV as { } as
KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the
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distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n */
=====
\n
*/\n\nimport {KernelConfig, Sqrt} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from
'./unary_kernel';\n\nexport const sqrtConfig: KernelConfig = createUnaryKernelConfig(Sqrt);\n\n"/**\n * @license\n *
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CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing
permissions and\n * limitations under the License.\n */
=====
\n
*/\n\nimport {KernelConfig, Square} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from
'./unary_kernel';\n\nexport const squareConfig: KernelConfig = createUnaryKernelConfig(Square);\n\n"/**\n *
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```

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```
=====
*/\nimport {KernelConfig, SquaredDifference} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig}
from './binary_kernel';\nconst supportsFullBroadcast = true;\nexport const squaredDifferenceConfig: KernelConfig
=\n createBinaryKernelConfig(SquaredDifference, supportsFullBroadcast);\n"/**\n * @license\n * Copyright
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you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an
\n * "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n
* See the License for the specific language governing permissions and\n * limitations under the License.\n *
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```

```
*/\n\nimport {KernelConfig, KernelFunc, Step, StepAttrs, StepInputs, TensorInfo} from '@tensorflow/tfjs-
core';\nimport {BackendWasm} from '../backend_wasm';\nimport {CppType} from './types';\n\nlet wasmStep:
(xId: number, alpha: number, dtype: number, outId: number) =>\n void;\n\nfunction setup(backend:
BackendWasm): void {\n wasmStep = backend.wasm.cwrap(Step, null /*void*/, [\n 'number', // x_id\n 'number', // alpha\n 'number', // dtype\n 'number', // out_id\n]);\n\n function step(\n args: {\n backend: BackendWasm,\n inputs: StepInputs,\n attrs: StepAttrs\n }):\n TensorInfo {\n const {backend, inputs, attrs} = args;\n const {alpha} = attrs;\n const {x} = inputs;\n const xId
= backend.dataIdMap.get(x.dataId).id;\n\n const out = backend.makeOutput(x.shape, x.dtype);\n const outId =
backend.dataIdMap.get(out.dataId).id;\n\n wasmStep(xId, alpha, CppDType[x.dtype], outId);\n return
out;\n }\n\n export const stepConfig: KernelConfig = {\n kernelName: Step,\n backendName: 'wasm',\n setupFunc:
setup,\n kernelFunc: step as {} as KernelFunc\n };
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http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the
License.\n *
=====
```

```
*/\n\nimport {KernelConfig, KernelFunc, slice_util, StridedSlice, StridedSliceAttrs, StridedSliceInputs, TensorInfo,
util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nimport {reshape} from
'./Reshape';\nimport {slice} from './Slice';\n\nlet wasmStridedSlice: (\n xId: number, xStridesBytes: Uint8Array,\n xRank: number,\n beginBytes: Uint8Array, endBytes: Uint8Array, stridesBytes: Uint8Array,\n outShapeBytes:
Uint8Array, outStridesBytes: Uint8Array,\n outShapeLength: number, outId: number) => void;\n\nfunction
setup(backend: BackendWasm): void {\n wasmStridedSlice = backend.wasm.cwrap(StridedSlice, null /*void*/, [\n
 'number', // xId\n 'array', // xStrides\n 'number', // xRank\n 'array', // beginBytes\n 'array', // endBytes\n 'array', // stridesBytes\n 'array', // outShapeBytes\n 'array', // outStridesBytes\n 'number', // outShapeLength\n 'number', // outId\n]);\n\n export function stridedSlice(args: {\n backend:
BackendWasm,\n inputs: StridedSliceInputs,\n attrs: StridedSliceAttrs\n }): TensorInfo {\n const {backend, inputs,
attrs} = args;\n const {x} = inputs;\n\n const {\n begin,\n end,\n strides,\n beginMask,\n endMask,\n ellipsisMask,\n newAxisMask,\n shrinkAxisMask\n } = attrs;\n\n const {\n finalShapeSparse,\n finalShape,\n isIdentity,\n sliceDim0,\n isSimpleSlice,\n begin: $begin,\n end: $end,\n strides: $strides\n } =
```

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} = \n slice_util.sliceInfo(\n x.shape, begin, end, strides, beginMask, endMask, ellipsisMask,\nnewAxisMask, shrinkAxisMask);\n\n let result;\n\n if (isIdentity) {\n // Optimization #1, slice is a no-op plus\n reshape\n result = reshape({inputs: {x}, backend, attrs: {shape: finalShape}});\n } else if (sliceDim0 ||\n isSimpleSlice) {\n // Optimization #2, slice is memory contiguous\n (only occurs in dim 0)\n util.assert(\n x.shape.length >= 1,\n () => `Input must have rank at least 1, got: ${x.shape.length}`);\n const size = slice_util.computeOutShape($begin, $end, $strides);\n // To tolerate\n begin[0] > end[0] (a 0-output slice), we min(begin, end).\n const sliced = slice({inputs: {x}, backend, attrs: {\n begin: $begin, size}});\n result =\n reshape({inputs: {x: sliced}, backend, attrs: {shape: finalShape}});\n backend.disposeData(sliced.dataId);\n } else {\n const out = backend.makeOutput(finalShapeSparse,\n 'float32');\n const xId = backend.dataIdMap.get(x.dataId).id;\n const xStridesBytes =\n new\n Uint8Array(new Int32Array(util.computeStrides(x.shape)).buffer);\n const beginBytes = new Uint8Array(new Int32Array($begin).buffer);\n const endBytes = new Uint8Array(new Int32Array($end).buffer);\n const\n stridesBytes = new Uint8Array(new Int32Array($strides).buffer);\n const outputShapeBytes =\n new Uint8Array(new Int32Array(finalShapeSparse).buffer);\n const outStridesBytes = new Uint8Array(\n new Int32Array(util.computeStrides(finalShapeSparse)).buffer);\n const outId =\n backend.dataIdMap.get(out.dataId).id;\n wasmStridedSlice(\n xId, xStridesBytes, x.shape.length,\n beginBytes, endBytes, stridesBytes,\n outputShapeBytes, outStridesBytes, finalShapeSparse.length, outId);\n result = reshape({inputs: {x: out}, backend, attrs: {shape: finalShape}});\n backend.disposeData(out.dataId);\n }\n }\n return result;\n }\n\n export const stridedSliceConfig: KernelConfig = {\n kernelName: StridedSlice,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: stridedSlice as {} as KernelFunc\n }; \n /**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License\n * at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in\n * writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT\n * WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific\n * language governing permissions and\n * limitations under the License.\n */\n\n =====\n\n /**\n * @nimport { KernelConfig, Sub } from '@tensorflow/tfjs-core';\n * @nimport { createBinaryKernelConfig } from\n * './binary_kernel';\n * @nconst supportsFullBroadcast = true;\n * @nexport const subConfig: KernelConfig =\n * createBinaryKernelConfig(Sub, supportsFullBroadcast);\n */\n /**\n * @license\n * Copyright 2019 Google LLC. All\n * Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this\n * file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is\n * distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either\n * express or implied.\n * See the License for the specific language governing permissions and\n * limitations under\n * the License.\n */\n\n =====\n\n /**\n * @nimport { backend_util, KernelConfig, KernelFunc, Sum, SumAttrs, SumInputs, TensorInfo, util } from\n * '@tensorflow/tfjs-core';\n * @nimport { BackendWasm } from '../backend_wasm';\n * @nimport\n * {permuteAxesAndTranspose} from './kernel_utils';\n * @nimport { CppDType } from './types';\n * @nlet wasmSum: (xId:\n * number, reduceSize: number, dtype: number, outId: number) =>\n * void;\n * @nfunction setup(backend:\n * BackendWasm): void {\n * \n * wasmSum = backend.wasm.cwrap(Sum, null /*void*/, [\n * 'number', // input_id\n * 'number', // reduce_size\n * 'number', // dtype\n * 'number', // out_id\n *]);\n * }\n * @nfunction sum(args: {backend: BackendWasm, inputs: SumInputs, attrs:\n * SumAttrs}): \n * TensorInfo {\n * \n * const {backend, inputs, attrs} = args;\n * const {axis, keepDims} = attrs;\n * const\n * {x} = inputs;\n * const xId = backend.dataIdMap.get(x.dataId).id;\n * let inputId = xId;\n * let input = x;\n * const

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{transposed, axes, originalAxes, inputWasTransposed} =\n permuteAxesAndTranspose(x, axis, backend);\n\nlet reductionAxes = axes;\n if (inputWasTransposed) {\n const transposedId =\n backend.dataIdMap.get(transposed.dataId).id;\n if (transposedId !== xId) {\n // transpose was not a no-op. We\n will need to dispose of this\n // once we are done.\n input = transposed;\n inputId = transposedId;\n }\n reductionAxes = backend_util.getInnerMostAxes(\n reductionAxes.length, input.shape.length);\n }\n}\n\nbackend_util.assertAxesAreInnerMostDims(\n 'sum', reductionAxes, input.shape.length);\n const [outShape,\n reduceShape] =\n backend_util.computeOutAndReduceShapes(input.shape, reductionAxes);\n const reduceSize\n = util.sizeFromShape(reduceShape);\n\n const out = backend.makeOutput(outShape, input.dtype);\n if\n (util.sizeFromShape(input.shape) !== 0) {\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmSum(inputId, reduceSize, CppDType[out.dtype], outId);\n }\n\n if (inputWasTransposed) {\n // dispose of\n the transposed tensor.\n backend.disposeData(transposed.dataId);\n }\n\n if (keepDims) {\n // reshape\n const\n newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n out.shape = newShape;\n }\n\n return out;\n}\n\n\nexport const sumConfig: KernelConfig = {\n kernelName: Sum,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: sum as {} as KernelFunc\n};\n\n", "/*\n * @license\n * Copyright 2021 Google\n LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not\n use this file except\n in compliance with the License.\n * You may obtain a copy of the License at\n *\n http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,\n software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\n OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n governing permissions and\n * limitations under the License.\n *\n =====\n\n *\n \nimport {KernelConfig, Tan} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from\n './unary_kernel';\nexport const tanConfig: KernelConfig = createUnaryKernelConfig(Tan);\n\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\n License at\n *\n http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,\n software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\n OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n governing permissions and\n * limitations under the License.\n *\n =====\n\n *\n \nimport {KernelConfig, Tanh} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from\n './unary_kernel';\nexport const tanhConfig: KernelConfig = createUnaryKernelConfig(Tanh);\n\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\n License at\n *\n http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law\n or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\n OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n the specific language governing permissions and\n * limitations under the License.\n *\n =====\n\n *\n \nimport {KernelConfig, KernelFunc, Tile, TileAttrs, TileInputs} from '@tensorflow/tfjs-core';\nimport\n {BackendWasm} from '../backend_wasm';\nimport {CppType} from './types';\n\nlet wasmTile: (\n xId:\n number, xShape: Uint8Array, xShapeSize: number, newShape: Uint8Array,\n newShapeSize: number, dtype:\n number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmTile =\n backend.wasm.cwrap(Tile, null /* void */, [\n 'number', // x_id\n 'array', // x_shape\n 'number', //\n x_shape.length\n 'array', // new_shape\n 'number', // new_shape.length\n 'number' // out_id\n]

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]);\n\nfunction tile(\n args: {inputs: TileInputs, backend: BackendWasm, attrs: TileAttrs}) {\n const {inputs, backend, attrs} = args;\n const {x} = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const {reps} = attrs;\n\n const newShape: number[] = new Array(x.shape.length);\n for (let i = 0; i < newShape.length; i++) {\n newShape[i] = x.shape[i] * reps[i];\n }\n const xShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);\n const newShapeBytes = new Uint8Array(new Int32Array(newShape).buffer);\n const out = backend.makeOutput(newShape, x.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmTile(\n xId, xShapeBytes, x.shape.length, newShapeBytes, newShape.length,\n CppDType[out.dtype], outId);\n return out;\n}\n\nexport const tileConfig: KernelConfig = {\n kernelName: Tile,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: tile as { } as KernelFunc\n};\n"/**\n * @license\n * Copyright 2020 Google LLC.

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/\n\nimport {KernelConfig, KernelFunc, TensorInfo, TopK, TopKAttrs, TopKInputs} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nimport {CppType} from './types';\n\nlet wasmTopK: (\n xId: number, xShapeBytes: Uint8Array, xShapeLength: number,\n xDtype: CppDType, k: number, sorted: boolean,\n outValuesId: number,\n outIndicesId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmTopK = backend.wasm.cwrap(TopK, null / void */, [\n 'number', // xId\n 'array', // x.shape\n 'number', // x.shape.length\n 'number', // x.dtype\n 'number', // k\n 'bool', // sorted\n 'number', // outValuesId\n 'number', // outIndicesId\n]);\n\n export const topK: (\n args: {inputs: TopKInputs, backend: BackendWasm, attrs: TopKAttrs}) =>\n TensorInfo[] | TensorInfo = ({inputs, backend, attrs}) => {\n const {x} = inputs;\n const {k, sorted} = attrs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const xShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);\n const outputShape = x.shape.slice();\n outputShape[outputShape.length - 1] = k;\n const outValues = backend.makeOutput(outputShape, x.dtype);\n const outValuesId = backend.dataIdMap.get(outValues.dataId).id;\n const outIndices = backend.makeOutput(outputShape, 'int32');\n const outIndicesId = backend.dataIdMap.get(outIndices.dataId).id;\n\n wasmTopK(\n xId, xShapeBytes, x.shape.length, CppDType[x.dtype], k, sorted,\n outValuesId, outIndicesId);\n return [outValues, outIndices];\n };\n\n export const topKConfig: KernelConfig = {\n kernelName: TopK,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: topK as { } as KernelFunc\n };\n\n /**\n * @license\n * Copyright 2021 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR

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*/\n\nimport {KernelConfig, KernelFunc, TensorInfo, Transform, TransformAttrs, TransformInputs, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\n\nlet wasmTransform: (\n imageId: number, transformsId: number, isBatchTransform: boolean,\n batch: number, outHeight: number, outWidth: number, numChannels: number,\n imageWidth: number, imageHeight: number, strides: Uint8Array,\n stridesLength: number, interpolationModeId: number, fillModeId: number,\n fillValue: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n wasmTransform = backend.wasm.cwrap(Transform,

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null /*void*/, [\n 'number', // imageId\n 'number', // transformsId\n 'bool', // isBatchTransform\n
'number', // batch\n 'number', // outHeight\n 'number', // outWidth\n 'number', // numChannels\n 'number',
// imageWidth\n 'number', // imageHeight\n 'array', // strides\n 'number', // stridesLength\n 'number', //
interpolationModeId\n 'number', // fillModeId\n 'number', // fillValue\n 'number' // outId\n
]);\n\nfunction transform(\n args:\n {backend: BackendWasm, inputs: TransformInputs, attrs:
TransformAttrs});\n TensorInfo {\n const {backend, inputs, attrs} = args;\n const {image, transforms} = inputs;\n
const {interpolation, fillMode, fillValue, outputShape} = attrs;\n\n const [batch, imageHeight, imageWidth,
numChannels] = image.shape;\n const [outHeight, outWidth] =\n outputShape != null ? outputShape :
[imageHeight, imageWidth];\n const outShape =\n [batch, outHeight, outWidth,\n numChannels] as
[number, number, number, number];\n const strides =\n new Uint8Array(new
Int32Array(util.computeStrides(image.shape)).buffer);\n\n const out = backend.makeOutput(outShape, image.dtype);\n const outId =
backend.dataIdMap.get(out.dataId).id;\n\n const imageData = backend.dataIdMap.get(image.dataId);\n const
imageId = imageData.id;\n\n const transformsData = backend.dataIdMap.get(transforms.dataId);\n const
transformsId = transformsData.id;\n\n const interpolationModeId = interpolation === 'nearest' ? 1 : 2;\n let
fillModeId;\n switch (fillMode) {\n case 'constant':\n fillModeId = 1;\n break;\n case 'reflect':\n
fillModeId = 2;\n break;\n case 'wrap':\n fillModeId = 3;\n break;\n case 'nearest':\n
fillModeId = 4;\n break;\n default:\n fillModeId = 1;\n break;\n }\n\n wasmTransform(\n imageId, transformsId,
(transforms.shape[0] > 1), batch, outHeight,\n outWidth, numChannels, imageWidth, imageHeight, strides,\n image.shape.length - 1, interpolationModeId, fillModeId, fillValue,\n outId);\n\n return out;\n }\n\nexport const transformConfig: KernelConfig = {\n kernelName: Transform,\n backendName:
'wasm',\n setupFunc: setup,\n kernelFunc: transform as { } as KernelFunc\n};\n\n"/**\n * @license\n * Copyright
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you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
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*/\n\nimport {KernelConfig, KernelFunc, TensorInfo, Unpack, UnpackAttrs, UnpackInputs}
from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport {slice} from
'./Slice';\n\nfunction unpack(\n args: {inputs: UnpackInputs, backend: BackendWasm, attrs: UnpackAttrs});\n TensorInfo[] {\n const {inputs, backend, attrs} = args;\n const {value} = inputs;\n let {axis} = attrs;\n if (axis <
0) {\n axis += value.shape.length;\n }\n\n const numOutputs = value.shape[axis];\n const rank =
value.shape.length;\n const outShape: number[] = new Array(rank - 1);\n let outIndex = 0;\n for (let i = 0; i < rank;\n i++) {\n if (i !== axis) {\n outShape[outIndex++] = value.shape[i];\n }\n }\n const outs: TensorInfo[] = new
Array(numOutputs);\n const begin = new Array(rank).fill(0);\n const size = value.shape.slice();\n size[axis] = 1;\n for (let i = 0; i < outs.length; i++) {\n begin[axis] = i;\n outs[i] = slice({inputs: {x: value}, attrs: {begin, size},
backend});\n }\n return outs.map(({dataId, dtype}) => ({dataId, dtype,
shape: outShape}));\n }\n\nexport const unpackConfig: KernelConfig = {\n kernelName: Unpack,\n backendName:
'wasm',\n kernelFunc: unpack as { } as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All
Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
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*\n\nimport { KernelConfig, KernelFunc, ZerosLike, ZerosLikeInputs } from '@tensorflow/tfjs-core';\n\nimport
{ BackendWasm }
from './backend_wasm';\n\nfunction zerosLike(args: { inputs: ZerosLikeInputs, backend: BackendWasm }) {\n
const { inputs: { x }, backend } = args;\n const out = backend.makeOutput(x.shape, x.dtype);\n const outVals =
backend.typedArrayFromHeap(out);\n outVals.fill(0);\n return out;\n}\n\nexport const zerosLikeConfig:
KernelConfig = {\n kernelName: ZerosLike,\n backendName: 'wasm',\n kernelFunc: zerosLike as {} as
KernelFunc,\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the
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Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License
for the specific language governing permissions and\n * limitations under the License.\n *

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We explicitly import the modular kernels so they get registered in the\n// global registry when we compile the
library. A modular build would replace\n// the contents of this file and import only the kernels that are
needed.\nimport { KernelConfig, registerKernel } from '@tensorflow/tfjs-core';\n\nimport { fusedMatMulConfig }
from './kernels/_FusedMatMul';\nimport { absConfig } from './kernels/Abs';\nimport { addConfig } from
 './kernels/Add';\nimport { addNConfig } from './kernels/AddN';\nimport { allConfig } from './kernels/All';\nimport
{ anyConfig } from './kernels/Any';\nimport { argMaxConfig } from './kernels/ArgMax';\nimport { avgPoolConfig }
from './kernels/AvgPool';\nimport { batchMatMulConfig } from './kernels/BatchMatMul';\nimport
{ batchToSpaceNDConfig } from './kernels/BatchToSpaceND';\nimport { castConfig } from './kernels/Cast';\nimport
{ ceilConfig } from './kernels/Ceil';\nimport { clipByValueConfig } from './kernels/ClipByValue';\nimport
{ concatConfig } from './kernels/Concat';\nimport { conv2DConfig } from './kernels/Conv2D';\nimport
{ conv2DBackpropInputConfig } from './kernels/Conv2DBackpropInput';\nimport { cosConfig } from
 './kernels/Cos';\nimport { coshConfig } from './kernels/Cosh';\nimport { cropAndResizeConfig } from
 './kernels/CropAndResize';\nimport { cumsumConfig } from './kernels/Cumsum';\nimport { depthToSpaceConfig }
from './kernels/DepthToSpace';\nimport { depthwiseConv2dNativeConfig } from
 './kernels/DepthwiseConv2dNative';\nimport { eluConfig } from './kernels/Elu';\nimport { equalConfig } from
 './kernels/Equal';\nimport { expConfig } from './kernels/Exp';\nimport { expandDimsConfig } from
 './kernels/ExpandDims';\nimport { fillConfig } from './kernels/Fill';\nimport { flipLeftRightConfig } from
 './kernels/FlipLeftRight';\nimport { floorConfig } from './kernels/Floor';\nimport { floorDivConfig } from
 './kernels/FloorDiv';\nimport
{ fusedBatchNormConfig } from './kernels/FusedBatchNorm';\nimport { fusedConv2DConfig } from
 './kernels/FusedConv2D';\nimport { fusedDepthwiseConv2DConfig } from
 './kernels/FusedDepthwiseConv2D';\nimport { gatherNdConfig } from './kernels/GatherNd';\nimport
{ gatherV2Config } from './kernels/GatherV2';\nimport { greaterConfig } from './kernels/Greater';\nimport
{ greaterEqualConfig } from './kernels/GreaterEqual';\nimport { identityConfig } from './kernels/Identity';\nimport
{ leakyReluConfig } from './kernels/LeakyRelu';\nimport { lessConfig } from './kernels/Less';\nimport
{ lessEqualConfig } from './kernels/LessEqual';\nimport { logConfig } from './kernels/Log';\nimport
{ logicalAndConfig } from './kernels/LogicalAnd';\nimport { maxConfig } from './kernels/Max';\nimport
{ maximumConfig } from './kernels/Maximum';\nimport { maxPoolConfig } from './kernels/MaxPool';\nimport
{ meanConfig } from './kernels/Mean';\nimport { minConfig } from './kernels/Min';\nimport { minimumConfig } from
 './kernels/Minimum';\nimport
{ mirrorPadConfig } from './kernels/MirrorPad';\nimport { multiplyConfig } from './kernels/Multiply';\nimport
{ negConfig } from './kernels/Neg';\nimport { nonMaxSuppressionV3Config } from
 './kernels/NonMaxSuppressionV3';\nimport { nonMaxSuppressionV4Config } from
 './kernels/NonMaxSuppressionV4';\nimport { nonMaxSuppressionV5Config } from

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./kernels/NonMaxSuppressionV5';\nimport {notEqualConfig} from './kernels/NotEqual';\nimport {oneHotConfig}
from './kernels/OneHot';\nimport {onesLikeConfig} from './kernels/OnesLike';\nimport {packConfig} from
./kernels/Pack';\nimport {padV2Config} from './kernels/PadV2';\nimport {powConfig} from
./kernels/Pow';\nimport {preluConfig} from './kernels/Prelu';\nimport {prodConfig} from './kernels/Prod';\nimport
{rangeConfig} from './kernels/Range';\nimport {realDivConfig} from './kernels/RealDiv';\nimport {reluConfig}
from './kernels/Relu';\nimport {relu6Config} from './kernels/Relu6';\nimport {reshapeConfig} from
./kernels/Reshape';\nimport {resizeBilinearConfig}
from './kernels/ResizeBilinear';\nimport {reverseConfig} from './kernels/Reverse';\nimport
{rotateWithOffsetConfig} from './kernels/RotateWithOffset';\nimport {roundConfig} from
./kernels/Round';\nimport {rsqrtConfig} from './kernels/Rsqrt';\nimport {scatterNdConfig} from
./kernels/ScatterNd';\nimport {selectConfig} from './kernels/Select';\nimport {sigmoidConfig} from
./kernels/Sigmoid';\nimport {sinConfig} from './kernels/Sin';\nimport {sliceConfig} from './kernels/Slice';\nimport
{softmaxConfig} from './kernels/Softmax';\nimport {spaceToBatchNDConfig} from
./kernels/SpaceToBatchND';\nimport {splitVConfig} from './kernels/SplitV';\nimport {sqrtConfig} from
./kernels/Sqrt';\nimport {squareConfig} from './kernels/Square';\nimport {squaredDifferenceConfig} from
./kernels/SquaredDifference';\nimport {stepConfig} from './kernels/Step';\nimport {stridedSliceConfig} from
./kernels/StridedSlice';\nimport {subConfig} from './kernels/Sub';\nimport {sumConfig} from
./kernels/Sum';\nimport
{tanConfig} from './kernels/Tan';\nimport {tanhConfig} from './kernels/Tanh';\nimport {tileConfig} from
./kernels/Tile';\nimport {topKConfig} from './kernels/TopK';\nimport {transformConfig} from
./kernels/Transform';\nimport {transposeConfig} from './kernels/Transpose';\nimport {unpackConfig} from
./kernels/Unpack';\nimport {zerosLikeConfig} from './kernels/ZerosLike';\n\n// List all kernel configs here\nconst
kernelConfigs: KernelConfig[] = [\n absConfig,\n addConfig,\n addNConfig,\n allConfig,\n anyConfig,\n argMaxConfig,\n avgPoolConfig,\n batchMatMulConfig,\n batchToSpaceNDConfig,\n castConfig,\n ceilConfig,\n clipByValueConfig,\n concatConfig,\n conv2DConfig,\n conv2DBackpropInputConfig,\n cosConfig,\n coshConfig,\n cropAndResizeConfig,\n cumsumConfig,\n depthToSpaceConfig,\n depthwiseConv2dNativeConfig,\n eluConfig,\n equalConfig,\n expConfig,\n expandDimsConfig,\n fillConfig,\n flipLeftRightConfig,\n floorConfig,\n floorDivConfig,\n fusedMatMulConfig,\n fusedBatchNormConfig,\n fusedConv2DConfig,\n fusedDepthwiseConv2DConfig,\n gatherNdConfig,\n gatherV2Config,\n greaterConfig,\n greaterEqualConfig,\n identityConfig,\n leakyReluConfig,\n lessConfig,\n lessEqualConfig,\n logConfig,\n logicalAndConfig,\n maxConfig,\n maximumConfig,\n maxPoolConfig,\n meanConfig,\n minConfig,\n minimumConfig,\n mirrorPadConfig,\n multiplyConfig,\n negConfig,\n nonMaxSuppressionV3Config,\n nonMaxSuppressionV4Config,\n nonMaxSuppressionV5Config,\n notEqualConfig,\n oneHotConfig,\n onesLikeConfig,\n packConfig,\n padV2Config,\n powConfig,\n preluConfig,\n prodConfig,\n rangeConfig,\n realDivConfig,\n reluConfig,\n relu6Config,\n reshapeConfig,\n resizeBilinearConfig,\n reverseConfig,\n rotateWithOffsetConfig,\n rsqrtConfig,\n roundConfig,\n scatterNdConfig,\n selectConfig,\n sigmoidConfig,\n sinConfig,\n sliceConfig,\n softmaxConfig,\n spaceToBatchNDConfig,\n splitVConfig,\n sqrtConfig,\n squareConfig,\n squaredDifferenceConfig,\n stepConfig,\n stridedSliceConfig,\n subConfig,\n sumConfig,\n tanConfig,\n tanhConfig,\n tileConfig,\n topKConfig,\n transformConfig,\n transposeConfig,\n unpackConfig,\n zerosLikeConfig\n];\n\nfor (const kernelConfig of kernelConfigs) {\n registerKernel(kernelConfig);\n}\n\n", "/*\n *
@license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version
2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n */
=====

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*/\n\nimport { env } from '@tensorflow/tfjs-core';\n\nconst ENV = env();\n\n/**\n * True if SIMD is supported.\n */\n// From: https://github.com/GoogleChromeLabs/wasm-feature-detect\nENV.registerFlag(\n // This typed array passed in to WebAssembly.validate is WebAssembly binary\n // code. In this case it is a small program that contains SIMD\n // instructions.\n 'WASM_HAS_SIMD_SUPPORT', async () => WebAssembly.validate(new\n Uint8Array([\n 0, 97, 115, 109, 1, 0, 0, 0, 1, 4, 1, 96, 0, 0, 3,\n 2, 1, 0, 10, 9, 1, 7, 0, 65, 0, 253, 15, 26, 11\n])));\n\n/**\n * True if threads are supported.\n */\n// From: https://github.com/GoogleChromeLabs/wasm-feature-detect\nENV.registerFlag('WASM_HAS_MULTITHREAD_SUPPORT', async () => {\n //\n // TODO(annxingyuan): Enable node support once this is resolved.\n //\n // https://github.com/tensorflow/tfjs/issues/3830\n if (ENV.get('IS_NODE')) {\n return false;\n }\n try {\n // Test for transferability of SABs (needed for Firefox)\n //\n // https://groups.google.com/forum/#!msg/mozilla.dev.platform/IHkBZIHETpA/dwsMNchWEQAJ\n new\n MessageChannel().port1.postMessage(new SharedArrayBuffer(1));\n // This typed array is a WebAssembly program containing threaded\n // instructions.\n return WebAssembly.validate(new Uint8Array([\n 0, 97, 115, 109, 1, 0, 0, 0, 1, 4, 1, 96, 0, 0, 3, 2, 1, 0, 5,\n 4, 1, 3, 1, 1, 10, 11, 1, 9, 0, 65, 0, 254, 16, 2, 0, 26, 11\n]));\n } catch (e) {\n return false;\n }\n});\n\n", "\nvar WasmBackendModuleThreadedSimd = (function() {\n var _scriptDir = typeof document !== 'undefined' && document.currentScript ? document.currentScript.src :\n undefined;\n if (typeof __filename !== 'undefined') _scriptDir = _scriptDir || __filename;\n return\n (\nfunction(WasmBackendModuleThreadedSimd) {\n WasmBackendModuleThreadedSimd =\n WasmBackendModuleThreadedSimd || {};\n\nfunction\n GROWABLE_HEAP_I8(){if(wasmMemory.buffer!=buffer){updateGlobalBufferAndViews(wasmMemory.buffer)}\n return\n HEAP8}\nfunction\n GROWABLE_HEAP_U8(){if(wasmMemory.buffer!=buffer){updateGlobalBufferAndViews(wasmMemory.buffer)}\n return HEAPU8}\nfunction\n GROWABLE_HEAP_I32(){if(wasmMemory.buffer!=buffer){updateGlobalBufferAndViews(wasmMemory.buffer)}\n return HEAP32}\nfunction\n GROWABLE_HEAP_U32(){if(wasmMemory.buffer!=buffer){updateGlobalBufferAndViews(wasmMemory.buffer)}\n return HEAPU32}\nfunction\n GROWABLE_HEAP_F64(){if(wasmMemory.buffer!=buffer){updateGlobalBufferAndViews(wasmMemory.buffer)}\n return HEAPF64}\nvar Module=typeof\n WasmBackendModuleThreadedSimd!="undefined"?WasmBackendModuleThreadedSimd:{};\nvar\n readyPromiseResolve,readyPromiseReject;Module["ready"]=new\n Promise(function(resolve,reject){readyPromiseResolve=resolve;readyPromiseReject=reject});\nvar\n moduleOverrides={};\nvar key;for(key in\n Module){if(Module.hasOwnProperty(key)){moduleOverrides[key]=Module[key]}}\nvar arguments_=[];\nvar\n thisProgram=\.this\.program;\nvar quit_=function(status,toThrow){throw\n toThrow};\nvar ENVIRONMENT_IS_WEB=false;\nvar ENVIRONMENT_IS_WORKER=false;\nvar\n ENVIRONMENT_IS_NODE=false;\nvar ENVIRONMENT_IS_SHELL=false;\nENVIRONMENT_IS_WEB=typeof\n window==="object";\nENVIRONMENT_IS_WORKER=typeof\n importScripts==="function";\nENVIRONMENT_IS_NODE=typeof process==="object"&&typeof\n process.versions==="object"&&typeof\n process.versions.node==="string";\nENVIRONMENT_IS_SHELL=!ENVIRONMENT_IS_WEB&&!ENVIRONM\n ENT_IS_NODE&&!ENVIRONMENT_IS_WORKER;\nvar\n ENVIRONMENT_IS_PTHREAD=Module["ENVIRONMENT_IS_PTHREAD"]||false;\nif(ENVIRONMENT_IS_P\n THREAD){buffer=Module["buffer"]}\nvar scriptDirectory=\.;\nfunction\n locateFile(path){if(Module["locateFile"]){return Module["locateFile"](path,scriptDirectory)}\n return\n scriptDirectory+path}\nvar read_,readAsync,readBinary,setWindowTitle;\nvar nodeFS;\nvar\n nodePath;\nif(ENVIRONMENT_IS_NODE){if(ENVIRONMENT_IS_WORKER){scriptDirectory=require(\n "path").

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dirname(scriptDirectory)+"^"}else{scriptDirectory=__dirname+"^"}read_=function
shell_read(filename,binary){if(!nodeFS)nodeFS=require("fs");if(!nodePath)nodePath=require("path");filename=n
odePath["normalize"](filename);return
nodeFS["readFileSync"](filename,binary?null:"utf8");readBinary=function readBinary(filename){var
ret=read_(filename,true);if(!ret.buffer){ret=new Uint8Array(ret)}assert(ret.buffer);return
ret};if(process["argv"].length>1){thisProgram=process["argv"][1].replace(/\\/g,"^")}arguments_=process["arg
v"].slice(2);process["on"]("uncaughtException",function(ex){if(!(ex instanceof ExitStatus)){throw
ex}});process["on"]("unhandledRejection",abort);quit_=function(status){process["exit"](status)};Module["insp
ect"]=function(){return"[Emscripten Module object]"};var
nodeWorkerThreads;try{nodeWorkerThreads=require("worker_threads")}catch(e){console.error("The
\"worker_threads\" module is not supported in this node.js build - perhaps a newer version is needed?");throw
e}global.Worker=nodeWorkerThreads.Worker}else if(ENVIRONMENT_IS_SHELL){if(typeof
read!="undefined"){read_=function shell_read(f){return read(f)}readBinary=function readBinary(f){var
data;if(typeof readbuffer==="function"){return new
Uint8Array(readbuffer(f))}data=read(f,"binary");assert(typeof data==="object");return data};if(typeof
scriptArgs!="undefined"){arguments_=scriptArgs}else if(typeof
arguments!="undefined"){arguments_=arguments}if(typeof
quit==="function"){quit_=function(status){quit(status)}}if(typeof print!="undefined"){if(typeof
console==="undefined")console={};console.log=print;console.warn=console.error=typeof
printErr!="undefined"?printErr:print}}else
if(ENVIRONMENT_IS_WEB||ENVIRONMENT_IS_WORKER){if(ENVIRONMENT_IS_WORKER){scriptDire
ctory=self.location.href}else if(typeof
document!="undefined"&&document.currentScript){scriptDirectory=document.currentScript.src}if(typeof
_scriptDir != "undefined" &&
_scriptDir){scriptDirectory=_scriptDir}if(scriptDirectory.indexOf("blob:")!==0){scriptDirectory=scriptDirectory.s
ubstr(0,scriptDirectory.lastIndexOf("^")+1)}else{scriptDirectory="/" }if(ENVIRONMENT_IS_NODE){read_=fun
ction
shell_read(filename,binary){if(!nodeFS)nodeFS=require("fs");if(!nodePath)nodePath=require("path");filename=n
odePath["normalize"](filename);return
nodeFS["readFileSync"](filename,binary?null:"utf8");readBinary=function readBinary(filename){var
ret=read_(filename,true);if(!ret.buffer){ret=new Uint8Array(ret)}assert(ret.buffer);return
ret}}else{read_=function(url){var xhr=new XMLHttpRequest;xhr.open("GET",url,false);xhr.send(null);return
xhr.responseText};if(ENVIRONMENT_IS_WORKER){readBinary=function(url){var xhr=new
XMLHttpRequest;xhr.open("GET",url,false);xhr.responseType="arraybuffer";xhr.send(null);return new
Uint8Array(xhr.response)}}readAsync=function(url,onload,onerror){var xhr=new
XMLHttpRequest;xhr.open("GET",url,true);xhr.responseType="arraybuffer";xhr.onload=function(){if(xhr.status
==200||xhr.status==0&&xhr.response){onload(xhr.response);return}onerror();}xhr.onerror=onerror;xhr.send(null)}
}setWindowTitle=function(title){document.title=title}}else{if(ENVIRONMENT_IS_NODE){if(typeof
performance==="undefined"){global.performance=require("perf_hooks").performance}}var
out=Module["print"]||console.log.bind(console);var err=Module["printErr"]||console.warn.bind(console);for(key
in
moduleOverrides){if(moduleOverrides.hasOwnProperty(key)){Module[key]=moduleOverrides[key]}}moduleOverr
ides=null;if(Module["arguments"]){arguments_=Module["arguments"];}if(Module["thisProgram"]){thisProgram=
Module["thisProgram"];}if(Module["quit"]){quit_=Module["quit"];}function
warnOnce(text){if(!warnOnce.shown)warnOnce.shown={};if(!warnOnce.shown[text]){warnOnce.shown[text]=1;er
r(text)}}var Atomics_load=Atomics.load;var Atomics_store=Atomics.store;var
Atomics_compareExchange=Atomics.compareExchange;var
wasmBinary;if(Module["wasmBinary"]){wasmBinary=Module["wasmBinary"];}var

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noExitRuntime=Module["noExitRuntime"]||true;if(typeof WebAssembly!=="object"){abort("no
native wasm support detected")}var wasmMemory;var wasmModule;var ABORT=false;var
EXITSTATUS;function assert(condition,text){if(!condition){abort("Assertion failed: "+text)}}function
getCFunc(ident){var func=Module["_"]+ident;assert(func,"Cannot call unknown function "+ident+", make sure
it is exported");return func}function ccall(ident,returnType,argTypes,args,opts){var
toC={"string":function(str){var ret=0;if(str!==null&&str!==undefined&&str!==0){var
len=(str.length<<2)+1;ret=stackAlloc(len);stringToUTF8(str,ret,len)}return ret},\array":function(arr){var
ret=stackAlloc(arr.length);writeArrayToMemory(arr,ret);return ret}};function
convertReturnValue(ret){if(returnType==="string")return UTF8ToString(ret);if(returnType==="boolean")return
Boolean(ret);return ret}var func=getCFunc(ident);var cArgs=[];var stack=0;if(args){for(var
i=0;i<args.length;i++){var
converter=toC[argTypes[i]];if(converter){if(stack===0)stack=stackSave();cArgs[i]=converter(args[i])}else{cArgs[i
]=args[i]}}var
ret=func.apply(null,cArgs);ret=convertReturnValue(ret);if(stack!==0)stackRestore(stack);return ret}function
cwrap(ident,returnType,argTypes,opts){argTypes=argTypes||[];var
numericArgs=argTypes.every(function(type){return type==="number"});var
numericRet=returnType!=="string";if(numericRet&&numericArgs&&!opts){return getCFunc(ident)}return
function(){return ccall(ident,returnType,argTypes,arguments,opts)}}function
UTF8ArrayToString(heap,idx,maxBytesToRead){var endIdx=idx+maxBytesToRead;var
str="";while(!(idx>=endIdx)){var u0=heap[idx++];if(!u0)return
str;if(!(u0&128)){str+=String.fromCharCode(u0);continue}var
u1=heap[idx++]&63;if((u0&224)==192){str+=String.fromCharCode((u0&31)<<6|u1);continue}var
u2=heap[idx++]&63;if((u0&240)==224){u0=(u0&15)<<12|u1<<6|u2}else{u0=(u0&7)<<18|u1<<12|u2<<6|heap[id
x++]&63}if(u0<65536){str+=String.fromCharCode(u0)}else{var ch=u0-
65536;str+=String.fromCharCode(55296|ch>>10,56320|ch&1023)}}return str}function
UTF8ToString(ptr,maxBytesToRead){return
ptr?UTF8ArrayToString(GROWABLE_HEAP_U8(),ptr,maxBytesToRead):""}function
stringToUTF8Array(str,heap,outIdx,maxBytesToWrite){if(!(maxBytesToWrite>0))return 0;var startIdx=outIdx;var
endIdx=outIdx+maxBytesToWrite-1;for(var i=0;i<str.length;++i){var
u=str.charCodeAt(i);if(u>=55296&&u<=57343){var
u1=str.charCodeAt(++i);u=65536+((u&1023)<<10|u1&1023)}if(u<=127){if(outIdx>=endIdx)break;heap[outIdx++]
=u}else if(u<=2047){if(outIdx+1>=endIdx)break;heap[outIdx++]=192|u>>6;heap[outIdx++]=128|u&63}else
if(u<=65535){if(outIdx+2>=endIdx)break;heap[outIdx++]=224|u>>12;heap[outIdx++]=128|u>>6&63;heap[outIdx
++]=128|u&63}else{if(outIdx+3>=endIdx)break;heap[outIdx++]=240|u>>18;heap[outIdx++]=128|u>>12&63;heap[
outIdx++]=128|u>>6&63;heap[outIdx++]=128|u&63}}heap[outIdx]=0;return outIdx-startIdx}function
stringToUTF8(str,outPtr,maxBytesToWrite){return
stringToUTF8Array(str,GROWABLE_HEAP_U8(),outPtr,maxBytesToWrite)}function lengthBytesUTF8(str){var
len=0;for(var i=0;i<str.length;++i){var
u=str.charCodeAt(i);if(u>=55296&&u<=57343)u=65536+((u&1023)<<10|str.charCodeAt(++i)&1023);if(u<=127)+
+len;else if(u<=2047)len+=2;else if(u<=65535)len+=3;else len+=4}return len}function
writeArrayToMemory(array,buffer){GROWABLE_HEAP_I8().set(array,buffer)}function
alignUp(x,multiple){if(x%multiple>0){x+=multiple-x%multiple}return x}var
buffer,HEAP8,HEAPU8,HEAP16,HEAPU16,HEAP32,HEAPU32,HEAPF32,HEAPF64;function
updateGlobalBufferAndViews(buf){buffer=buf;Module["HEAP8"]=HEAP8=new
Int8Array(buf);Module["HEAP16"]=HEAP16=new Int16Array(buf);Module["HEAP32"]=HEAP32=new
Int32Array(buf);Module["HEAPU8"]=HEAPU8=new Uint8Array(buf);Module["HEAPU16"]=HEAPU16=new
Uint16Array(buf);Module["HEAPU32"]=HEAPU32=new
Uint32Array(buf);Module["HEAPF32"]=HEAPF32=new

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Float32Array(buf);Module["HEAPF64"]=HEAPF64=new Float64Array(buf)}var
INITIAL_MEMORY=Module["INITIAL_MEMORY"]||16777216;if(ENVIRONMENT_IS_PTHREAD){wasmmem
ory=Module["wasmMemory"];buffer=Module["buffer"]}else{if(Module["wasmMemory"]){wasmMemory=
Module["wasmMemory"]}else{wasmMemory=new
WebAssembly.Memory({"initial":INITIAL_MEMORY/65536,"maximum":2147483648/65536,"shared":true});
if(!(wasmMemory.buffer instanceof SharedArrayBuffer)){err("requested a shared WebAssembly.Memory but the
returned buffer is not a SharedArrayBuffer, indicating that while the browser has SharedArrayBuffer it does not
have WebAssembly threads support - you may need to set a
flag");if(ENVIRONMENT_IS_NODE){console.log("(on node you may need: --experimental-wasm-threads --
experimental-wasm-bulk-memory and also use a recent version)")}throw Error("bad
memory")}}if(wasmMemory){buffer=wasmMemory.buffer}INITIAL_MEMORY=buffer.byteLength;updateGlob
alBufferAndViews(buffer);var wasmTable;var __ATPRERUN__=[];var __ATINIT__=[];var __ATMAIN__=[];var
__ATEXIT__=[];var __ATPOSTRUN__=[];var runtimeInitialized=false;var
runtimeExited=false;if(!ENVIRONMENT_IS_PTHREAD)__ATINIT__.push({func:function(){__wasm_call_ctors
()}});function
preRun(){if(ENVIRONMENT_IS_PTHREAD)return;if(Module["preRun"]){if(typeof
Module["preRun"]=="function")Module["preRun"]=Module["preRun"];while(Module["preRun"].length){a
ddOnPreRun(Module["preRun"].shift())}callRuntimeCallbacks(__ATPRERUN__)}function
initRuntime(){runtimeInitialized=true;if(ENVIRONMENT_IS_PTHREAD)return;callRuntimeCallbacks(__ATINIT
__)function
preMain(){if(ENVIRONMENT_IS_PTHREAD)return;callRuntimeCallbacks(__ATMAIN__)}function
exitRuntime(){if(ENVIRONMENT_IS_PTHREAD)return;runtimeExited=true}function
postRun(){if(ENVIRONMENT_IS_PTHREAD)return;if(Module["postRun"]){if(typeof
Module["postRun"]=="function")Module["postRun"]=Module["postRun"];while(Module["postRun"].lengt
h){addOnPostRun(Module["postRun"].shift())}callRuntimeCallbacks(__ATPOSTRUN__)}function
addOnPreRun(cb){__ATPRERUN__.unshift(cb)}function addOnPostRun(cb){__ATPOSTRUN__.unshift(cb)}var
runDependencies=0;var runDependencyWatcher=null;var dependenciesFulfilled=null;function
addRunDependency(id){assert(!ENVIRONMENT_IS_PTHREAD,"addRunDependency cannot be used in a
pthread
worker");runDependencies++;if(Module["monitorRunDependencies"]){Module["monitorRunDependencies"](ru
nDependencies)}}function removeRunDependency(id){runDependencies--
;if(Module["monitorRunDependencies"]){Module["monitorRunDependencies"](runDependencies)}if(runDepend
encies==0){if(runDependencyWatcher!=null){clearInterval(runDependencyWatcher);runDependencyWatcher=null}
if(dependenciesFulfilled){var
callback=dependenciesFulfilled;dependenciesFulfilled=null;callback()}}Module["preloadedImages"]={};Module
["preloadedAudios"]={};function
abort(what){if(Module["onAbort"]){Module["onAbort"](what)}if(ENVIRONMENT_IS_PTHREAD)console.err
or("Pthread aborting at "+(new
Error).stack);what+="\n";err(what);ABORT=true;EXITSTATUS=1;what+="abort("+what+"). Build with -s
ASSERTIONS=1 for more info.";var e=new WebAssembly.RuntimeError(what);readyPromiseReject(e);throw
e}function hasPrefix(str,prefix){return
String.prototype.startsWith?str.startsWith(prefix):str.indexOf(prefix)===0}var
dataURIPrefix="data:application/octet-stream;base64,";function isDataURI(filename){return
hasPrefix(filename,dataURIPrefix)}var fileURIPrefix="file://";function isFileURI(filename){return
hasPrefix(filename,fileURIPrefix)}var wasmBinaryFile="tfjs-backend-wasm-threaded-
simd.wasm";if(!isDataURI(wasmBinaryFile)){wasmBinaryFile=locateFile(wasmBinaryFile)}function
getBinary(file){try{if(file===wasmBinaryFile&&wasmBinary){return new
Uint8Array(wasmBinary)}if(readBinary){return readBinary(file)}else{throw"both async and sync fetching of the

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wasm failed\"} }catch(err){ abort(err)} }function
getBinaryPromise(){if(!wasmBinary&&(ENVIRONMENT_IS_WEB||ENVIRONMENT_IS_WORKER)){if(typeof
fetch===\"function\"&&!isFileURI(wasmBinaryFile)){return fetch(wasmBinaryFile,{credentials:\"same-
origin\"}),then(function(response){if(!response[\"ok\"]){throw\"failed to load wasm binary file at
\"+wasmBinaryFile+\"\"})return
response[\"arrayBuffer\"]()).catch(function(){return getBinary(wasmBinaryFile)}})else{if(readAsync){return new
Promise(function(resolve,reject){readAsync(wasmBinaryFile,function(response){resolve(new
Uint8Array(response)),reject}))})}return Promise.resolve().then(function(){return
getBinary(wasmBinaryFile)})}function createWasm(){var info={\"a\":asmLibraryArg};function
receiveInstance(instance,module){var
exports=instance.exports;Module[\"asm\"]=exports;wasmTable=Module[\"asm\"][\"I\"];wasmModule=module;if(!E
NVIRONMENT_IS_PTHREAD){var
numWorkersToLoad=PThread.unusedWorkers.length;PThread.unusedWorkers.forEach(function(w){PThread.load
WasmModuleToWorker(w,function(){if(!--numWorkersToLoad)removeRunDependency(\"wasm-
instantiate\")}))}if(!ENVIRONMENT_IS_PTHREAD){addRunDependency(\"wasm-instantiate\")}function
receiveInstantiatedSource(output){receiveInstance(output[\"instance\"],output[\"module\"])}function
instantiateArrayBuffer(receiver){return getBinaryPromise().then(function(binary){return
WebAssembly.instantiate(binary,info)).then(receiver,function(reason){err(\"failed to asynchronously prepare
wasm: \" +reason);abort(reason)})}function instantiateAsync(){if(!wasmBinary&&typeof
WebAssembly.instantiateStreaming===\"function\"&&!isDataURI(wasmBinaryFile)&&!isFileURI(wasmBinaryFil
e)&&typeof fetch===\"function\"){return fetch(wasmBinaryFile,{credentials:\"same-
origin\"}),then(function(response){var result=WebAssembly.instantiateStreaming(response,info);return
result.then(receiveInstantiatedSource,function(reason){err(\"wasm streaming compile failed: \" +reason);err(\"falling
back to ArrayBuffer instantiation\");return instantiateArrayBuffer(receiveInstantiatedSource)}))}else{return
instantiateArrayBuffer(receiveInstantiatedSource)}if(Module[\"instantiateWasm\"]){try{var
exports=Module[\"instantiateWasm\"](info,receiveInstance);return exports}catch(e){err(\"Module.instantiateWasm
callback failed with error: \" +e);return false}}instantiateAsync().catch(PromiseReject);return{}}var
ASM_CONSTS={10520:function(){throw\"Canceled!\"},10538:function($0,$1){setTimeout(function(){__emscript
en_do_dispatch_to_thread($0,$1),0}});function initPthreadsJS(){PThread.initRuntime()}function
callRuntimeCallbacks(callbacks){while(callbacks.length>0){var callback=callbacks.shift();if(typeof
callback===\"function\"){callback(Module);continue}var func=callback.func;if(typeof
func===\"number\"){if(callback.arg===undefined){wasmTable.get(func)}else{wasmTable.get(func)(callback.arg)
}}else{func(callback.arg===undefined?null:callback.arg)}}}var
ERRNO_CODES={EPERM:63,ENOENT:44,ESRCH:71,EINTR:27,EIO:29,ENXIO:60,E2BIG:1,ENOEXEC:45,E
BADF:8,ECHILD:12,EAGAIN:6,EWOULDBLOCK:6,ENOMEM:48,EACCES:2,EFAULT:21,ENOTBLK:105,EB
USY:10,EEXIST:20,EXDEV:75,ENODEV:43,ENOTDIR:54,EISDIR:31,EINVAL:28,ENFILE:41,EMFILE:33,EN
OTTY:59,ETXTBSY:74,EFBIG:22,ENOSPC:51,ESPIPE:70,EROFS:69,EMLINK:34,EPIPE:64,EDOM:18,ERAN
GE:68,ENOMSG:49,EIDRM:24,ECHRNA:106,EL2NSYNC:156,EL3HLT:107,EL3RST:108,ELNRNG:109,EUNA
TCH:110,ENOSCSI:111,EL2HLT:112,EDEADLK:16,ENOLCK:46,EBADE:113,EBADR:114,EXFULL:115,ENOA
NO:104,EBADRQC:103,EBADSLT:102,EDEADLOCK:16,EBFONT:101,ENOSTR:100,ENODATA:116,ETIME:
117,ENOSR:118,ENONET:119,ENOPKG:120,EREMOTE:121,ENOLINK:47,EADV:122,ESRMNT:123,ECOMM
:124,EPROTO:65,EMULTIHOP:36,EDOTDOT:125,EBADMSG:9,ENOTUNIQ:126,EBADFD:127,EREMCHG:1
28,ELIBACC:129,ELIBBAD:130,ELIBSCN:131,ELIBMAX:132,ELIBEXEC:133,ENOSYS:52,ENOTEMPTY:55,
ENAMETOOLONG:37,ELOOP:32,EOPNOTSUPP:138,EPFNOSUPPORT:139,ECONNRESET:15,ENOBUFS:42,
EAFNOSUPPORT:5,EPROTOTYPE:67,ENOTSOK:57,ENOPROTOOPT:50,ESHUTDOWN:140,ECONNREFU
SED:14,EADDRINUSE:3,ECONNABORTED:13,ENETUNREACH:40,ENETDOWN:38,ETIMEDOUT:73,EHOS
TDOWN:142,EHOSTUNREACH:23,EINPROGRESS:26,EALREADY:7,EDESTADDRREQ:17,EMSGSIZE:35,E
PROTONOSUPPORT:66,ESOCKTNOSUPPORT:137,EADDRNOTAVAIL:4,ENETRESET:39,EISCONN:30,EN

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OTCONN:53,ETOOMANYREFS:141,EUSERS:136,EDQUOT:19,ESTALE:72,ENOTSUP:138,ENOMEDIUM:14
8,EILSEQ:25,E_OVERFLOW:61,ECANCELED:11,ENOTRECOVERABLE:56,EOWNERDEAD:62,ESTRPIPE:13
5};function
_emsripten_futex_wake(addr,count){if(addr<=0||addr>GROWABLE_HEAP_I8().length||addr&3!=0||count<0)retu
rn-28;if(count==0)return 0;if(count>=2147483647)count=Infinity;var
mainThreadWaitAddress=Atomics.load(GROWABLE_HEAP_I32(),__emsripten_main_thread_futex>>2);var
mainThreadWoken=0;if(mainThreadWaitAddress==addr){var
loadedAddr=Atomics.compareExchange(GROWABLE_HEAP_I32(),__emsripten_main_thread_futex>>2,mainTh
readWaitAddress,0);if(loadedAddr==mainThreadWaitAddress){--count;mainThreadWoken=1;if(count<=0)return
1}}var ret=Atomics.notify(GROWABLE_HEAP_I32(),addr>>2,count);if(ret>=0)return
ret+mainThreadWoken;throw\"Atomics.notify returned an unexpected value
\"+ret}Module[\"_emsripten_futex_wake\"]=_emsripten_futex_wake;function
killThread(pthread_ptr){if(ENVIRONMENT_IS_PTHREAD)throw\"Internal Error! killThread() can only ever be
called from main application thread!\";if(!pthread_ptr)throw\"Internal Error! Null pthread_ptr in
killThread!\";GROWABLE_HEAP_I32()[pthread_ptr+12>>2]=0;var
pthread=PThread.threads[pthread_ptr];pthread.worker.terminate();PThread.freeThreadData(pthread);PThread.runni
ngWorkers.splice(PThread.runningWorkers.indexOf(pthread.worker),1);pthread.worker.pthread=undefined}functio
n cancelThread(pthread_ptr){if(ENVIRONMENT_IS_PTHREAD)throw\"Internal Error! cancelThread() can only
ever be called from main application thread!\";if(!pthread_ptr)throw\"Internal Error! Null pthread_ptr in
cancelThread!\";var
pthread=PThread.threads[pthread_ptr];pthread.worker.postMessage({\"cmd\":\"cancel\"})}function
cleanupThread(pthread_ptr){if(ENVIRONMENT_IS_PTHREAD)throw\"Internal Error! cleanupThread() can only
ever be called from main application thread!\";if(!pthread_ptr)throw\"Internal Error! Null pthread_ptr in
cleanupThread!\";var
pthread=PThread.threads[pthread_ptr];if(pthread){GROWABLE_HEAP_I32()[pthread_ptr+12>>2]=0;var
worker=pthread.worker;PThread.returnWorkerToPool(worker)}}var
PThread={unusedWorkers:[],runningWorkers:[],initMainThreadBlock:function(){var
pthreadPoolSize=8;for(var
i=0;i<pthreadPoolSize;++i){PThread.allocateUnusedWorker()}},initRuntime:function(){var
tb=_malloc(228);for(var
i=0;i<228/4;++i)GROWABLE_HEAP_U32()[tb/4+i]=0;GROWABLE_HEAP_I32()[tb+12>>2]=tb;var
headPtr=tb+152;GROWABLE_HEAP_I32()[headPtr>>2]=headPtr;var tlsMemory=_malloc(512);for(var
i=0;i<128;++i)GROWABLE_HEAP_U32()[tlsMemory/4+i]=0;Atomics.store(GROWABLE_HEAP_U32(),tb+100
>>2,tlsMemory);Atomics.store(GROWABLE_HEAP_U32(),tb+40>>2,tb);__emsripten_thread_init(tb,1,ENVIRON
MENT_IS_WORKER,1);__emsripten_register_main_browser_thread_id(tb);initWorker:function(){},threads:{},t
hreadExitHandlers:[],setThreadStatus:function(){},runExitHandlers:function(){while(PThread.threadExitHandlers.l
ength>0){PThread.threadExitHandlers.pop()()}if(ENVIRONMENT_IS_PTHREAD&&_pthread_self())__pthread
_tsd_run_dtors()},runExitHandlersAndDeinitThread:function(tb,exitCode){Atomics.store(GROWABLE_HEAP_U
32(),tb+56>>2,1);Atomics.store(GROWABLE_HEAP_U32(),tb+60>>2,0);PThread.runExitHandlers();Atomics.stor
e(GROWABLE_HEAP_U32(),tb+4>>2,exitCode);Atomics.store(GROWABLE_HEAP_U32(),tb+0>>2,1);_emscri
pten_futex_wake(tb+0,2147483647);__emsripten_thread_init(0,0,0)},threadExit:function(exitCode){var
tb=_pthread_self();if(tb){PThread.runExitHandlersAndDeinitThread(tb,exitCode);if(ENVIRONMENT_IS_PTHRE
AD){postMessage({\"cmd\":\"exit\"})}},threadCancel:function(){PThread.runExitHandlersAndDeinitThread(_pthr
ead_self(),-1);postMessage({\"cmd\":\"cancelDone\"})},terminateAllThreads:function(){for(var t in
PThread.threads){var
pthread=PThread.threads[t];if(pthread&&pthread.worker){PThread.returnWorkerToPool(pthread.worker)}}PThre
ad.threads={};for(var i=0;i<PThread.unusedWorkers.length;++i){var
worker=PThread.unusedWorkers[i];worker.terminate()}PThread.unusedWorkers=[];for(var

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i=0;i<PThread.runningWorkers.length;++i){ var worker=PThread.runningWorkers[i];var
pthread=worker.pthread;PThread.freeThreadData(pthread);worker.terminate()}PThread.runningWorkers=[],freeTh
readData:function(pthread){ if(!pthread)return;if(pthread.threadInfoStruct){ var
tlsMemory=GROWABLE_HEAP_I32()[pthread.threadInfoStruct+100>>2];GROWABLE_HEAP_I32()[pthread.thr
eadInfoStruct+100>>2]=0;_free(tlsMemory);_free(pthread.threadInfoStruct)}pthread.threadInfoStruct=0;if(pthread.
allocatedOwnStack&&pthread.stackBase)_free(pthread.stackBase);pthread.stackBase=0;if(pthread.worker)pthread.
worker.pthread=null},returnWorkerToPool:function(worker){PThread.runWithoutMainThreadQueuedCalls(funcio
n){ delete
PThread pthreads[worker.pthread.threadInfoStruct];PThread.unusedWorkers.push(worker);PThread.runningWorker
s.splice(PThread.runningWorkers.indexOf(worker),1);PThread.freeThreadData(worker.pthread);worker.pthread=un
defined}}},runWithoutMainThreadQueuedCalls:function(func){ GROWABLE_HEAP_I32()[__emscripten_allow_m
ain_runtime_queued_calls>>2]=0;try{ func()} finally{ GROWABLE_HEAP_I32()[__emscripten_allow_runti
me_queued_calls>>2]=1 }},receiveObjectTransfer:function(data){ },loadWasmModuleToWorker:function(worker,o
nFinishedLoading){ worker.onmessage=function(e){ var
d=e["data"];var
cmd=d["cmd"];if(worker.pthread)PThread.currentProxiedOperationCallerThread=worker.pthread.threadInfoStruct;
if(d["targetThread"]&&d["targetThread"]!=_pthread_self()){ var
thread=PThread.pthreads[d.targetThread];if(thread){ thread.worker.postMessage(e.data,d["transferList"]);}else{ con
sole.error('Internal error! Worker sent a message \''+cmd+'\' to target pthread '+d["targetThread"]+', but that
thread no longer
exists!')}PThread.currentProxiedOperationCallerThread=undefined;return}if(cmd===\'processQueuedMainThread
Work\'){ __emscripten_main_thread_process_queued_calls()}else
if(cmd===\'spawnThread\'){ spawnThread(e.data)}else
if(cmd===\'cleanupThread\'){ cleanupThread(d["thread"]);}else
if(cmd===\'killThread\'){ killThread(d["thread"]);}else
if(cmd===\'cancelThread\'){ cancelThread(d["thread"]);}else
if(cmd===\'loaded\'){ worker.loaded=true;if(onFinishedLoading)onFinishedLoading(worker);if(worker.runPthread)
{ worker.runPthread();delete
worker.runPthread } else if(cmd===\'print\'){ out("\Thread \"'+d["threadId"]+'": \"'+d["text"]') } else
if(cmd===\'printErr\'){ err("\Thread \"'+d["threadId"]+'": \"'+d["text"]') } else if(cmd===\'alert\'){ alert("\Thread
\"'+d["threadId"]+'": \"'+d["text"]') } else if(cmd===\'exit\'){ var
detached=worker.pthread&&Atomics.load(GROWABLE_HEAP_U32(),worker.pthread.threadInfoStruct+64>>2);if
(detached){ PThread.returnWorkerToPool(worker)} } else
if(cmd===\'exitProcess\'){ try{ exit(d["returnCode"]);} catch(e){ if(e instanceof ExitStatus)return;throw e } } else
if(cmd===\'cancelDone\'){ PThread.returnWorkerToPool(worker)} else
if(cmd===\'objectTransfer\'){ PThread.receiveObjectTransfer(e.data)} else
if(e.data.target===\'setImmediate\'){ worker.postMessage(e.data)} else{ err("\worker sent an unknown command
\'"+cmd')PThread.currentProxiedOperationCallerThread=undefined};worker.onerror=function(e){ err("\pthread sent
an error! \"'+e.filename+'\": \"'+e.lineno+'":
\"'+e.message');if(ENVIRONMENT_IS_NODE){ worker.on("\message",function(data){ worker.onmessage({ data:d
ata}));worker.on("\error",function(data){ worker.onerror(data)});worker.on("\exit",function(data){ })} } worker.post
Message({ "\cmd": "\load", "\urlOrBlob": Module["mainScriptUrlOrBlob"]||_scriptDir, "\wasmMemory": wasmMe
memory, "\wasmModule": wasmModule }),allocateUnusedWorker:function(){ var
pthreadMainJs=locateFile("\tfjs-backend-wasm-threaded-simd.worker.js");PThread.unusedWorkers.push(new
Worker(pthreadMainJs)),getNewWorker:function(){ if(PThread.unusedWorkers.length==0){ PThread.allocateUnus
edWorker();PThread.loadWasmModuleToWorker(PThread.unusedWorkers[0]) } if(PThread.unusedWorkers.length>
0)return PThread.unusedWorkers.pop();else return null},busySpinWait:function(msecs){ var
t=performance.now()+msecs;while(performance.now()<t){ } };function

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establishStackSpace(stackTop,stackMax){_emscripten_stack_set_limits(stackTop,stackMax);stackRestore(stackTop
)}Module[\"establishStackSpace\"]=establishStackSpace;function
getNoExitRuntime(){return noExitRuntime}Module[\"getNoExitRuntime\"]=getNoExitRuntime;function
invokeEntryPoint(ptr,arg){return
wasmTable.get(ptr)(arg)}Module[\"invokeEntryPoint\"]=invokeEntryPoint;function
__assert_fail(condition,filename,line,func){abort(\"Assertion failed: \"+UTF8ToString(condition)+\", at:
\"+[filename?UTF8ToString(filename):\"unknown filename\",line,func?UTF8ToString(func):\"unknown
function\"])}function __call_main(argc,argv){var returnCode=_main(argc,argv)}var
_emscripten_get_now;if(ENVIRONMENT_IS_NODE){_emscripten_get_now=function(){var
t=process[\"hrtime\"]();return t[0]*1e3+t[1]/1e6}}else
if(ENVIRONMENT_IS_PTHREAD){_emscripten_get_now=function(){return performance.now()-
Module[\"__performance_now_clock_drift\"]}}else if(typeof
dateNow!=\"undefined\"){_emscripten_get_now=dateNow}else _emscripten_get_now=function(){return
performance.now()};function setErrNo(value){GROWABLE_HEAP_I32()[__errno_location()>>2]=value;return
value}function _atexit(func,arg){if(ENVIRONMENT_IS_PTHREAD)return
_emscripten_proxy_to_main_thread_js(1,1,func,arg)}function
_emscripten_notify_thread_queue(targetThreadId,mainThreadId){if(targetThreadId==mainThreadId){postMessag
e({\"cmd\": \"processQueuedMainThreadWork\"})}else
if(ENVIRONMENT_IS_PTHREAD){postMessage({\"targetThread\":targetThreadId,\"cmd\": \"processThreadQueu
e\"})}else {var pthread=PThread.pthreads[targetThreadId];var
worker=pthread&&pthread.worker;if(!worker){return}worker.postMessage({\"cmd\": \"processThreadQueue\"})}ret
urn 1}function _abort(){abort()}function _emscripten_asm_const_int(code,sigPtr,argbuf){var
args=readAsmConstArgs(sigPtr,argbuf);return ASM_CONSTS[code].apply(null,args)}function
_emscripten_conditional_set_current_thread_status(expectedStatus,newStatus){}function
_emscripten_futex_wait(addr,val,timeout){if(addr<=0||addr>GROWABLE_HEAP_I8().length||addr&3!=0)return-
28;if(!ENVIRONMENT_IS_WEB){var
ret=Atomics.wait(GROWABLE_HEAP_I32(),addr>>2,val,timeout);if(ret===\"timed-out\")return-
73;if(ret===\"not-equal\")return-6;if(ret===\"ok\")return
0;throw\"Atomics.wait returned an unexpected value
\"+ret}else {if(Atomics.load(GROWABLE_HEAP_I32(),addr>>2)!=val){return-6}var
tNow=performance.now();var tEnd=tNow+timeout;var
lastAddr=Atomics.exchange(GROWABLE_HEAP_I32(),__emscripten_main_thread_futex>>2,addr);while(1){tNo
w=performance.now();if(tNow>tEnd){lastAddr=Atomics.exchange(GROWABLE_HEAP_I32(),__emscripten_mai
n_thread_futex>>2,0);return-
73}lastAddr=Atomics.exchange(GROWABLE_HEAP_I32(),__emscripten_main_thread_futex>>2,0);if(lastAddr==
0){break}_emscripten_main_thread_process_queued_calls();if(Atomics.load(GROWABLE_HEAP_I32(),addr>>2)!
=val){return-
6}lastAddr=Atomics.exchange(GROWABLE_HEAP_I32(),__emscripten_main_thread_futex>>2,addr)}return
0}}function
_emscripten_memcpy_big(dest,src,num){GROWABLE_HEAP_U8().copyWithin(dest,src,src+num)}function
_emscripten_num_logical_cores(){if(ENVIRONMENT_IS_NODE)return require(\"os\").cpus().length;return
navigator[\"hardwareConcurrency\"]}function
_emscripten_proxy_to_main_thread_js(index,sync){var numCallArgs=arguments.length-2;var
stack=stackSave();var serializedNumCallArgs=numCallArgs;var args=stackAlloc(serializedNumCallArgs*8);var
b=args>>3;for(var i=0;i<numCallArgs;i++){var arg=arguments[2+i];GROWABLE_HEAP_F64()[b+i]=arg}var
ret=_emscripten_run_in_main_runtime_thread_js(index,serializedNumCallArgs,args,sync);stackRestore(stack);retur
n ret}var _emscripten_receive_on_main_thread_js_callArgs=[];var readAsmConstArgsArray=[];function
readAsmConstArgs(sigPtr,buf){readAsmConstArgsArray.length=0;var

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ch;buf>>=2;while(ch=GROWABLE_HEAP_U8()[sigPtr++){var
double=ch<105;if(double&&buf&&1)buf++;readAsmConstArgsArray.push(double?GROWABLE_HEAP_F64()[buf
++>>1]:GROWABLE_HEAP_I32()[buf]);++buf}return readAsmConstArgsArray}function
_emscipten_receive_on_main_thread_js(index,numCallArgs,args){_emscipten_receive_on_main_thread_js_callA
rgs.length=numCallArgs;var b=args>>3;for(var
i=0;i<numCallArgs;i++){_emscipten_receive_on_main_thread_js_callArgs[i]=GROWABLE_HEAP_F64()[b+i]}v
ar
isEmAsmConst=index<0;var func=!isEmAsmConst?proxiedFunctionTable[index]:ASM_CONSTS[-index-
1];return func.apply(null,_emscipten_receive_on_main_thread_js_callArgs)}function
_emscipten_get_heap_size(){return GROWABLE_HEAP_U8().length}function
emscipten_realloc_buffer(size){try{wasmmMemory.grow(size-
buffer.byteLength+65535>>>16);updateGlobalBufferAndViews(wasmmMemory.buffer);return
1}catch(e){}}function _emscipten_resize_heap(requestedSize){var
oldSize=_emscipten_get_heap_size();if(requestedSize<=oldSize){return false}var
maxHeapSize=2147483648;if(requestedSize>maxHeapSize){return false}for(var
cutDown=1;cutDown<=4;cutDown*=2){var
overGrownHeapSize=oldSize*(1+.2/cutDown);overGrownHeapSize=Math.min(overGrownHeapSize,requestedSize
+100663296);var
newSize=Math.min(maxHeapSize,alignUp(Math.max(requestedSize,overGrownHeapSize),65536));var
replacement=emscipten_realloc_buffer(newSize);if(replacement){return true}}return false}var
JSEvents={inEventHandler:0,removeAllEventListeners:function(){for(var
i=JSEvents.eventHandlers.length-1;i>=0;--
i){JSEvents._removeHandler(i)}JSEvents.eventHandlers=[];JSEvents.deferredCalls=[]},registerRemoveEventListen
ers:function(){if(!JSEvents.removeEventListenersRegistered){__ATEXIT__.push(JSEvents.removeAllEventListene
rs);JSEvents.removeEventListenersRegistered=true}},deferredCalls:[],deferCall:function(targetFunction,precedence
,argsList){function arraysHaveEqualContent(arrA,arrB){if(arrA.length!=arrB.length)return false;for(var i in
arrA){if(arrA[i]!=arrB[i])return false}return true}for(var i in JSEvents.deferredCalls){var
call=JSEvents.deferredCalls[i];if(call.targetFunction==targetFunction&&arraysHaveEqualContent(call.argsList,args
List)){return}}JSEvents.deferredCalls.push({targetFunction:targetFunction,precedence:precedence,argsList:argsList
});JSEvents.deferredCalls.sort(function(x,y){return
x.precedence<y.precedence}),removeDeferredCalls:function(targetFunction){for(var
i=0;i<JSEvents.deferredCalls.length;++i){if(JSEvents.deferredCalls[i].targetFunction==targetFunction){JSEvents.d
eferredCalls.splice(i,1);--i}},canPerformEventHandlerRequests:function(){return
JSEvents.inEventHandler&&JSEvents.currentEventHandler.allowsDeferredCalls},runDeferredCalls:function(){if(!J
SEvents.canPerformEventHandlerRequests()){return}for(var i=0;i<JSEvents.deferredCalls.length;++i){var
call=JSEvents.deferredCalls[i];JSEvents.deferredCalls.splice(i,1);--
i;call.targetFunction.apply(null,call.argsList)},eventHandlers:[],removeAllHandlersOnTarget:function(target,event
TypeString){for(var
i=0;i<JSEvents.eventHandlers.length;++i){if(JSEvents.eventHandlers[i].target==target&&(!eventTypeString||event
TypeString==JSEvents.eventHandlers[i].eventTypeString)){JSEvents._removeHandler(i--
)}}},_removeHandler:function(i){var
h=JSEvents.eventHandlers[i];h.target.removeEventListener(h.eventTypeString,h.eventListenerFunc,h.useCapture);J
SEvents.eventHandlers.splice(i,1)},registerOrRemoveHandler:function(eventHandler){var
jsEventHandler=function
jsEventHandler(event){++JSEvents.inEventHandler;JSEvents.currentEventHandler=eventHandler;JSEvents.runDef
erredCalls();eventHandler.handlerFunc(event);JSEvents.runDeferredCalls();--
JSEvents.inEventHandler};if(eventHandler.callbackfunc){eventHandler.eventListenerFunc=jsEventHandler;eventH
andler.target.addEventListener(eventHandler.eventTypeString,jsEventHandler,eventHandler.useCapture);JSEvents.e

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ventHandlers.push(eventHandler);JSEvents.registerRemoveEventListeners()}else{for(var
i=0;i<JSEvents.eventHandlers.length;++i){if(JSEvents.eventHandlers[i].target==eventHandler.target&&JSEvents.e
ventHandlers[i].eventTypeString==eventHandler.eventTypeString){JSEvents._removeHandler(i--
)}}},queueEventHandlerOnThread_iiii:function(targetThread,eventHandlerFunc,eventTypeId,eventData,userData)
{var stackTop=stackSave();var
varargs=stackAlloc(12);GROWABLE_HEAP_I32()[varargs>>2]=eventTypeId;GROWABLE_HEAP_I32()[varargs
+4>>2]=eventData;GROWABLE_HEAP_I32()[varargs+8>>2]=userData;__emscripten_call_on_thread(0,targetThr
ead,637534208,eventHandlerFunc,eventData,varargs);stackRestore(stackTop)},getTargetThreadForEventCallback:f
unction(targetThread){switch(targetThread){case
1:return 0;case 2:return PThread.currentProxiedOperationCallerThread;default:return
targetThread}},getNodeNameForTarget:function(target){if(!target)return\"\";if(target==window)return\"#window\";
if(target==screen)return\"#screen\";return
target&&target.nodeName?target.nodeName:\"\"},fullscreenEnabled:function(){return
document.fullscreenEnabled||document.webkitFullscreenEnabled}};function stringToNewUTF8(jsString){var
length=lengthBytesUTF8(jsString)+1;var cString=_malloc(length);stringToUTF8(jsString,cString,length);return
cString}function
_emsripten_set_offscreencanvas_size_on_target_thread_js(targetThread,targetCanvas,width,height){var
stackTop=stackSave();var varargs=stackAlloc(12);var
targetCanvasPtr=0;if(targetCanvas){targetCanvasPtr=stringToNewUTF8(targetCanvas)}GROWABLE_HEAP_I32(
)[varargs>>2]=targetCanvasPtr;GROWABLE_HEAP_I32()[varargs+4>>2]=width;GROWABLE_HEAP_I32()[var
args+8>>2]=height;__emscripten_call_on_thread(0,targetThread,657457152,0,targetCanvasPtr,varargs);stackRestor
e(stackTop)}function
_emsripten_set_offscreencanvas_size_on_target_thread(targetThread,targetCanvas,width,height){targetCanvas=tar
getCanvas?UTF8ToString(targetCanvas):\"\";_emsripten_set_offscreencanvas_size_on_target_thread_js(targetThr
ead,targetCanvas,width,height)}function maybeCStringToJsString(cString){return
cString>2?UTF8ToString(cString):cString}var specialHTMLTargets=[0,typeof
document!=\"undefined\"?document:0,typeof window!=\"undefined\"?window:0];function
findEventTarget(target){target=maybeCStringToJsString(target);var
domElement=specialHTMLTargets[target]||(typeof
document!=\"undefined\"?document.querySelector(target):undefined);return domElement}function
findCanvasEventTarget(target){return findEventTarget(target)}function
_emsripten_set_canvas_element_size_calling_thread(target,width,height){var
canvas=findCanvasEventTarget(target);if(!canvas)return-
4;if(canvas.canvasSharedPtr){GROWABLE_HEAP_I32()[canvas.canvasSharedPtr>>2]=width;GROWABLE_HEA
P_I32()[canvas.canvasSharedPtr+4>>2]=height;if(canvas.offscreenCanvas||!canvas.controlTransferredOffscreen){if
(canvas.offscreenCanvas)canvas=canvas.offscreenCanvas;var
autoResizeViewport=false;if(canvas.GLctxObject&&canvas.GLctxObject.GLctx){var
prevViewport=canvas.GLctxObject.GLctx.getParameter(2978);autoResizeViewport=prevViewport[0]==0&&prev
Viewport[1]==0&&prevViewport[2]==canvas.width&&prevViewport[3]==canvas.height}canvas.width=width;
canvas.height=height;if(autoResizeViewport){canvas.GLctxObject.GLctx.viewport(0,0,width,height)}}else
if(canvas.canvasSharedPtr){var
targetThread=GROWABLE_HEAP_I32()[canvas.canvasSharedPtr+8>>2];_emsripten_set_offscreencanvas_size_o
n_target_thread(targetThread,target,width,height);return 1}else{return-4}return 0}function
_emsripten_set_canvas_element_size_main_thread(target,width,height){if(ENVIRONMENT_IS_PTHREAD)retur
n
_emsripten_proxy_to_main_thread_js(2,1,target,width,height);return
_emsripten_set_canvas_element_size_calling_thread(target,width,height)}function
_emsripten_set_canvas_element_size(target,width,height){var

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canvas=findCanvasEventTarget(target);if(canvas){return
_emsripten_set_canvas_element_size_calling_thread(target,width,height)}else{return
_emsripten_set_canvas_element_size_main_thread(target,width,height)}}function
_emsripten_set_current_thread_status(newStatus){}function
_emsripten_set_thread_name(threadId,name){}function __webgl_enable_ANGLE_instanced_arrays(ctx){var
ext=ctx.getExtension("ANGLE_instanced_arrays");if(ext){ctx["vertexAttribDivisor"]=function(index,divisor){ex
t["vertexAttribDivisorANGLE"](index,divisor)};ctx["drawArraysInstanced"]=function(mode,first,count,primcou
nt){ext["drawArraysInstancedANGLE"](mode,first,count,primcount)};ctx["drawElementsInstanced"]=function(
mode,count,type,indices,primcount){ext["drawElementsInstancedANGLE"](mode,count,type,indices,primcount)};
return
1}}function __webgl_enable_OES_vertex_array_object(ctx){var
ext=ctx.getExtension("OES_vertex_array_object");if(ext){ctx["createVertexArray"]=function(){return
ext["createVertexArrayOES"]();};ctx["deleteVertexArray"]=function(vao){ext["deleteVertexArrayOES"](vao)};
ctx["bindVertexArray"]=function(vao){ext["bindVertexArrayOES"](vao)};ctx["isVertexArray"]=function(vao)
{return ext["isVertexArrayOES"](vao)};return 1}}function __webgl_enable_WEBGL_draw_buffers(ctx){var
ext=ctx.getExtension("WEBGL_draw_buffers");if(ext){ctx["drawBuffers"]=function(n,bufs){ext["drawBuffers
WEBGL"](n,bufs)};return 1}}function
__webgl_enable_WEBGL_multi_draw(ctx){return!(ctx.multiDrawWebgl=ctx.getExtension("WEBGL_multi_dra
w"))}var
GL={counter:1,buffers:[],programs:[],framebuffers:[],renderbuffers:[],textures:[],uniforms:[],shaders:[],vaos:[],cont
exts:{},offscreenCanvases:{},timerQueriesEXT:[],programInfos:{},stringCache:{},unpackAlignment:4,recordError:
function
recordError(errorCode){if(!GL.lastError){GL.lastError=errorCode}},getNewId:function(table){var
ret=GL.counter++;for(var i=table.length;i<ret;i++){table[i]=null}return
ret},getSource:function(shader,count,string,length){var source="";for(var i=0;i<count;++i){var
len=length?GROWABLE_HEAP_I32()[length+i*4>>2]:-
1;source+=UTF8ToString(GROWABLE_HEAP_I32()[string+i*4>>2],len<0?undefined:len)}return
source},createContext:function(canvas,webGLContextAttributes){var
ctx=canvas.getContext("webgl",webGLContextAttributes);if(!ctx)return 0;var
handle=GL.registerContext(ctx,webGLContextAttributes);return
handle},registerContext:function(ctx,webGLContextAttributes){var
handle=_malloc(8);GROWABLE_HEAP_I32()[handle+4>>2]=_pthread_self();var
context={handle:handle,attributes:webGLContextAttributes,version:webGLContextAttributes.majorVersion,GLctx:
ctx};if(ctx.canvas)ctx.canvas.GLctxObject=context;GL.contexts[handle]=context;if(typeof
webGLContextAttributes.enableExtensionsByDefault==="undefined"||webGLContextAttributes.enableExtensions
ByDefault){GL.initExtensions(context)}return
handle},makeContextCurrent:function(contextHandle){GL.currentContext=GL.contexts[contextHandle];Module.ctx
=GLctx=GL.currentContext&&GL.currentContext.GLctx;return!(contextHandle&&!GLctx)},getContext:function(c
ontextHandle){return
GL.contexts[contextHandle]},deleteContext:function(contextHandle){if(GL.currentContext===GL.contexts[context
Handle])GL.currentContext=null;if(typeof
JSEvents==="object")JSEvents.removeAllHandlersOnTarget(GL.contexts[contextHandle].GLctx.canvas);if(GL.co
ntexts[contextHandle]&&GL.contexts[contextHandle].GLctx.canvas)GL.contexts[contextHandle].GLctx.canvas.GL
ctxObject=undefined;_free(GL.contexts[contextHandle].handle);GL.contexts[contextHandle]=null},initExtensions:f
unction(context){if(!context)context=GL.currentContext;if(context.initExtensionsDone)return;context.initExtension
sDone=true;var
GLctx=context.GLctx;__webgl_enable_ANGLE_instanced_arrays(GLctx);__webgl_enable_OES_vertex_array_obj
ect(GLctx);__webgl_enable_WEBGL_draw_buffers(GLctx);GLctx.disjointTimerQueryExt=GLctx.getExtension("

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EXT_disjoint_timer_query\");__webgl_enable_WEBGL_multi_draw(GLctx);var
exts=GLctx.getSupportedExtensions()||[];exts.forEach(function(ext){if(ext.indexOf("\lose_context")<0&&ext.inde
xOf("\debug")<0){GLctx.getExtension(ext)}}),populateUniformTable:function(program){var
p=GL.programs[program];var
ptable=GL.programInfos[program]={uniforms:{},maxUniformLength:0,maxAttributeLength:-
1,maxUniformBlockNameLength:-1};var utable=ptable.uniforms;var
numUniforms=GLctx.getProgramParameter(p,35718);for(var i=0;i<numUniforms;++i){var
u=GLctx.getActiveUniform(p,i);var
name=u.name;ptable.maxUniformLength=Math.max(ptable.maxUniformLength,name.length+1);if(name.slice(-
1)!="\"){name=name.slice(0,name.lastIndexOf("\("))}var loc=GLctx.getUniformLocation(p,name);if(loc){var
id=GL.getNewId(GL.uniforms);utable[name]=[u.size,id];GL.uniforms[id]=loc;for(var
j=1;j<u.size;++j){var
n=name+"\["+j+"\]";loc=GLctx.getUniformLocation(p,n);id=GL.getNewId(GL.uniforms);GL.uniforms[id]=loc}}
};var __emscripten_webgl_power_preferences=["default","\low-power","\high-performance"];function
_emscripten_webgl_do_create_context(target,attributes){var a=attributes>>2;var
powerPreference=GROWABLE_HEAP_I32()[a+(24>>2)];var
contextAttributes={"alpha":!!GROWABLE_HEAP_I32()[a+(0>>2)],"depth":!!GROWABLE_HEAP_I32()[a+(4
>>2)],"stencil":!!GROWABLE_HEAP_I32()[a+(8>>2)],"antialias":!!GROWABLE_HEAP_I32()[a+(12>>2)],"p
remultipliedAlpha":!!GROWABLE_HEAP_I32()[a+(16>>2)],"preserveDrawingBuffer":!!GROWABLE_HEAP_
I32()[a+(20>>2)],"powerPreference":__emscripten_webgl_power_preferences[powerPreference],"\failIfMajorPerf
ormanceCaveat":!!GROWABLE_HEAP_I32()[a+(28>>2)],majorVersion:GROWABLE_HEAP_I32()[a+(32>>2)],
minorVersion:GROWABLE_HEAP_I32()[a+(36>>2)],enableExtensionsByDefault:GROWABLE_HEAP_I32()[a+(
40>>2)],explicitSwapControl:GROWABLE_HEAP_I32()[a+(44>>2)],proxyContextToMainThread:GROWABLE_
HEAP_I32()[a+(48>>2)],renderViaOffscreenBackBuffer:GROWABLE_HEAP_I32()[a+(52>>2)]};var
canvas=findCanvasEventTarget(target);if(!canvas){return 0}if(contextAttributes.explicitSwapControl){return
0}var contextHandle=GL.createContext(canvas,contextAttributes);return contextHandle}function
_emscripten_webgl_create_context(a0,a1){return _emscripten_webgl_do_create_context(a0,a1)}var
SYSCALLS={mappings:{},buffers:[null,[],[]],printChar:function(stream,curr){var
buffer=SYSCALLS.buffers[stream];if(curr===0||curr===10){(stream===1?out:err)(UTF8ArrayToString(buffer,0));
buffer.length=0}else{buffer.push(curr)}},varargs:undefined,get:function(){SYSCALLS.varargs+=4;var
ret=GROWABLE_HEAP_I32()[SYSCALLS.varargs-4>>2];return ret},getStr:function(ptr){var
ret=UTF8ToString(ptr);return ret},get64:function(low,high){return low}};function
_fd_close(fd){if(ENVIRONMENT_IS_PTHREAD)return _emscripten_proxy_to_main_thread_js(3,1,fd);return
0}function _fd_seek(fd,offset_low,offset_high,whence,newOffset){if(ENVIRONMENT_IS_PTHREAD)return
_emscripten_proxy_to_main_thread_js(4,1,fd,offset_low,offset_high,whence,newOffset)}function
_fd_write(fd,iow,iocnt,pnum){if(ENVIRONMENT_IS_PTHREAD)return
_emscripten_proxy_to_main_thread_js(5,1,fd,iow,iocnt,pnum);var num=0;for(var i=0;i<iocnt;i++){var
ptr=GROWABLE_HEAP_I32()[iow+i*8>>2];var len=GROWABLE_HEAP_I32()[iow+(i*8+4)>>2];for(var
j=0;j<len;j++){SYSCALLS.printChar(fd,GROWABLE_HEAP_U8)[ptr+j]}num+=len}GROWABLE_HEAP_I32
()[pnum>>2]=num;return 0}function _pthread_cleanup_pop(execute){var
routine=PThread.threadExitHandlers.pop();if(execute)routine()}function
_pthread_cleanup_push(routine,arg){PThread.threadExitHandlers.push(function(){wasnTable.get(routine)(arg)})}f
unction spawnThread(threadParams){if(ENVIRONMENT_IS_PTHREAD)throw"\Internal Error! spawnThread()
can only ever be called from main application thread!";var
worker=PThread.getNewWorker();if(worker.pthread!==undefined)throw"\Internal
error!";if(!threadParams.pthread_ptr)throw"\Internal
error, no pthread ptr!";PThread.runningWorkers.push(worker);var tlsMemory=_malloc(128*4);for(var
i=0;i<128;++i){GROWABLE_HEAP_I32()[tlsMemory+i*4>>2]=0}var

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stackHigh=threadParams.stackBase+threadParams.stackSize;var
pthread=PThread.pthreads[threadParams.pthread_ptr]={ worker:worker,stackBase:threadParams.stackBase,stackSize
:threadParams.stackSize,allocatedOwnStack:threadParams.allocatedOwnStack,threadInfoStruct:threadParams.pthread
d_ptr};var
tis=pthread.threadInfoStruct>>2;Atomics.store(GROWABLE_HEAP_U32(),tis+(64>>2),threadParams.detached);A
tomics.store(GROWABLE_HEAP_U32(),tis+(100>>2),tlsMemory);Atomics.store(GROWABLE_HEAP_U32(),tis
+(40>>2),pthread.threadInfoStruct);Atomics.store(GROWABLE_HEAP_U32(),tis+(80>>2),threadParams.stackSiz
e);Atomics.store(GROWABLE_HEAP_U32(),tis+(76>>2),stackHigh);Atomics.store(GROWABLE_HEAP_U32(),t
is+(104>>2),threadParams.stackSize);Atomics.store(GROWABLE_HEAP_U32(),tis+(104+8>>2),stackHigh);Atom
ics.store(GROWABLE_HEAP_U32(),tis+(104+12>>2),threadParams.detached);var
global_libc=_emscripten_get_global_libc();var
global_locale=global_libc+40;Atomics.store(GROWABLE_HEAP_U32(),tis+(172>>2),global_locale);worker.pthr
ead=pthread;var
msg={"cmd\\":\\"run\\",\\"start_routine\\":threadParams.startRoutine,\\"arg\\":threadParams.arg,\\"threadInfoStruct\\":thre
adParams.pthread_ptr,\\"stackBase\\":threadParams.stackBase,\\"stackSize\\":threadParams.stackSize};worker.runPthre
ad=function(){msg.time=performance.now();worker.postMessage(msg,threadParams.transferList)};if(worker.loaded
){worker.runPthread();delete worker.runPthread}}function
_pthread_create(pthread_ptr,attr,start_routine,arg){if(typeof SharedArrayBuffer===\\"undefined\\"){err(\\"Current
environment does not support SharedArrayBuffer, pthreads are not available!\\");return
6}if(!pthread_ptr){err(\\"pthread_create called with a null thread pointer!\\");return 28}var transferList=[];var
error=0;if(ENVIRONMENT_IS_PTHREAD&&(transferList.length===0||error)){return
_emscripten_sync_run_in_main_thread_4(687865856,pthread_ptr,attr,start_routine,arg)}if(error)return
error;var stackSize=0;var stackBase=0;var detached=0;if(attr&&attr!=
1){stackSize=GROWABLE_HEAP_I32()[attr>>2];stackSize+=81920;stackBase=GROWABLE_HEAP_I32()[attr+
8>>2];detached=GROWABLE_HEAP_I32()[attr+12>>2]!==0}else{stackSize=2097152}var
allocatedOwnStack=stackBase===0;if(allocatedOwnStack){stackBase=_memalign(16,stackSize)}else{stackBase=
stackSize;assert(stackBase>0)}var threadInfoStruct=_malloc(228);for(var
i=0;i<228>>2;+=i)GROWABLE_HEAP_U32()[threadInfoStruct>>2+i]=0;GROWABLE_HEAP_I32()[pthread_p
tr>>2]=threadInfoStruct;GROWABLE_HEAP_I32()[threadInfoStruct+12>>2]=threadInfoStruct;var
headPtr=threadInfoStruct+152;GROWABLE_HEAP_I32()[headPtr>>2]=headPtr;var
threadParams={stackBase:stackBase,stackSize:stackSize,allocatedOwnStack:allocatedOwnStack,detached:detached
,startRoutine:start_routine,pthread_ptr:threadInfoStruct,arg:arg,transferList:transferList};if(ENVIRONMENT_IS_P
THREAD){threadParams.cmd=\\"spawnThread\\";postMessage(threadParams,transferList)}else{spawnThread(thread
Params)}return
0}function __pthread_testcancel_js(){if(!ENVIRONMENT_IS_PTHREAD)return;var
tb=__pthread_self();if(!tb)return;var
cancelDisabled=Atomics.load(GROWABLE_HEAP_U32(),tb+56>>2);if(cancelDisabled)return;var
canceled=Atomics.load(GROWABLE_HEAP_U32(),tb+0>>2);if(canceled===2)throw\\"Canceled!\\"}function
_emscripten_check_blocking_allowed(){if(ENVIRONMENT_IS_NODE)return;if(ENVIRONMENT_IS_WORKE
R)return;warnOnce(\\"Blocking on the main thread is very dangerous, see
https://emscripten.org/docs/porting/pthreads.html#blocking-on-the-main-browser-thread\\");}function
__emscripten_do_pthread_join(thread,status,block){if(!thread){err(\\"pthread_join attempted on a null thread
pointer!\\");return
ERRNO_CODES.ESRCH}if(ENVIRONMENT_IS_PTHREAD&&__pthread_self()===thread){err(\\"PThread
\\"+thread+\\" is attempting to join to itself!\\");return ERRNO_CODES.EDEADLK}else
if(!ENVIRONMENT_IS_PTHREAD&&__emscripten_main_browser_thread_id()===thread){err(\\"Main
thread \\"+thread+\\" is attempting to join to itself!\\");return ERRNO_CODES.EDEADLK}var
self=GROWABLE_HEAP_I32()[thread+12>>2];if(self!==thread){err(\\"pthread_join attempted on thread

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\"+thread+\", which does not point to a valid thread, or does not exist anymore!\");return
ERRNO_CODES.ESRCH}var
detached=Atomics.load(GROWABLE_HEAP_U32(),thread+64>>2);if(detached){err(\"Attempted to join thread
\"+thread+\", which was already detached!\");return
ERRNO_CODES.EINVAL}if(block){_emscripten_check_blocking_allowed()}for(;;){var
threadStatus=Atomics.load(GROWABLE_HEAP_U32(),thread+0>>2);if(threadStatus==1){var
threadExitCode=Atomics.load(GROWABLE_HEAP_U32(),thread+4>>2);if(status)GROWABLE_HEAP_I32()[sta
tus>>2]=threadExitCode;Atomics.store(GROWABLE_HEAP_U32(),thread+64>>2,1);if(!ENVIRONMENT_IS_PT
HREAD)cleanupThread(thread);else postMessage({\"cmd\": \"cleanupThread\", \"thread\": thread});return
0}if(!block){return
ERRNO_CODES.EBUSY}__pthread_testcancel_js();if(!ENVIRONMENT_IS_PTHREAD)_emscripten_main_thre
ad_process_queued_calls();_emscripten_futex_wait(thread+0,threadStatus,ENVIRONMENT_IS_PTHREAD?100:1
)}}function
_pthread_join(thread,status){return __emscripten_do_pthread_join(thread,status,true)}function
_sysconf(name){if(ENVIRONMENT_IS_PTHREAD)return
_emscripten_proxy_to_main_thread_js(6,1,name);switch(name){case 30:return 16384;case 85:var
maxHeapSize=2147483648;return maxHeapSize/16384;case 132:case 133:case 12:case 137:case 138:case 15:case
235:case 16:case 17:case 18:case 19:case 20:case 149:case 13:case 10:case 236:case 153:case 9:case 21:case 22:case
159:case 154:case 14:case 77:case 78:case 139:case 82:case 68:case 67:case 164:case 11:case 29:case 47:case
48:case 95:case 52:case 51:case 46:return 200809;case 27:case 246:case 127:case 128:case 23:case 24:case 160:case
161:case 181:case 182:case 242:case 183:case 184:case 243:case 244:case 245:case 165:case 178:case 179:case
49:case 50:case 168:case 169:case 175:case 170:case 171:case 172:case
97:case 76:case 32:case 173:case 35:case 80:case 81:case 79:return -1;case 176:case 177:case 7:case 155:case 8:case
157:case 125:case 126:case 92:case 93:case 129:case 130:case 131:case 94:case 91:return 1;case 74:case 60:case
69:case 70:case 4:return 1024;case 31:case 42:case 72:return 32;case 87:case 26:case 33:return 2147483647;case
34:case 1:return 47839;case 38:case 36:return 99;case 43:case 37:return 2048;case 0:return 2097152;case 3:return
65536;case 28:return 32768;case 44:return 32767;case 75:return 16384;case 39:return 1e3;case 89:return 700;case
71:return 256;case 40:return 255;case 2:return 100;case 180:return 64;case 25:return 20;case 5:return 16;case
6:return 6;case 73:return 4;case 84:{if(typeof navigator===\"object\")return
navigator[\"hardwareConcurrency\"]||1;return 1}}setErrNo(28);return-
1}if(!ENVIRONMENT_IS_PTHREAD)PThread.initMainThreadBlock();var GLctx;var
proxiedFunctionTable=[null,_atexit,_emscripten_set_canvas_element_size_main_thread,_fd_close,_fd_seek,_fd_wr
ite,_sysconf];var
asmLibraryArg={\"e\":__assert_fail,\"r\":__call_main,\"x\":__emscripten_notify_thread_queue,\"b\":_abort,\"y\":
_emscripten_asm_const_int,\"j\":_emscripten_conditional_set_current_thread_status,\"d\":_emscripten_futex_wait,\"
c\":_emscripten_futex_wake,\"f\":_emscripten_get_now,\"p\":_emscripten_memcpy_big,\"A\":_emscripten_num_l
ogical_cores,\"u\":_emscripten_receive_on_main_thread_js,\"q\":_emscripten_resize_heap,\"v\":_emscripten_set_ca
nvas_element_size,\"i\":_emscripten_set_current_thread_status,\"s\":_emscripten_set_thread_name,\"w\":_emscript
en_webgl_create_context,\"l\":_fd_close,\"n\":_fd_seek,\"g\":_fd_write,\"o\":initPthreadsJS,\"a\":wasmMemory||Mo
dule[\"wasmMemory\"],\"z\":_pthread_cleanup_pop,\"k\":_pthread_cleanup_push,\"h\":_pthread_create,\"m\":_pthr
ead_join,\"t\":_sysconf};var asm=createWasm();var
__wasm_call_ctors=Module[\"__wasm_call_ctors\"]=function(){return(__wasm_call_ctors=Module[\"__wasm
_call_ctors\"]=Module[\"asm\"][\"B\"]).apply(null,arguments)};var
_init=Module[\"_init\"]=function(){return(_init=Module[\"_init\"]=Module[\"asm\"][\"C\"]).apply(null,arguments)};
var
_init_with_threads_count=Module[\"_init_with_threads_count\"]=function(){return(_init_with_threads_count=Mod
ule[\"_init_with_threads_count\"]=Module[\"asm\"][\"D\"]).apply(null,arguments)};var
_get_threads_count=Module[\"_get_threads_count\"]=function(){return(_get_threads_count=Module[\"_get_threads

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_count"]="Module["asm\"][\"E\").apply(null,arguments)};var
_register_tensor=Module["_register_tensor"]=function(){return(_register_tensor=Module["_register_tensor"]="Module["asm\"][\"F\").apply(null,arguments)};var
_dispose_data=Module["_dispose_data"]=function(){return(_dispose_data=Module["_dispose_data"]="Module["asm\"][\"G\").apply(null,arguments)};var
_dispose=Module["_dispose"]=function(){return(_dispose=Module["_dispose"]="Module["asm\"][\"H\").apply(null,arguments)};var
_Abs=Module["_Abs"]=function(){return(_Abs=Module["_Abs"]="Module["asm\"][\"J\").apply(null,arguments)};var
_Add=Module["_Add"]=function(){return(_Add=Module["_Add"]="Module["asm\"][\"K\").apply(null,arguments)};var
_AddN=Module["_AddN"]=function(){return(_AddN=Module["_AddN"]="Module["asm\"][\"L\").apply(null,arguments)};var
_All=Module["_All"]=function(){return(_All=Module["_All"]="Module["asm\"][\"M\").apply(null,arguments)};var
_Any=Module["_Any"]=function(){return(_Any=Module["_Any"]="Module["asm\"][\"N\").apply(null,arguments)};var
_ArgMax=Module["_ArgMax"]=function(){return(_ArgMax=Module["_ArgMax"]="Module["asm\"][\"O\").apply(null,arguments)};var
_AvgPool=Module["_AvgPool"]=function(){return(_AvgPool=Module["_AvgPool"]="Module["asm\"][\"P\").apply(null,arguments)};var
_BatchMatMul=Module["_BatchMatMul"]=function(){return(_BatchMatMul=Module["_BatchMatMul"]="Module["asm\"][\"Q\").apply(null,arguments)};var
_Ceil=Module["_Ceil"]=function(){return(_Ceil=Module["_Ceil"]="Module["asm\"][\"R\").apply(null,arguments)};var
_ClipByValue=Module["_ClipByValue"]=function(){return(_ClipByValue=Module["_ClipByValue"]="Module["asm\"][\"S\").apply(null,arguments)};var
_Conv2D=Module["_Conv2D"]=function(){return(_Conv2D=Module["_Conv2D"]="Module["asm\"][\"T\").apply(null,arguments)};var
_Conv2DBackpropInput=Module["_Conv2DBackpropInput"]=function(){return(_Conv2DBackpropInput=Module["_Conv2DBackpropInput"]="Module["asm\"][\"U\").apply(null,arguments)};var
_Cos=Module["_Cos"]=function(){return(_Cos=Module["_Cos"]="Module["asm\"][\"V\").apply(null,arguments)};var
_Cosh=Module["_Cosh"]=function(){return(_Cosh=Module["_Cosh"]="Module["asm\"][\"W\").apply(null,arguments)};var
_CropAndResize=Module["_CropAndResize"]=function(){return(_CropAndResize=Module["_CropAndResize"]="Module["asm\"][\"X\").apply(null,arguments)};var
_Cumsum=Module["_Cumsum"]=function(){return(_Cumsum=Module["_Cumsum"]="Module["asm\"][\"Y\").apply(null,arguments)};var
_DepthToSpace=Module["_DepthToSpace"]=function(){return(_DepthToSpace=Module["_DepthToSpace"]="Module["asm\"][\"Z\").apply(null,arguments)};var
_DepthwiseConv2dNative=Module["_DepthwiseConv2dNative"]=function(){return(_DepthwiseConv2dNative=Module["_DepthwiseConv2dNative"]="Module["asm\"][\"_\").apply(null,arguments)};var
_Elu=Module["_Elu"]=function(){return(_Elu=Module["_Elu"]="Module["asm\"][\"$\").apply(null,arguments)};var
_Equal=Module["_Equal"]=function(){return(_Equal=Module["_Equal"]="Module["asm\"][\"aa\").apply(null,arguments)};var
_Exp=Module["_Exp"]=function(){return(_Exp=Module["_Exp"]="Module["asm\"][\"ba\").apply(null,arguments)};

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s));var
_FlipLeftRight=Module["_FlipLeftRight"]=function(){return(_FlipLeftRight=Module["_FlipLeftRight"]=Module["asm"][_"ca"]).apply(null,arguments));var
_Floor=Module["_Floor"]=function(){return(_Floor=Module["_Floor"]=Module["asm"][_"da"]).apply(null,arguments));var
_FloorDiv=Module["_FloorDiv"]=function(){return(_FloorDiv=Module["_FloorDiv"]=Module["asm"][_"ea"]).apply(null,arguments));var
_FusedBatchNorm=Module["_FusedBatchNorm"]=function(){return(_FusedBatchNorm=Module["_FusedBatchNorm"]=Module["asm"][_"fa"]).apply(null,arguments));var
_FusedConv2D=Module["_FusedConv2D"]=function(){return(_FusedConv2D=Module["_FusedConv2D"]=Module["asm"][_"ga"]).apply(null,arguments));var
_FusedDepthwiseConv2D=Module["_FusedDepthwiseConv2D"]=function(){return(_FusedDepthwiseConv2D=Module["_FusedDepthwiseConv2D"]=Module["asm"][_"ha"]).apply(null,arguments));var
_Gather=Module["_Gather"]=function(){return(_Gather=Module["_Gather"]=Module["asm"][_"ia"]).apply(null,arguments));var
_GatherNd=Module["_GatherNd"]=function(){return(_GatherNd=Module["_GatherNd"]=Module["asm"][_"ja"]).apply(null,arguments));var
_Greater=Module["_Greater"]=function(){return(_Greater=Module["_Greater"]=Module["asm"][_"ka"]).apply(null,arguments));var
_GreaterEqual=Module["_GreaterEqual"]=function(){return(_GreaterEqual=Module["_GreaterEqual"]=Module["asm"][_"la"]).apply(null,arguments));var
_LeakyRelu=Module["_LeakyRelu"]=function(){return(_LeakyRelu=Module["_LeakyRelu"]=Module["asm"][_"ma"]).apply(null,arguments));var
_Less=Module["_Less"]=function(){return(_Less=Module["_Less"]=Module["asm"][_"na"]).apply(null,arguments));var
_LessEqual=Module["_LessEqual"]=function(){return(_LessEqual=Module["_LessEqual"]=Module["asm"][_"oa"]).apply(null,arguments));var
_Log=Module["_Log"]=function(){return(_Log=Module["_Log"]=Module["asm"][_"pa"]).apply(null,arguments));var
_LogicalAnd=Module["_LogicalAnd"]=function(){return(_LogicalAnd=Module["_LogicalAnd"]=Module["asm"][_"qa"]).apply(null,arguments));var
_Max=Module["_Max"]=function(){return(_Max=Module["_Max"]=Module["asm"][_"ra"]).apply(null,arguments));var
_MaxPool=Module["_MaxPool"]=function(){return(_MaxPool=Module["_MaxPool"]=Module["asm"][_"sa"]).apply(null,arguments));var
_Maximum=Module["_Maximum"]=function(){return(_Maximum=Module["_Maximum"]=Module["asm"][_"ta"]).apply(null,arguments));var
_Mean=Module["_Mean"]=function(){return(_Mean=Module["_Mean"]=Module["asm"][_"ua"]).apply(null,arguments));var
_Min=Module["_Min"]=function(){return(_Min=Module["_Min"]=Module["asm"][_"va"]).apply(null,arguments));var
_Minimum=Module["_Minimum"]=function(){return(_Minimum=Module["_Minimum"]=Module["asm"][_"wa"]).apply(null,arguments));var
_MirrorPad=Module["_MirrorPad"]=function(){return(_MirrorPad=Module["_MirrorPad"]=Module["asm"][_"xa"]).apply(null,arguments));var
_Multiply=Module["_Multiply"]=function(){return(_Multiply=Module["_Multiply"]=Module["asm"][_"ya"]).apply(null,arguments));var
_Neg=Module["_Neg"]=function(){return(_Neg=Module["_Neg"]=Module["asm"][_"za"]).apply(null,arguments));var

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ts));var
_NonMaxSuppressionV3=Module["_NonMaxSuppressionV3"]=function(){return(_NonMaxSuppressionV3=Module["_NonMaxSuppressionV3"]=Module["asm"][_"Aa"]).apply(null,arguments));var
_NonMaxSuppressionV4=Module["_NonMaxSuppressionV4"]=function(){return(_NonMaxSuppressionV4=Module["_NonMaxSuppressionV4"]=Module["asm"][_"Ba"]).apply(null,arguments));var
_NonMaxSuppressionV5=Module["_NonMaxSuppressionV5"]=function(){return(_NonMaxSuppressionV5=Module["_NonMaxSuppressionV5"]=Module["asm"][_"Ca"]).apply(null,arguments));var
_NotEqual=Module["_NotEqual"]=function(){return(_NotEqual=Module["_NotEqual"]=Module["asm"][_"Da"]).apply(null,arguments));var
_OneHot=Module["_OneHot"]=function(){return(_OneHot=Module["_OneHot"]=Module["asm"][_"Ea"]).apply(null,arguments));var
_PadV2=Module["_PadV2"]=function(){return(_PadV2=Module["_PadV2"]=Module["asm"][_"Fa"]).apply(null,arguments));var
_Pow=Module["_Pow"]=function(){return(_Pow=Module["_Pow"]=Module["asm"][_"Ga"]).apply(null,arguments));var
_Prelu=Module["_Prelu"]=function(){return(_Prelu=Module["_Prelu"]=Module["asm"][_"Ha"]).apply(null,arguments));var
_Prod=Module["_Prod"]=function(){return(_Prod=Module["_Prod"]=Module["asm"][_"Ia"]).apply(null,arguments));var
_RealDiv=Module["_RealDiv"]=function(){return(_RealDiv=Module["_RealDiv"]=Module["asm"][_"Ja"]).apply(null,arguments));var
_Relu=Module["_Relu"]=function(){return(_Relu=Module["_Relu"]=Module["asm"][_"Ka"]).apply(null,arguments));var
_Relu6=Module["_Relu6"]=function(){return(_Relu6=Module["_Relu6"]=Module["asm"][_"La"]).apply(null,arguments));var
_ResizeBilinear=Module["_ResizeBilinear"]=function(){return(_ResizeBilinear=Module["_ResizeBilinear"]=Module["asm"][_"Ma"]).apply(null,arguments));var
_Reverse=Module["_Reverse"]=function(){return(_Reverse=Module["_Reverse"]=Module["asm"][_"Na"]).apply(null,arguments));var
_RotateWithOffset=Module["_RotateWithOffset"]=function(){return(_RotateWithOffset=Module["_RotateWithOffset"]=Module["asm"][_"Oa"]).apply(null,arguments));var
_Round=Module["_Round"]=function(){return(_Round=Module["_Round"]=Module["asm"][_"Pa"]).apply(null,arguments));var
_Rsqrt=Module["_Rsqrt"]=function(){return(_Rsqrt=Module["_Rsqrt"]=Module["asm"][_"Qa"]).apply(null,arguments));var
_ScatterNd=Module["_ScatterNd"]=function(){return(_ScatterNd=Module["_ScatterNd"]=Module["asm"][_"Ra"]).apply(null,arguments));var
_SelectV2=Module["_SelectV2"]=function(){return(_SelectV2=Module["_SelectV2"]=Module["asm"][_"Sa"]).apply(null,arguments));var
_Sigmoid=Module["_Sigmoid"]=function(){return(_Sigmoid=Module["_Sigmoid"]=Module["asm"][_"Ta"]).apply(null,arguments));var
_Sin=Module["_Sin"]=function(){return(_Sin=Module["_Sin"]=Module["asm"][_"Ua"]).apply(null,arguments));var
_Softmax=Module["_Softmax"]=function(){return(_Softmax=Module["_Softmax"]=Module["asm"][_"Va"]).apply(null,arguments));var
_Sqrt=Module["_Sqrt"]=function(){return(_Sqrt=Module["_Sqrt"]=Module["asm"][_"Wa"]).apply(null,arguments));var
_Square=Module["_Square"]=function(){return(_Square=Module["_Square"]=Module["asm"][_"Xa"]).apply(n

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ull,arguments));var
_SquaredDifference=Module["_SquaredDifference"]=function(){return(_SquaredDifference=Module["_SquaredDifference"]=Module["_asm"])[_Ya]).apply(null,arguments));var
_Step=Module["_Step"]=function(){return(_Step=Module["_Step"]=Module["_asm"])[_Za]).apply(null,arguments));var
_StridedSlice=Module["_StridedSlice"]=function(){return(_StridedSlice=Module["_StridedSlice"]=Module["_asm"])[_a]).apply(null,arguments));var
_Sub=Module["_Sub"]=function(){return(_Sub=Module["_Sub"]=Module["_asm"])[_Sa]).apply(null,arguments));var
_Sum=Module["_Sum"]=function(){return(_Sum=Module["_Sum"]=Module["_asm"])[_ab]).apply(null,arguments));var
_Tan=Module["_Tan"]=function(){return(_Tan=Module["_Tan"]=Module["_asm"])[_bb]).apply(null,arguments));var
_Tanh=Module["_Tanh"]=function(){return(_Tanh=Module["_Tanh"]=Module["_asm"])[_cb]).apply(null,arguments));var
_Tile=Module["_Tile"]=function(){return(_Tile=Module["_Tile"]=Module["_asm"])[_db]).apply(null,arguments));var
_TopK=Module["_TopK"]=function(){return(_TopK=Module["_TopK"]=Module["_asm"])[_eb]).apply(null,arguments));var
_Transform=Module["_Transform"]=function(){return(_Transform=Module["_Transform"]=Module["_asm"])[_fb]).apply(null,arguments));var
_Transpose=Module["_Transpose"]=function(){return(_Transpose=Module["_Transpose"]=Module["_asm"])[_gb]).apply(null,arguments));var
__FusedMatMul=Module["__FusedMatMul"]=function(){return(__FusedMatMul=Module["__FusedMatMul"]=Module["_asm"])[_hb]).apply(null,arguments));var
_malloc=Module["_malloc"]=function(){return(_malloc=Module["_malloc"]=Module["_asm"])[_ib]).apply(null,arguments));var
_free=Module["_free"]=function(){return(_free=Module["_free"]=Module["_asm"])[_jb]).apply(null,arguments));var
__errno_location=Module["__errno_location"]=function(){return(__errno_location=Module["__errno_location"]=Module["_asm"])[_kb]).apply(null,arguments));var
_emscripten_get_global_libc=Module["_emscripten_get_global_libc"]=function(){return(_emscripten_get_global_libc=Module["_emscripten_get_global_libc"]=Module["_asm"])[_lb]).apply(null,arguments));var
_thread_self=Module["_thread_self"]=function(){return(_thread_self=Module["_thread_self"]=Module["_asm"])[_mb]).apply(null,arguments));var
__pthread_tsd_run_dtors=Module["__pthread_tsd_run_dtors"]=function(){return(__pthread_tsd_run_dtors=Module["__pthread_tsd_run_dtors"]=Module["_asm"])[_nb]).apply(null,arguments));var
_emscripten_main_thread_process_queued_calls=Module["_emscripten_main_thread_process_queued_calls"]=function(){return(_emscripten_main_thread_process_queued_calls=Module["_emscripten_main_thread_process_queued_calls"]=Module["_asm"])[_ob]).apply(null,arguments));var
_emscripten_current_thread_process_queued_calls=Module["_emscripten_current_thread_process_queued_calls"]=function(){return(_emscripten_current_thread_process_queued_calls=Module["_emscripten_current_thread_process_queued_calls"]=Module["_asm"])[_pb]).apply(null,arguments));var
_emscripten_register_main_browser_thread_id=Module["_emscripten_register_main_browser_thread_id"]=function(){return(_emscripten_register_main_browser_thread_id=Module["_emscripten_register_main_browser_thread_id"]=Module["_asm"])[_qb]).apply(null,arguments));var
_emscripten_main_browser_thread_id=Module["_emscripten_main_browser_thread_id"]=function(){return(_emscripten_main_browser_thread_id=Module["_emscripten_main_browser_thread_id"]=Module["_asm"])[_rb]).app

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ly(null,arguments));var
__emscripten_do_dispatch_to_thread=Module[\"__emscripten_do_dispatch_to_thread\"]=function(){return(__emsc
ripten_do_dispatch_to_thread=Module[\"__emscripten_do_dispatch_to_thread\"]=Module[\"asm\"][\"sb\"]).apply(n
ull,arguments));var
__emscripten_sync_run_in_main_thread_4=Module[\"_emscripten_sync_run_in_main_thread_4\"]=function(){retur
n(__emscripten_sync_run_in_main_thread_4=Module[\"_emscripten_sync_run_in_main_thread_4\"]=Module[\"asm\
\"][\"tb\"]).apply(null,arguments));var
__emscripten_run_in_main_runtime_thread_js=Module[\"_emscripten_run_in_main_runtime_thread_js\"]=function(
){return(__emscripten_run_in_main_runtime_thread_js=Module[\"_emscripten_run_in_main_runtime_thread_js\"]=
Module[\"asm\"][\"ub\"]).apply(null,arguments));var
__emscripten_call_on_thread=Module[\"__emscripten_call_on_thread\"]=function(){return(__emscripten_call_on_t
hread=Module[\"_emscripten_call_on_thread\"]=Module[\"asm\"][\"vb\"]).apply(null,arguments));var
__emscripten_tls_init=Module[\"_emscripten_tls_init\"]=function(){return(__emscripten_tls_init=Module[\"_emscrip
ten_tls_init\"]=Module[\"asm\"][\"wb\"]).apply(null,arguments));var
__emscripten_thread_init=Module[\"__emscripten_thread_init\"]=function(){return(__emscripten_thread_init=Mod
ule[\"_emscripten_thread_init\"]=Module[\"asm\"][\"xb\"]).apply(null,arguments));var
stackSave=Module[\"stackSave\"]=function(){return(stackSave=Module[\"stackSave\"]=Module[\"asm\"][\"yb\"]).a
pply(null,arguments));var
stackRestore=Module[\"stackRestore\"]=function(){return(stackRestore=Module[\"stackRestore\"]=Module[\"asm\
\"][\"zb\"]).apply(null,arguments));var
stackAlloc=Module[\"stackAlloc\"]=function(){return(stackAlloc=Module[\"stackAlloc\"]=Module[\"asm\"][\"Ab\
\"]).apply(null,arguments));var
__emscripten_stack_set_limits=Module[\"_emscripten_stack_set_limits\"]=function(){return(__emscripten_stack_set
limits=Module[\"_emscripten_stack_set_limits\"]=Module[\"asm\"][\"Bb\"]).apply(null,arguments));var
__memalign=Module[\"_memalign\"]=function(){return(__memalign=Module[\"_memalign\"]=Module[\"asm\"][\"Cb
\"]).apply(null,arguments));var
__emscripten_allow_main_runtime_queued_calls=Module[\"__emscripten_allow_main_runtime_queued_calls\"]=1
0512;var
__emscripten_main_thread_futex=Module[\"__emscripten_main_thread_futex\"]=12148;Module[\"cwrap\"]=cwrap
;Module[\"PThread\"]=PThread;Module[\"PThread\"]=PThread;Module[\"wasmMemory\"]=wasmMemory;Module
[\"ExitStatus\"]=ExitStatus;var
calledRun;function ExitStatus(status){this.name=\"ExitStatus\";this.message=\"Program terminated with
exit(\\\"+status+\\\")\";this.status=status}dependenciesFulfilled=function
runCaller(){if(!calledRun)run();if(!calledRun)dependenciesFulfilled=runCaller};function
run(args){args=args||arguments_;if(runDependencies>0){return}if(ENVIRONMENT_IS_PTHREAD){readyPromis
eResolve(Module);initRuntime();postMessage({\"cmd\":\"loaded\"]);return}preRun();if(runDependencies>0){retur
n}function
doRun(){if(calledRun)return;calledRun=true;Module[\"calledRun\"]=true;if(ABORT)return;initRuntime();preMain(
);readyPromiseResolve(Module);if(Module[\"onRuntimeInitialized\"])Module[\"onRuntimeInitialized\"]();postRun(
)}if(Module[\"setStatus\"])Module[\"setStatus\"](\"Running...\");setTimeout(function(){setTimeout(function(){Mo
dule[\"setStatus\"](\"\\\"),1);doRun(),1)}else{doRun()}}Module[\"run\"]=run;function
exit(status,implicit){if(implicit&&noExitRuntime&&status===0){return}if(!implicit){if(ENVIRONMENT_IS_PT
HREAD){postMessage({\"cmd\":\"exitProcess\",\"returnCode\":status});throw
new
ExitStatus(status)}else{}if(noExitRuntime){}else{PThread.terminateAllThreads();EXITSTATUS=status;exitRunti
me();if(Module[\"onExit\"])Module[\"onExit\"](status);ABORT=true}quit_(status,new
ExitStatus(status))}if(Module[\"preInit\"])if(typeof
Module[\"preInit\"]==\"function\")Module[\"preInit\"]=[Module[\"preInit\"]];while(Module[\"preInit\"].length>0){

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Module["preInit"].pop()}){if(ENVIRONMENT_IS_PTHREAD){noExitRuntime=false;PThread.initWorker()}run();\n\n return WasmBackendModuleThreadedSimd.ready}\n);\n\n}());\n\nif (typeof exports === 'object' && typeof module === 'object')\n module.exports = WasmBackendModuleThreadedSimd;\n\nelse if (typeof define === 'function' && define['amd'])\n define([], function() { return WasmBackendModuleThreadedSimd; });\n\nelse if (typeof exports === 'object')\n exports["WasmBackendModuleThreadedSimd"]\n = WasmBackendModuleThreadedSimd;\n\n","export const wasmWorkerContents = 'var Module={};function threadPrintErr(){var text=Array.prototype.slice.call(arguments).join("\\ ");console.error(text)}function threadAlert(){var text=Array.prototype.slice.call(arguments).join("\\ ");postMessage({cmd:"alert\\",text:text,threadId:Module["_pthread_self"]()})}}var err=threadPrintErr,this.alert=threadAlert;Module["instantiateWasm"]=function(info,receiveInstance){var instance=new WebAssembly.Instance(Module["wasmModule"],info);Module["wasmModule"]=null;receiveInstance(instance);return instance.exports};function moduleLoaded(){this.onmessage=function(e){try{if(e.data.cmd===\\"load\\"){Module["wasmModule"]=e.data.wasmModule;Module["wasmMemory"]=e.data.wasmMemory;Module["buffer"]=Module["wasmMemory"].buffer;Module["ENVIRONMENT_IS_PTHREAD"]=true;if(typeof e.data.urlOrBlob===\\"string\\"){importScripts(e.data.urlOrBlob)}else{var objectUrl=URL.createObjectURL(e.data.urlOrBlob);importScripts(objectUrl);URL.revokeObjectURL(objectUrl)}WasmBackendModuleThreadedSimd(Module).then(function(instance){Module=instance;moduleLoaded()})}else if(e.data.cmd===\\"objectTransfer\\"){Module["PThread"].receiveObjectTransfer(e.data)}else if(e.data.cmd===\\"run\\"){Module["__performance_now_clock_drift"]=performance.now()-e.data.time;Module["__emscripten_thread_init"](e.data.threadInfoStruct,0,0);var max=e.data.stackBase;var top=e.data.stackBase+e.data.stackSize;Module["establishStackSpace"](top,max);Module["__emscripten_tls_init"]();Module["PThread"].receiveObjectTransfer(e.data);Module["PThread"].setThreadStatus(Module["_pthread_self"](),1);try{var result=Module["invokeEntryPoint"](e.data.start_routine,e.data.arg);if(!Module["getNoExitRuntime"]())Module["PThread"].threadExit(result)}catch(ex){if(ex===\\"Canceled!"){Module["PThread"].threadCancel()}else if(ex!=\\"unwind\\"){if(ex instanceof Module["ExitStatus"]){if(Module["getNoExitRuntime"]()){}}else{Module["PThread"].threadExit(ex.status)}}else{Module["PThread"].threadExit(-2);throw ex}}} }else if(e.data.cmd===\\"cancel\\"){if(Module["_pthread_self"]()){Module["PThread"].threadCancel()} }else if(e.data.target===\\"setimmediate\\"){ }else if(e.data.cmd===\\"processThreadQueue\\"){if(Module["_pthread_self"]()){Module["__emscripten_current_thread_queued_calls"]()} }else{err(\\"worker.js received unknown command \"+e.data.cmd);err(e.data)} }catch(ex){err(\\"worker.js onmessage() captured an uncaught exception: \"+ex);if(ex&&ex.stack)err(ex.stack);throw ex }};if(typeof process===\\"object\\"&&typeof process.versions===\\"object\\"&&typeof process.versions.node===\\"string\\"){self={location:{href:__filename}};var onmessage=this.onmessage;var nodeWorkerThreads=require(\\"worker_threads\\");global.Worker=nodeWorkerThreads.Worker;var parentPort=nodeWorkerThreads.parentPort;parentPort.on(\\"message\\",function(data){onmessage({data:data})});var nodeFS=require(\\"fs\\");var nodeRead=function(filename){return nodeFS.readFileSync(filename,\\"utf8\\")};function globalEval(x){global.require=require;global.Module=Module;eval.call(null,x)}importScripts=function(f){globalEval(nodeRead(f))};postMessage=function(msg){parentPort.postMessage(msg)};if(typeof performance===\\"undefined\\"){performance={now:function(){return Date.now()}}};";\n\nvar WasmBackendModule = (function() {\n var _scriptId = typeof document !== 'undefined' && document.currentScript ? document.currentScript.src : undefined;\n if (typeof filename !== 'undefined')
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_scriptDir = _scriptDir || __filename;\n return (\nfunction(WasmBackendModule) {\n WasmBackendModule =
WasmBackendModule || {};\n\nvar Module=typeof
WasmBackendModule!="undefined"?WasmBackendModule:{};var
readyPromiseResolve,readyPromiseReject;Module["ready"]=new
Promise(function(resolve,reject){readyPromiseResolve=resolve;readyPromiseReject=reject});var
moduleOverrides={};var key;for(key in
Module){if(Module.hasOwnProperty(key)){moduleOverrides[key]=Module[key]}}var
arguments_=[];var thisProgram=\.this.program\;;var quit_=function(status,toThrow){throw toThrow};var
ENVIRONMENT_IS_WEB=false;var ENVIRONMENT_IS_WORKER=false;var
ENVIRONMENT_IS_NODE=false;var ENVIRONMENT_IS_SHELL=false;ENVIRONMENT_IS_WEB=typeof
window==="object";ENVIRONMENT_IS_WORKER=typeof
importScripts==="function";ENVIRONMENT_IS_NODE=typeof process==="object"&&typeof
process.versions==="object"&&typeof
process.versions.node==="string";ENVIRONMENT_IS_SHELL=!ENVIRONMENT_IS_WEB&&!ENVIRONM
ENT_IS_NODE&&!ENVIRONMENT_IS_WORKER;var scriptDirectory=\.\";function
locateFile(path){if(Module["locateFile"]){return Module["locateFile"](path,scriptDirectory)}return
scriptDirectory+path}var read_,readAsync,readBinary,setWindowTitle;var nodeFS;var
nodePath;if(ENVIRONMENT_IS_NODE){if(ENVIRONMENT_IS_WORKER){scriptDirectory=require(\"path\").
dirname(scriptDirectory)+\"/\"}else{scriptDirectory=__dirname+\"/\"}read_=function
shell_read(filename,binary){if(!nodeFS)nodeFS=require(\"fs\");if(!nodePath)nodePath=require(\"path\");filename=n
odePath[\"normalize\"](filename);return
nodeFS[\"readFileSync\"](filename,binary?null:\"utf8\");}readBinary=function readBinary(filename){var
ret=read_(filename,true);if(!ret.buffer){ret=new Uint8Array(ret)}assert(ret.buffer);return
ret};if(process[\"argv\"].length>1){thisProgram=process[\"argv\"][1].replace(/\\\\\\\\g,\"/\");arguments_=process[\"arg
v\"].slice(2);process[\"on\"](\"uncaughtException\",function(ex){if(!(ex instanceof ExitStatus)){throw
ex}});process[\"on\"](\"unhandledRejection\",abort);quit_=function(status){process[\"exit\"](status)};Module[\"insp
ect\"]=function(){return\"[Emscripten Module object]\"} }else if(ENVIRONMENT_IS_SHELL){if(typeof
read!=\"undefined\"){read_=function shell_read(f){return read(f)} }readBinary=function readBinary(f){var
data;if(typeof readbuffer==="function"){return new
Uint8Array(readbuffer(f))}data=read(f,\"binary\");assert(typeof data==="object");return data };if(typeof
scriptArgs!="undefined"){arguments_=scriptArgs}else
if(typeof arguments!="undefined"){arguments_=arguments}if(typeof
quit==="function"){quit_=function(status){quit(status)}}if(typeof print!="undefined"){if(typeof
console==="undefined")console={};console.log=print;console.warn=console.error=typeof
printErr!="undefined"?printErr:print} }else
if(ENVIRONMENT_IS_WEB||ENVIRONMENT_IS_WORKER){if(ENVIRONMENT_IS_WORKER){scriptDire
ctory=self.location.href}else if(typeof
document!="undefined"&&document.currentScript){scriptDirectory=document.currentScript.src}if(_scriptDir){s
criptDirectory=_scriptDir}if(scriptDirectory.indexOf(\"blob:\")!==-1){scriptDirectory=scriptDirectory.substr(0,script
Directory.lastIndexOf(\"/\")+1)}else{scriptDirectory=\.\"} }read_=function(url){var xhr=new
XMLHttpRequest;xhr.open(\"GET\",url,false);xhr.send(null);return
xhr.responseText};if(ENVIRONMENT_IS_WORKER){readBinary=function(url){var xhr=new
XMLHttpRequest;xhr.open(\"GET\",url,false);xhr.responseType=\"arraybuffer\";xhr.send(null);return
new Uint8Array(xhr.response)} }readAsync=function(url,onload,onerror){var xhr=new
XMLHttpRequest;xhr.open(\"GET\",url,true);xhr.responseType=\"arraybuffer\";xhr.onload=function(){if(xhr.status
==200||xhr.status==0&&xhr.response){onload(xhr.response);return }onerror();}xhr.onerror=onerror;xhr.send(null)}
}setWindowTitle=function(title){document.title=title} }else{ }var
out=Module[\"print\"]||console.log.bind(console);var err=Module[\"printErr\"]||console.warn.bind(console);for(key

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moduleOverrides){if(moduleOverrides.hasOwnProperty(key)){Module[key]=moduleOverrides[key]}}moduleOverr
ides=null;if(Module["arguments\"])arguments_=Module["arguments\"];if(Module["thisProgram\"])thisProgram=
Module["thisProgram\"];if(Module["quit\"])quit_=Module["quit\"];var
wasmBinary;if(Module["wasmBinary\"])wasmBinary=Module["wasmBinary\"];var
noExitRuntime=Module["noExitRuntime\"]||true;if(typeof WebAssembly!=="object"){abort("no native wasm
support detected")}var wasmMemory;var
ABORT=false;var EXITSTATUS;function assert(condition,text){if(!condition){abort("Assertion failed:
"+text)}}function getCFunc(ident){var func=Module["_"+ident];assert(func,"Cannot call unknown function
"+ident+", make sure it is exported");return func}function ccall(ident,returnType,argTypes,args,opts){var
toC={"string":function(str){var ret=0;if(str===null&&str===undefined&&str===0){var
len=(str.length<<2)+1;ret=stackAlloc(len);stringToUTF8(str,ret,len)}return ret},"array":function(arr){var
ret=stackAlloc(arr.length);writeArrayToMemory(arr,ret);return ret}};function
convertReturnValue(ret){if(returnType==="string")return UTF8ToString(ret);if(returnType==="boolean")return
Boolean(ret);return ret}var func=getCFunc(ident);var cArgs=[];var stack=0;if(args){for(var
i=0;i<args.length;i++){var
converter=toC[argTypes[i]];if(converter){if(stack===0)stack=stackSave();cArgs[i]=converter(args[i])}else{cArgs[i
]=args[i]}}var ret=func.apply(null,cArgs);ret=convertReturnValue(ret);if(stack!==0)stackRestore(stack);return
ret}function cwrap(ident,returnType,argTypes,opts){argTypes=argTypes||[];var
numericArgs=argTypes.every(function(type){return type==="number"});var
numericRet=returnType!=="string";if(numericRet&&numericArgs&&!opts){return getCFunc(ident)}return
function(){return ccall(ident,returnType,argTypes,arguments,opts)}}var UTF8Decoder=typeof
TextDecoder!=="undefined"?new TextDecoder("utf8"):undefined;function
UTF8ArrayToString(heap,idx,maxBytesToRead){var endIdx=idx+maxBytesToRead;var
endPtr=idx;while(heap[endPtr]&&!(endPtr>=endIdx))++endPtr;if(endPtr-
idx>16&&heap.subarray&&UTF8Decoder){return UTF8Decoder.decode(heap.subarray(idx,endPtr))}else{var
str="";while(idx<endPtr){var u0=heap[idx++];if(!(u0&128)){str+=String.fromCharCode(u0);continue}var
u1=heap[idx++]&63;if((u0&224)==192){str+=String.fromCharCode((u0&31)<<6|u1);continue}var
u2=heap[idx++]&63;if((u0&240)==224){u0=(u0&15)<<12|u1<<6|u2}else{u0=(u0&7)<<18|u1<<12|u2<<6|heap[id
x++]&63;if(u0<65536){str+=String.fromCharCode(u0)}else{var
ch=u0-65536;str+=String.fromCharCode(55296|ch>>10,56320|ch&1023)}}}return str}function
UTF8ToString(ptr,maxBytesToRead){return
ptr?UTF8ArrayToString(HEAPU8,ptr,maxBytesToRead):""}function
stringToUTF8Array(str,heap,outIdx,maxBytesToWrite){if(!(maxBytesToWrite>0))return 0;var startIdx=outIdx;var
endIdx=outIdx+maxBytesToWrite-1;for(var i=0;i<str.length;++i){var
u=str.charCodeAtAt(i);if(u>=55296&&u<=57343){var
u1=str.charCodeAtAt(++i);u=65536+((u&1023)<<10|u1&1023)}if(u<=127){if(outIdx>=endIdx)break;heap[outIdx++]
=u}else if(u<=2047){if(outIdx+1>=endIdx)break;heap[outIdx++]=192|u>>6;heap[outIdx++]=128|u&63}else
if(u<=65535){if(outIdx+2>=endIdx)break;heap[outIdx++]=224|u>>12;heap[outIdx++]=128|u>>6&63;heap[outIdx
++]=128|u&63}else{if(outIdx+3>=endIdx)break;heap[outIdx++]=240|u>>18;heap[outIdx++]=128|u>>12&63;heap[
outIdx++]=128|u>>6&63;heap[outIdx++]=128|u&63}}heap[outIdx]=0;return outIdx-startIdx}function
stringToUTF8(str,outPtr,maxBytesToWrite){return
stringToUTF8Array(str,HEAPU8,outPtr,maxBytesToWrite)}function
writeArrayToMemory(array,buffer){HEAP8.set(array,buffer)}function
alignUp(x,multiple){if(x%multiple>0){x+=multiple-x%multiple}return x}var
buffer,HEAP8,HEAPU8,HEAP16,HEAPU16,HEAP32,HEAPU32,HEAPF32,HEAPF64;function
updateGlobalBufferAndViews(buf){buffer=buf;Module["HEAP8"]=HEAP8=new
Int8Array(buf);Module["HEAP16"]=HEAP16=new Int16Array(buf);Module["HEAP32"]=HEAP32=new
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Int32Array(buf);Module["HEAPU8"]=HEAPU8=new Uint8Array(buf);Module["HEAPU16"]=HEAPU16=new
Uint16Array(buf);Module["HEAPU32"]=HEAPU32=new
Uint32Array(buf);Module["HEAPF32"]=HEAPF32=new
Float32Array(buf);Module["HEAPF64"]=HEAPF64=new Float64Array(buf)}var
INITIAL_MEMORY=Module["INITIAL_MEMORY"]||16777216;var wasmTable;var __ATPRERUN__=[];var
__ATINIT__=[];var __ATMAIN__=[];var __ATPOSTRUN__=[];var
runtimeInitialized=false;__ATINIT__.push({func:function(){__wasm_call_ctors()}});function
preRun(){if(Module["preRun"]){if(typeof
Module["preRun"]="function")Module["preRun"]=[Module["preRun"]];while(Module["preRun"].length){a
ddOnPreRun(Module["preRun"].shift())}callRuntimeCallbacks(__ATPRERUN__)}function
initRuntime(){runtimeInitialized=true;callRuntimeCallbacks(__ATINIT__)}function
preMain(){callRuntimeCallbacks(__ATMAIN__)}function postRun(){if(Module["postRun"]){if(typeof
Module["postRun"]="function")Module["postRun"]=[Module["postRun"]];while(Module["postRun"].lengt
h){addOnPostRun(Module["postRun"].shift())}callRuntimeCallbacks(__ATPOSTRUN__)}function
addOnPreRun(cb){__ATPRERUN__.unshift(cb)}function addOnPostRun(cb){__ATPOSTRUN__.unshift(cb)}var
runDependencies=0;var runDependencyWatcher=null;var dependenciesFulfilled=null;function
addRunDependency(id){runDependencies++;if(Module["monitorRunDependencies"]){Module["monitorRunDep
endencies"](runDependencies)}}function removeRunDependency(id){runDependencies--
;if(Module["monitorRunDependencies"]){Module["monitorRunDependencies"](runDependencies)}if(runDepend
encies==0){if(runDependencyWatcher!==null){clearInterval(runDependencyWatcher);runDependencyWatcher=null
}if(dependenciesFulfilled){var
callback=dependenciesFulfilled;dependenciesFulfilled=null;callback()}}Module["preloadedImages"]={};Module
["preloadedAudios"]={};function
abort(what){if(Module["onAbort"]){Module["onAbort"](what)}what+="\n";err(what);ABORT=true;EXITSTAT
US=1;what+="abort(\n"+what+"\n). Build with -s ASSERTIONS=1 for more info.";var e=new
WebAssembly.RuntimeError(what);readyPromiseReject(e);throw e}function hasPrefix(str,prefix){return
String.prototype.startsWith?str.startsWith(prefix):str.indexOf(prefix)===0}var
dataURIPrefix="data:application/octet-stream;base64,";function isDataURI(filename){return
hasPrefix(filename,dataURIPrefix)}var fileURIPrefix="file://^";function isFileURI(filename){return
hasPrefix(filename,fileURIPrefix)}var wasmBinaryFile="tfjs-backend-
wasm.wasm";if(!isDataURI(wasmBinaryFile)){wasmBinaryFile=locateFile(wasmBinaryFile)}function
getBinary(file){try{if(file==wasmBinaryFile&&wasmBinary){return new
Uint8Array(wasmBinary)}if(readBinary){return readBinary(file)}else{throw"both async and sync fetching of the
wasm failed"}}catch(err){abort(err)}}function
getBinaryPromise(){if(!wasmBinary&&(ENVIRONMENT_IS_WEB||ENVIRONMENT_IS_WORKER)){if(typeof
fetch==="function"&&!isFileURI(wasmBinaryFile)){return fetch(wasmBinaryFile,{credentials:"same-
origin"}).then(function(response){if(!response["ok"]){throw"failed to load wasm binary file at
"+wasmBinaryFile+""}return response["arrayBuffer"]()).catch(function(){return
getBinary(wasmBinaryFile)})}else{if(readAsync){return new
Promise(function(resolve,reject){readAsync(wasmBinaryFile,function(response){resolve(new
Uint8Array(response))},reject)}))}}return Promise.resolve().then(function(){return
getBinary(wasmBinaryFile)})}function createWasm(){var info={"a":asmLibraryArg};function
receiveInstance(instance,module){var
exports=instance.exports;Module["asm"]=exports;wasmMemory=Module["asm"]["j"];updateGlobalBufferAnd
Views(wasmMemory.buffer);wasmTable=Module["asm"]["r"];removeRunDependency("wasm-
instantiate")}addRunDependency("wasm-instantiate");function
receiveInstantiatedSource(output){receiveInstance(output["instance"])}function
instantiateArrayBuffer(receiver){return getBinaryPromise().then(function(binary){return

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WebAssembly.instantiate(binary,info)).then(receiver,function(reason){err(\"failed to asynchronously prepare
wasm: \"+reason);abort(reason)})}function instantiateAsync(){if(!wasmBinary&&typeof
WebAssembly.instantiateStreaming===\"function\"&&!isDataURI(wasmBinaryFile)&&!isFileURI(wasmBinaryFil
e)&&typeof fetch===\"function\"){return fetch(wasmBinaryFile,{credentials:\"same-
origin\").then(function(response){var result=WebAssembly.instantiateStreaming(response,info);return
result.then(receiveInstantiatedSource,function(reason){err(\"wasm streaming compile failed: \"+reason);err(\"falling
back to
ArrayBuffer instantiation\");return instantiateArrayBuffer(receiveInstantiatedSource)}))}else{return
instantiateArrayBuffer(receiveInstantiatedSource)}if(Module[\"instantiateWasm\"]){try{var
exports=Module[\"instantiateWasm\"](info,receiveInstance);return exports}catch(e){err(\"Module.instantiateWasm
callback failed with error: \"+e);return false}}instantiateAsync().catch(Promise.reject);return{}}function
callRuntimeCallbacks(callbacks){while(callbacks.length>0){var callback=callbacks.shift();if(typeof
callback===\"function\"){callback(Module);continue}var func=callback.func;if(typeof
func===\"number\"){if(callback.arg===undefined){wasmTable.get(func)()}else{wasmTable.get(func)(callback.arg)
}}else{func(callback.arg===undefined?null:callback.arg)}}function _abort(){abort()}function
_emscripten_memcpy_big(dest,src,num){HEAPU8.copyWithin(dest,src,src+num)}function
_emscripten_get_heap_size(){return HEAPU8.length}function
emscripten_realloc_buffer(size){try{wasmMemory.grow(size-
buffer.byteLength+65535>>>16);updateGlobalBufferAndViews(wasmMemory.buffer);return
1}catch(e){}}function _emscripten_resize_heap(requestedSize){var oldSize=_emscripten_get_heap_size();var
maxHeapSize=2147483648;if(requestedSize>maxHeapSize){return false}for(var
cutDown=1;cutDown<=4;cutDown*=2){var
overGrownHeapSize=oldSize*(1+.2/cutDown);overGrownHeapSize=Math.min(overGrownHeapSize,requestedSize
+100663296);var
newSize=Math.min(maxHeapSize,alignUp(Math.max(requestedSize,overGrownHeapSize),65536));var
replacement=emscripten_realloc_buffer(newSize);if(replacement){return true}}return false}var
SYSCALLS={mappings:{},buffers:[null,[],[]],printChar:function(stream,curr){var
buffer=SYSCALLS.buffers[stream];if(curr===0||curr===10){(stream===1?out:err)(UTF8ArrayToString(buffer,0));
buffer.length=0}else{buffer.push(curr)}},varargs:undefined,get:function(){SYSCALLS.varargs+=4;var
ret=HEAP32[SYSCALLS.varargs-4>>2];return ret},getStr:function(ptr){var ret=UTF8ToString(ptr);return
ret},get64:function(low,high){return
low}};function _fd_close(fd){return 0}function _fd_seek(fd,offset_low,offset_high,whence,newOffset){}function
_fd_write(fd,iov,iovcnt,pnum){var num=0;for(var i=0;i<iovcnt;i++){var ptr=HEAP32[iov+i*8>>2];var
len=HEAP32[iov+(i*8+4)>>2];for(var
j=0;j<len;j++){SYSCALLS.printChar(fd,HEAPU8[ptr+j])}num+=len}HEAP32[pnum>>2]=num;return 0}function
_pthread_create(){return 6}function _pthread_join(){return 28}function
setErrNo(value){HEAP32[___errno_location()>>2]=value;return value}function
_sysconf(name){switch(name){case 30:return 16384;case 85:var maxHeapSize=2147483648;return
maxHeapSize/16384;case 132:case 133:case 12:case 137:case 138:case 15:case 235:case 16:case 17:case 18:case
19:case 20:case 149:case 13:case 10:case 236:case 153:case 9:case 21:case 22:case 159:case 154:case 14:case
77:case 78:case 139:case 82:case 68:case 67:case 164:case 11:case 29:case 47:case 48:case 95:case 52:case 51:case
46:return 200809;case 27:case 246:case 127:case 128:case 23:case 24:case 160:case
161:case 181:case 182:case 242:case 183:case 184:case 243:case 244:case 245:case 165:case 178:case 179:case
49:case 50:case 168:case 169:case 175:case 170:case 171:case 172:case 97:case 76:case 32:case 173:case 35:case
80:case 81:case 79:return -1;case 176:case 177:case 7:case 155:case 8:case 157:case 125:case 126:case 92:case
93:case 129:case 130:case 131:case 94:case 91:return 1;case 74:case 60:case 69:case 70:case 4:return 1024;case
31:case 42:case 72:return 32;case 87:case 26:case 33:return 2147483647;case 34:case 1:return 47839;case 38:case
36:return 99;case 43:case 37:return 2048;case 0:return 2097152;case 3:return 65536;case 28:return 32768;case

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44:return 32767;case 75:return 16384;case 39:return 1e3;case 89:return 700;case 71:return 256;case 40:return
255;case 2:return 100;case 180:return 64;case 25:return 20;case 5:return 16;case 6:return 6;case 73:return 4;case
84:{if(typeof navigator===\"object\")return navigator[\"hardwareConcurrency\"]||1;return 1 } }setErrNo(28);return-
1 }var
asmLibraryArg={\"a\":_abort,\"d\":_emscripten_memcpy_big,\"e\":_emscripten_resize_heap,\"f\":_fd_close,\"c\":_f
d_seek,\"b\":_fd_write,\"h\":_pthread_create,\"g\":_pthread_join,\"i\":_sysconf};var asm=createWasm();var
__wasm_call_ctors=Module[\"__wasm_call_ctors\"]=function(){return(__wasm_call_ctors=Module[\"__wasm
_call_ctors\"]=Module[\"asm\"][\"k\"]).apply(null,arguments)};var
_init=Module[\"_init\"]=function(){return(_init=Module[\"_init\"]=Module[\"asm\"][\"l\"]).apply(null,arguments)};
var
_init_with_threads_count=Module[\"_init_with_threads_count\"]=function(){return(_init_with_threads_count=Mod
ule[\"_init_with_threads_count\"]=Module[\"asm\"][\"m\"]).apply(null,arguments)};var
_get_threads_count=Module[\"_get_threads_count\"]=function(){return(_get_threads_count=Module[\"_get_threads
_count\"]=Module[\"asm\"][\"n\"]).apply(null,arguments)};var
_register_tensor=Module[\"_register_tensor\"]=function(){return(_register_tensor=Module[\"_register_tensor\"]=M
odule[\"asm\"][\"o\"]).apply(null,arguments)};var
_dispose_data=Module[\"_dispose_data\"]=function(){return(_dispose_data=Module[\"_dispose_data\"]=Module[\"
asm\"][\"p\"]).apply(null,arguments)};var
_dispose=Module[\"_dispose\"]=function(){return(_dispose=Module[\"_dispose\"]=Module[\"asm\"][\"q\"]).apply(n
ull,arguments)};var
_Abs=Module[\"_Abs\"]=function(){return(_Abs=Module[\"_Abs\"]=Module[\"asm\"][\"s\"]).apply(null,arguments
)};var
_Add=Module[\"_Add\"]=function(){return(_Add=Module[\"_Add\"]=Module[\"asm\"][\"t\"]).apply(null,argument
s)};var
_AddN=Module[\"_AddN\"]=function(){return(_AddN=Module[\"_AddN\"]=Module[\"asm\"][\"u\"]).apply(null,ar
guments)};var
_All=Module[\"_All\"]=function(){return(_All=Module[\"_All\"]=Module[\"asm\"][\"v\"]).apply(null,arguments)};
var
_Any=Module[\"_Any\"]=function(){return(_Any=Module[\"_Any\"]=Module[\"asm\"][\"w\"]).apply(null,argumen
ts)};var
_ArgMax=Module[\"_ArgMax\"]=function(){return(_ArgMax=Module[\"_ArgMax\"]=Module[\"asm\"][\"x\"]).app
ly(null,arguments)};var
_AvgPool=Module[\"_AvgPool\"]=function(){return(_AvgPool=Module[\"_AvgPool\"]=Module[\"asm\"][\"y\"]).a
pply(null,arguments)};var
_BatchMatMul=Module[\"_BatchMatMul\"]=function(){return(_BatchMatMul=Module[\"_BatchMatMul\"]=Modu
le[\"asm\"][\"z\"]).apply(null,arguments)};var
_Ceil=Module[\"_Ceil\"]=function(){return(_Ceil=Module[\"_Ceil\"]=Module[\"asm\"][\"A\"]).apply(null,argument
s)};var
_ClipByValue=Module[\"_ClipByValue\"]=function(){return(_ClipByValue=Module[\"_ClipByValue\"]=Module[\"
asm\"][\"B\"]).apply(null,arguments)};var
_Conv2D=Module[\"_Conv2D\"]=function(){return(_Conv2D=Module[\"_Conv2D\"]=Module[\"asm\"][\"C\"]).ap
ply(null,arguments)};var
_Conv2DBackpropInput=Module[\"_Conv2DBackpropInput\"]=function(){return(_Conv2DBackpropInput=Modul
e[\"_Conv2DBackpropInput\"]=Module[\"asm\"][\"D\"]).apply(null,arguments)};var
_Cos=Module[\"_Cos\"]=function(){return(_Cos=Module[\"_Cos\"]=Module[\"asm\"][\"E\"]).apply(null,arguments
)};var
_Cosh=Module[\"_Cosh\"]=function(){return(_Cosh=Module[\"_Cosh\"]=Module[\"asm\"][\"F\"]).apply(null,argu
ments)};var

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_CropAndResize=Module["_CropAndResize"]=function(){return(_CropAndResize=Module["_CropAndResize"]=Module["asm"][_"G"]).apply(null,arguments)};var
_Cumsum=Module["_Cumsum"]=function(){return(_Cumsum=Module["_Cumsum"]=Module["asm"][_"H"]).apply(null,arguments)};var
_DepthToSpace=Module["_DepthToSpace"]=function(){return(_DepthToSpace=Module["_DepthToSpace"]=Module["asm"][_"I"]).apply(null,arguments)};var
_DepthwiseConv2dNative=Module["_DepthwiseConv2dNative"]=function(){return(_DepthwiseConv2dNative=Module["_DepthwiseConv2dNative"]=Module["asm"][_"J"]).apply(null,arguments)};var
_Elu=Module["_Elu"]=function(){return(_Elu=Module["_Elu"]=Module["asm"][_"K"]).apply(null,arguments)};var
_Equal=Module["_Equal"]=function(){return(_Equal=Module["_Equal"]=Module["asm"][_"L"]).apply(null,arguments)};var
_Exp=Module["_Exp"]=function(){return(_Exp=Module["_Exp"]=Module["asm"][_"M"]).apply(null,arguments)};var
_FlipLeftRight=Module["_FlipLeftRight"]=function(){return(_FlipLeftRight=Module["_FlipLeftRight"]=Module["asm"][_"N"]).apply(null,arguments)};var
_Floor=Module["_Floor"]=function(){return(_Floor=Module["_Floor"]=Module["asm"][_"O"]).apply(null,arguments)};var
_FloorDiv=Module["_FloorDiv"]=function(){return(_FloorDiv=Module["_FloorDiv"]=Module["asm"][_"P"]).apply(null,arguments)};var
_FusedBatchNorm=Module["_FusedBatchNorm"]=function(){return(_FusedBatchNorm=Module["_FusedBatchNorm"]=Module["asm"][_"Q"]).apply(null,arguments)};var
_FusedConv2D=Module["_FusedConv2D"]=function(){return(_FusedConv2D=Module["_FusedConv2D"]=Module["asm"][_"R"]).apply(null,arguments)};var
_FusedDepthwiseConv2D=Module["_FusedDepthwiseConv2D"]=function(){return(_FusedDepthwiseConv2D=Module["_FusedDepthwiseConv2D"]=Module["asm"][_"S"]).apply(null,arguments)};var
_Gather=Module["_Gather"]=function(){return(_Gather=Module["_Gather"]=Module["asm"][_"T"]).apply(null,arguments)};var
_GatherNd=Module["_GatherNd"]=function(){return(_GatherNd=Module["_GatherNd"]=Module["asm"][_"U"]).apply(null,arguments)};var
_Greater=Module["_Greater"]=function(){return(_Greater=Module["_Greater"]=Module["asm"][_"V"]).apply(null,arguments)};var
_GreaterEqual=Module["_GreaterEqual"]=function(){return(_GreaterEqual=Module["_GreaterEqual"]=Module["asm"][_"W"]).apply(null,arguments)};var
_LeakyRelu=Module["_LeakyRelu"]=function(){return(_LeakyRelu=Module["_LeakyRelu"]=Module["asm"][_"X"]).apply(null,arguments)};var
_Less=Module["_Less"]=function(){return(_Less=Module["_Less"]=Module["asm"][_"Y"]).apply(null,arguments)};var
_LessEqual=Module["_LessEqual"]=function(){return(_LessEqual=Module["_LessEqual"]=Module["asm"][_"Z"]).apply(null,arguments)};var
_Log=Module["_Log"]=function(){return(_Log=Module["_Log"]=Module["asm"][_" _"]).apply(null,arguments)};var
_LogicalAnd=Module["_LogicalAnd"]=function(){return(_LogicalAnd=Module["_LogicalAnd"]=Module["asm"][_"$"]).apply(null,arguments)};var
_Max=Module["_Max"]=function(){return(_Max=Module["_Max"]=Module["asm"][_"aa"]).apply(null,arguments)};var
_MaxPool=Module["_MaxPool"]=function(){return(_MaxPool=Module["_MaxPool"]=Module["asm"][_"ba"]).apply(null,arguments)};var

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_Maximum=Module["_Maximum"]=function(){return(_Maximum=Module["_Maximum"]=Module["asm"])[_c
a").apply(null,arguments)};var
_Mean=Module["_Mean"]=function(){return(_Mean=Module["_Mean"]=Module["asm"])[_da").apply(null,ar
guments)};var
_Min=Module["_Min"]=function(){return(_Min=Module["_Min"]=Module["asm"])[_ea").apply(null,argumen
ts)};var
_Minimum=Module["_Minimum"]=function(){return(_Minimum=Module["_Minimum"]=Module["asm"])[_fa
").apply(null,arguments)};var
_MirrorPad=Module["_MirrorPad"]=function(){return(_MirrorPad=Module["_MirrorPad"]=Module["asm"])[_g
a").apply(null,arguments)};var
_Multiply=Module["_Multiply"]=function(){return(_Multiply=Module["_Multiply"]=Module["asm"])[_ha
").apply(null,arguments)};var
_Neg=Module["_Neg"]=function(){return(_Neg=Module["_Neg"]=Module["asm"])[_ia").apply(null,argument
s)};var
_NonMaxSuppressionV3=Module["_NonMaxSuppressionV3"]=function(){return(_NonMaxSuppressionV3=Mod
ule["_NonMaxSuppressionV3"]=Module["asm"])[_ja").apply(null,arguments)};var
_NonMaxSuppressionV4=Module["_NonMaxSuppressionV4"]=function(){return(_NonMaxSuppressionV4=Mod
ule["_NonMaxSuppressionV4"]=Module["asm"])[_ka").apply(null,arguments)};var
_NonMaxSuppressionV5=Module["_NonMaxSuppressionV5"]=function(){return(_NonMaxSuppressionV5=Mod
ule["_NonMaxSuppressionV5"]=Module["asm"])[_la").apply(null,arguments)};var
_NotEqual=Module["_NotEqual"]=function(){return(_NotEqual=Module["_NotEqual"]=Module["asm"])[_ma
").apply(null,arguments)};var
_OneHot=Module["_OneHot"]=function(){return(_OneHot=Module["_OneHot"]=Module["asm"])[_na").appl
y(null,arguments)};var
_PadV2=Module["_PadV2"]=function(){return(_PadV2=Module["_PadV2"]=Module["asm"])[_oa").apply(nul
l,arguments)};var
_Pow=Module["_Pow"]=function(){return(_Pow=Module["_Pow"]=Module["asm"])[_pa").apply(null,argume
nts)};var
_Prelu=Module["_Prelu"]=function(){return(_Prelu=Module["_Prelu"]=Module["asm"])[_qa").apply(null,argu
ments)};var
_Prod=Module["_Prod"]=function(){return(_Prod=Module["_Prod"]=Module["asm"])[_ra").apply(null,argum
ents)};var
_RealDiv=Module["_RealDiv"]=function(){return(_RealDiv=Module["_RealDiv"]=Module["asm"])[_sa").app
ly(null,arguments)};var
_Relu=Module["_Relu"]=function(){return(_Relu=Module["_Relu"]=Module["asm"])[_ta").apply(null,argume
nts)};var
_Relu6=Module["_Relu6"]=function(){return(_Relu6=Module["_Relu6"]=Module["asm"])[_ua").apply(null,ar
guments)};var
_ResizeBilinear=Module["_ResizeBilinear"]=function(){return(_ResizeBilinear=Module["_ResizeBilinear"]=Mo
dule["asm"])[_va").apply(null,arguments)};var
_Reverse=Module["_Reverse"]=function(){return(_Reverse=Module["_Reverse"]=Module["asm"])[_wa").app
ly(null,arguments)};var
_RotateWithOffset=Module["_RotateWithOffset"]=function(){return(_RotateWithOffset=Module["_RotateWith
Offset"]=Module["asm"])[_xa").apply(null,arguments)};var
_Round=Module["_Round"]=function(){return(_Round=Module["_Round"]=Module["asm"])[_ya").apply(nul
l,arguments)};var
_Rsqrt=Module["_Rsqrt"]=function(){return(_Rsqrt=Module["_Rsqrt"]=Module["asm"])[_za").apply(null,arg
uments)};var

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_ScatterNd=Module["_ScatterNd"]=function(){return(_ScatterNd=Module["_ScatterNd"]=Module["asm"][_"Aa\"]).apply(null,arguments));var
_SelectV2=Module["_SelectV2"]=function(){return(_SelectV2=Module["_SelectV2"]=Module["asm"][_"Ba\"]).apply(null,arguments));var
_Sigmoid=Module["_Sigmoid"]=function(){return(_Sigmoid=Module["_Sigmoid"]=Module["asm"][_"Ca\"]).apply(null,arguments));var
_Sin=Module["_Sin"]=function(){return(_Sin=Module["_Sin"]=Module["asm"][_"Da\"]).apply(null,arguments)};var
_Softmax=Module["_Softmax"]=function(){return(_Softmax=Module["_Softmax"]=Module["asm"][_"Ea\"]).apply(null,arguments));var
_Sqrt=Module["_Sqrt"]=function(){return(_Sqrt=Module["_Sqrt"]=Module["asm"][_"Fa\"]).apply(null,arguments)};var
_Square=Module["_Square"]=function(){return(_Square=Module["_Square"]=Module["asm"][_"Ga\"]).apply(null,arguments)};var
_SquaredDifference=Module["_SquaredDifference"]=function(){return(_SquaredDifference=Module["_SquaredDifference"]=Module["asm"][_"Ha\"]).apply(null,arguments)};var
_Step=Module["_Step"]=function(){return(_Step=Module["_Step"]=Module["asm"][_"Ia\"]).apply(null,arguments)};var
_StridedSlice=Module["_StridedSlice"]=function(){return(_StridedSlice=Module["_StridedSlice"]=Module["asm"][_"Ja\"]).apply(null,arguments)};var
_Sub=Module["_Sub"]=function(){return(_Sub=Module["_Sub"]=Module["asm"][_"Ka\"]).apply(null,arguments)};var
_Sum=Module["_Sum"]=function(){return(_Sum=Module["_Sum"]=Module["asm"][_"La\"]).apply(null,arguments)};var
_Tan=Module["_Tan"]=function(){return(_Tan=Module["_Tan"]=Module["asm"][_"Ma\"]).apply(null,arguments)};var
_Tanh=Module["_Tanh"]=function(){return(_Tanh=Module["_Tanh"]=Module["asm"][_"Na\"]).apply(null,arguments)};var
_Tile=Module["_Tile"]=function(){return(_Tile=Module["_Tile"]=Module["asm"][_"Oa\"]).apply(null,arguments)};var
_TopK=Module["_TopK"]=function(){return(_TopK=Module["_TopK"]=Module["asm"][_"Pa\"]).apply(null,arguments)};var
_Transform=Module["_Transform"]=function(){return(_Transform=Module["_Transform"]=Module["asm"][_"Qa\"]).apply(null,arguments)};var
_Transpose=Module["_Transpose"]=function(){return(_Transpose=Module["_Transpose"]=Module["asm"][_"Ra\"]).apply(null,arguments)};var
__FusedMatMul=Module["__FusedMatMul"]=function(){return(__FusedMatMul=Module["__FusedMatMul"]=Module["asm"][_"Sa\"]).apply(null,arguments)};var
_malloc=Module["_malloc"]=function(){return(_malloc=Module["_malloc"]=Module["asm"][_"Ta\"]).apply(null,arguments)};var
_free=Module["_free"]=function(){return(_free=Module["_free"]=Module["asm"][_"Ua\"]).apply(null,arguments)};var
___errno_location=Module["___errno_location"]=function(){return(___errno_location=Module["___errno_location"]=Module["asm"][_"Va\"]).apply(null,arguments)};var
stackSave=Module["stackSave"]=function(){return(stackSave=Module["stackSave"]=Module["asm"][_"Wa\"]).apply(null,arguments)};var
stackRestore=Module["stackRestore"]=function(){return(stackRestore=Module["stackRestore"]=Module["asm"][_"Xa\"]).apply(null,arguments)};var

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stackAlloc=Module["stackAlloc"]=function(){return(stackAlloc=Module["stackAlloc"]=Module["asm"]["Ya"]
)].apply(null,arguments)};Module["cwrap"]="cwrap";var calledRun;function
ExitStatus(status){this.name="ExitStatus";this.message="Program terminated with
exit("+status+")";this.status=status}dependenciesFulfilled=function
runCaller(){if(!calledRun)run();if(!calledRun)dependenciesFulfilled=runCaller};function
run(args){args=args||arguments._;if(runDependencies>0){return}preRun();if(runDependencies>0){return}function
doRun(){if(calledRun)return;calledRun=true;Module["calledRun"]=true;if(ABORT)return;initRuntime();preMain(
);readyPromiseResolve(Module);if(Module["onRuntimeInitialized"])Module["onRuntimeInitialized"]();postRun(
)}if(Module["setStatus"]){Module["setStatus"]("Running...");setTimeout(function(){setTimeout(function(){Mo
dule["setStatus"](""),1});doRun(),1})else{doRun()}}Module["run"]=run;if(Module["preInit"]){if(typeof
Module["preInit"]=="function")Module["preInit"]=[Module["preInit"]];while(Module["preInit"].length>0){
Module["preInit"].pop()}run();\n\n\n return WasmBackendModule.ready\n\n);\n\n})();\nif (typeof exports ===
'object' && typeof module === 'object')\n module.exports = WasmBackendModule;\nelse if (typeof define ===
'function' && define['amd'])\n define([], function() { return WasmBackendModule; });\nelse if (typeof exports ===
'object')\n exports["WasmBackendModule"] = WasmBackendModule;\n","/*\n * @license\n * Copyright 2019
Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you
may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
======\n
*/\nimport './flags_wasm';\n\nimport {backend_util, BackendTimingInfo, DataStorage, DataType, deprecationWarn,
engine, env, KernelBackend, TensorInfo, util} from '@tensorflow/tfjs-core';\n\nimport {BackendWasmModule,
WasmFactoryConfig} from '../wasm-out/tfjs-backend-wasm';\nimport {BackendWasmThreadedSimdModule} from
'../wasm-out/tfjs-backend-wasm-threaded-simd';\nimport wasmFactoryThreadedSimd from '../wasm-out/tfjs-
backend-wasm-threaded-simd.js';\n// @ts-ignore\nimport {wasmWorkerContents} from '../wasm-out/tfjs-backend-
wasm-threaded-simd.worker.js';\nimport wasmFactory from '../wasm-out/tfjs-backend-wasm.js';\n\ninterface
TensorData {\n id: number;\n memoryOffset: number;\n shape: number[];\n dtype: DataType;\n refCount:
number;\n /** Only used for string tensors, storing encoded bytes. */\n stringBytes?: Uint8Array[];\n}\n\nexport
type DataId = object; // object instead of {} to force non-primitive.\n\nexport class BackendWasm extends
KernelBackend {\n // 0 is reserved for null data ids.\n private dataIdNextNumber = 1;\n dataIdMap:
DataStorage<TensorData>;\n\n constructor(public
wasm: BackendWasmModule|BackendWasmThreadedSimdModule) {\n super();\n
this.wasm.tfjs.initWithThreadsCount(threadsCount);\n actualThreadsCount = this.wasm.tfjs.getThreadsCount();\n
this.dataIdMap = new DataStorage(this, engine());\n }\n\n write(values: backend_util.BackendValues, shape:
number[], dtype: DataType):\n DataId {\n const dataId = {id: this.dataIdNextNumber++};\n
this.move(dataId, values, shape, dtype, 1);\n return dataId;\n }\n\n numDataIds(): number {\n return
this.dataIdMap.numDataIds();\n }\n\n async time(f: () => void): Promise<BackendTimingInfo> {\n const start =
util.now();\n f();\n const kernelMs = util.now() - start;\n return {kernelMs};\n }\n\n move(\n dataId:
DataId, values: backend_util.BackendValues, shape: number[],\n dtype: DataType, refCount: number): void {\n
const id = this.dataIdNextNumber++; \n if (dtype === 'string') {\n const stringBytes = values as Uint8Array[];\n
this.dataIdMap.set(\n dataId,\n {id, stringBytes, shape, dtype, memoryOffset: null, refCount});\n
return;\n }\n\n const size = util.sizeFromShape(shape);\n const numBytes = size *
util.bytesPerElement(dtype);\n const memoryOffset = this.wasm._malloc(numBytes);\n\n
this.dataIdMap.set(dataId, {id, memoryOffset, shape, dtype, refCount});\n\n this.wasm.tfjs.registerTensor(id, size,
memoryOffset);\n\n if (values != null) {\n this.wasm.HEAPU8.set(\n new Uint8Array(\n (values
```

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as backend_util.TypedArray).buffer,\n (values as backend_util.TypedArray).byteOffset, numBytes),\n memoryOffset);\n }\n}\n\n async read(dataId: DataId): Promise<backend_util.BackendValues> {\n return\n this.readSync(dataId);\n}\n\n readSync(dataId: DataId): backend_util.BackendValues {\n const {memoryOffset,\n dtype, shape, stringBytes} =\n this.dataIdMap.get(dataId);\n if (dtype === 'string') {\n return\n stringBytes;\n }\n const bytes = this.wasm.HEAPU8.slice(\n memoryOffset,\n memoryOffset +\n util.sizeFromShape(shape) * util.bytesPerElement(dtype));\n return typedArrayFromBuffer(bytes.buffer, dtype);\n}\n\n /**\n * Dispose the memory if the dataId has 0 refCount. Return true if the memory\n * is released, false\n * otherwise.\n * @param dataId\n * @oaram force Optional, remove the data regardless of refCount\n */\n disposeData(dataId: DataId, force = false): boolean {\n if (this.dataIdMap.has(dataId)) {\n const data =\n this.dataIdMap.get(dataId);\n data.refCount--;\n if (!force && data.refCount > 0) {\n return false;\n }\n this.wasm._free(data.memoryOffset);\n this.wasm.tfjs.disposeData(data.id);\n this.dataIdMap.delete(dataId);\n }\n return true;\n }\n\n /** Return refCount of a `TensorData`. */\n refCount(dataId: DataId): number {\n if (this.dataIdMap.has(dataId)) {\n const tensorData =\n this.dataIdMap.get(dataId);\n return tensorData.refCount;\n }\n return 0;\n }\n\n incRef(dataId: DataId) {\n const data = this.dataIdMap.get(dataId);\n if (data != null) {\n data.refCount++;\n }\n }\n\n floatPrecision():\n 32 {\n return 32;\n }\n\n // Returns the memory offset of a tensor. Useful for debugging and unit\n // testing.\n getMemoryOffset(dataId: DataId): number {\n return this.dataIdMap.get(dataId).memoryOffset;\n }\n\n dispose() {\n this.wasm.tfjs.dispose();\n if ('PThread' in this.wasm) {\n this.wasm.PThread.terminateAllThreads();\n }\n this.wasm = null;\n }\n\n memory() {\n return {unreliable:\n false};\n }\n\n /**\n * Make a tensor info for the output of an op. If `memoryOffset` is not\n * present, this\n * method allocates memory on the WASM heap. If `memoryOffset` is present, the memory was allocated\n * elsewhere (in c++) and we just record\n * the pointer where that memory lives.\n */\n makeOutput(shape:\n number[], dtype: DataType, memoryOffset?: number):\n TensorInfo {\n let dataId: {\n }; if (memoryOffset\n == null) {\n dataId = this.write(null /* values */, shape, dtype);\n } else {\n const id =\n this.dataIdNextNumber++;\n dataId = {id};\n this.dataIdMap.set(dataId, {id, memoryOffset, shape, dtype,\n refCount: 1});\n const size = util.sizeFromShape(shape);\n this.wasm.tfjs.registerTensor(id, size,\n memoryOffset);\n }\n return {dataId, shape, dtype};\n }\n\n typedArrayFromHeap({shape, dtype, dataId}:\n TensorInfo):\n backend_util.TypedArray {\n const buffer = this.wasm.HEAPU8.buffer;\n const\n {memoryOffset} = this.dataIdMap.get(dataId);\n const size = util.sizeFromShape(shape);\n switch (dtype) {\n case 'float32':\n return new Float32Array(buffer, memoryOffset, size);\n case 'int32':\n return new\n Int32Array(buffer, memoryOffset, size);\n case 'bool':\n return new Uint8Array(buffer, memoryOffset,\n size);\n default:\n throw new Error(`Unknown dtype ${dtype}`);\n }\n }\n\n function\n createInstantiateWasmFunc(path: string) {\n // this will be replace by rollup plugin patchWechatWebAssembly in\n // minprogram's output.\n // tslint:disable-next-line:no-any\n return (imports: any, callback: any) => {\n util.fetch(path, {credentials: 'same-origin'}).then((response) => {\n if (!response['ok']) {\n imports.env.a(`failed to load wasm binary file at '${path}'`);\n response.arrayBuffer().then(binary => {\n WebAssembly.instantiate(binary, imports).then(output => {\n callback(output.instance, output.module);\n });\n });\n }\n });\n return {\n };\n }\n }\n\n /**\n * Returns the path of the WASM binary.\n * @param\n * simdSupported whether SIMD is supported\n * @param threadsSupported whether multithreading is supported\n * @param wasmModuleFolder the directory containing the WASM binaries.\n */\n function getPathToWasmBinary(\n simdSupported: boolean, threadsSupported: boolean,\n wasmModuleFolder: string) {\n if (wasmPath != null)\n {\n // If wasmPath is defined, the user has supplied a full path to\n // the vanilla .wasm binary.\n return\n wasmPath;\n }\n let path: WasmBinaryName = 'tfjs-backend-wasm.wasm';\n if (simdSupported &&\n threadsSupported) {\n path = 'tfjs-backend-wasm-threaded-simd.wasm';\n } else if (simdSupported) {\n path =\n 'tfjs-backend-wasm-simd.wasm';\n }\n if (wasmFileMap != null) {\n if (wasmFileMap[path] != null) {\n return\n wasmFileMap[path];\n }\n }\n return\n wasmModuleFolder + path;\n }\n }\n\n /**\n * Initializes the wasm\n * module and creates the js <--> wasm bridge.\n */\n * NOTE: We wrap the wasm module in a object with property\n * 'wasm' instead of\n * returning Promise<BackendWasmModule> to avoid freezing Chrome (last tested\n * in

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Chrome 76).\n */\nexport async function init(): Promise<{ wasm: BackendWasmModule}> {\n const
[simdSupported,
 threadsSupported] = await Promise.all([\n env().getAsync('WASM_HAS_SIMD_SUPPORT'),\n
env().getAsync('WASM_HAS_MULTITHREAD_SUPPORT')\n]);\n\n return new Promise((resolve, reject) =>
{\n const factoryConfig: WasmFactoryConfig = {};\n\n /**\n * This function overrides the Emscripten
module locateFile utility.\n * @param path The relative path to the file that needs to be loaded.\n * @param
prefix The path to the main JavaScript file's directory.\n */\n factoryConfig.locateFile = (path, prefix) => {\n
if (path.endsWith('.worker.js')) {\n const response = wasmWorkerContents;\n const blob = new
Blob([response], { type: 'application/javascript' });\n return URL.createObjectURL(blob);\n }\n\n if
(path.endsWith('.wasm')) {\n return getPathToWasmBinary(\n simdSupported as boolean,\n threadsSupported as boolean,\n wasmPathPrefix != null ? wasmPathPrefix : prefix);\n }\n return prefix
+ path;\n });\n\n // Use the instantiateWasm override when system fetch is not available.\n // Reference:\n //
https://github.com/emscripten-
core/emscripten/blob/2bca083cbbd5a4133db61fbd74d04f7feecfa907/tests/manual_wasm_instantiate.html#L170\n
if (customFetch) {\n factoryConfig.instantiateWasm =\n
createInstantiateWasmFunc(getPathToWasmBinary(\n simdSupported as boolean, threadsSupported as
boolean,\n wasmPathPrefix != null ? wasmPathPrefix : ''));\n }\n\n let initialized = false;\n
factoryConfig.onAbort = () => {\n if (initialized) {\n // Emscripten already called console.warn so no need to
double log.\n return;\n }\n if (initAborted) {\n // Emscripten calls `onAbort` twice, resulting in double
error\n // messages.\n return;\n }\n initAborted = true;\n const rejectMsg =\n 'Make sure the
server can serve the `.wasm` file relative to the ' +\n 'bundled
js file. For more details see https://github.com/tensorflow/tfjs/blob/master/tfjs-backend-wasm/README.md#using-
bundlers';\n reject({ message: rejectMsg });\n };\n\n let wasm: Promise<BackendWasmModule>;\n // If
`.wasmPath` has been defined we must initialize the vanilla module.\n if (threadsSupported && simdSupported
&& wasmPath == null) {\n factoryConfig.mainScriptUrlOrBlob = new Blob([\n [var
WasmBackendModuleThreadedSimd = ` +\n wasmFactoryThreadedSimd.toString()),\n { type:
'text/javascript' }];\n wasm = wasmFactoryThreadedSimd(factoryConfig);\n } else {\n // The wasmFactory
works for both vanilla and SIMD binaries.\n wasm = wasmFactory(factoryConfig);\n }\n\n // The WASM
module has been successfully created by the factory.\n // Any error will be caught by the onAbort callback defined
above.\n wasm.then((module) => {\n initialized = true;\n initAborted = false;\n\n const voidReturnType:
string = null;\n // Using the tfjs namespace to avoid conflict with emscripten's API.\n module.tfjs = {\n
init: module.cwrap('init', null, []),\n initWithThreadsCount: module.cwrap('init_with_threads_count',
null, ['number']),\n getThreadsCount: module.cwrap('get_threads_count', 'number', []),\n registerTensor:
module.cwrap(\n 'register_tensor', null,\n [\n 'number', // id\n 'number', // size\n
'number', // memoryOffset\n]),\n disposeData: module.cwrap('dispose_data', voidReturnType,\n ['number']),\n dispose: module.cwrap('dispose', voidReturnType, []),\n };\n\n resolve({ wasm: module });\n
});\n });\n\n function typedArrayFromBuffer(\n buffer: ArrayBuffer, dtype: DataType):
backend_util.TypedArray {\n switch (dtype) {\n case 'float32':\n return new Float32Array(buffer);\n case
'int32':\n return new Int32Array(buffer);\n case 'bool':\n return new Uint8Array(buffer);\n default:\n throw new Error(`Unknown dtype ${dtype}`);\n }\n }\n\n const wasmBinaryNames = [\n 'tfjs-backend-wasm.wasm', 'tfjs-backend-wasm-simd.wasm',\n 'tfjs-
backend-wasm-threaded-simd.wasm'\n] as const;\n type WasmBinaryName = typeof
wasmBinaryNames[number];\n\n let wasmPath: string = null;\n let wasmPathPrefix: string = null;\n let wasmFileMap:
{[key in WasmBinaryName]?: string} = {};\n\n let initAborted = false;\n let customFetch = false;\n\n /**\n *
@deprecated Use `setWasmPaths` instead.\n * Sets the path to the `.wasm` file which will be fetched when the
wasm\n * backend is initialized. See\n * https://github.com/tensorflow/tfjs/blob/master/tfjs-backend-
wasm/README.md#using-bundlers\n * for more details.\n * @param path wasm file path or url\n * @param

```



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usePlatformFetch optional boolean to use platform fetch to download\n * the wasm file, default to false.\n *\n *
@doc {heading: 'Environment', namespace: 'wasm'}\n
*/\nexport function setWasmPath(path: string, usePlatformFetch = false): void {\n deprecationWarn(\n
'setWasmPath has been deprecated in favor of setWasmPaths and' +\n ' will be removed in a future release.);\n if
(initAborted) {\n throw new Error(\n 'The WASM backend was already initialized. Make sure you call ' +\n
 '\n `setWasmPath()` before you call `tf.setBackend()` or `tf.ready()`);\n }\n wasmPath = path;\n customFetch =
usePlatformFetch;\n}\n\n/**\n * Configures the locations of the WASM binaries.\n *\n * ```js\n * setWasmPaths({\n
* 'tfjs-backend-wasm.wasm': 'renamed.wasm',\n * 'tfjs-backend-wasm-simd.wasm': 'renamed-simd.wasm',\n *
'tfjs-backend-wasm-threaded-simd.wasm': 'renamed-threaded-simd.wasm'\n * });\n * tf.setBackend('wasm');\n *
```\n *\n * @param prefixOrFileMap This can be either a string or object:\n * - (string) The path to the directory
where the WASM binaries are located.\n * Note that this prefix will be used to load each
binary (vanilla,\n * SIMD-enabled, threading-enabled, etc.).\n * - (object) Mapping from names of WASM
binaries to custom\n * full paths specifying the locations of those binaries. This is useful if\n * your WASM
binaries are not all located in the same directory, or if your\n * WASM binaries have been renamed.\n * @param
usePlatformFetch optional boolean to use platform fetch to download\n * the wasm file, default to false.\n *\n *
@doc {heading: 'Environment', namespace: 'wasm'}\n */\nexport function setWasmPaths(\n  prefixOrFileMap:
string|{[key in WasmBinaryName]?: string},\n  usePlatformFetch = false): void {\n  if (initAborted) {\n    throw
new Error(\n      'The WASM backend was already initialized. Make sure you call ' +\n
    '\n    `setWasmPaths()` before you call `tf.setBackend()` or ' +\n
    '\n    `tf.ready()`);\n  }\n\n  if (typeof prefixOrFileMap === 'string') {\n
    wasmPathPrefix = prefixOrFileMap;\n  } else {\n    wasmFileMap = prefixOrFileMap;\n
    const missingPaths =\n      wasmBinaryNames.filter(name => wasmFileMap[name] == null);\n    if
(missingPaths.length > 0) {\n      throw new Error(\n        `There were no entries found for the following binaries: `
+ \n        `${missingPaths.join(',')}. Please either call setWasmPaths with a ` + \n
        `map providing a path for each binary, or with a string indicating ` + \n
        `the directory where all the binaries can be found.);\n    }\n  }\n\n  customFetch = usePlatformFetch;\n}\n\n/** Used in unit tests. */\nexport function resetWasmPath(): void {\n
  wasmPath = null;\n  wasmPathPrefix = null;\n  wasmFileMap = {};\n  customFetch = false;\n  initAborted =
false;\n}\n\nlet threadsCount = -1;\nlet actualThreadsCount = -1;\n\n/**\n * Sets the number of threads that will be
used by XNNPACK to create\n * threadpool (default to the number of logical CPU cores).\n *\n * This must be
called before calling `tf.setBackend('wasm')`.\n */\nexport function setThreadsCount(numThreads:
number) {\n  threadsCount = numThreads;\n}\n\n/**\n * Gets the actual threads count that is used by
XNNPACK.\n *\n * It is set after the backend is initialized.\n */\nexport function getThreadsCount(): number {\n
  if (actualThreadsCount === -1) {\n    throw new Error('WASM backend not initialized.);\n  }\n  return
actualThreadsCount;\n}\n\n"/** @license See the LICENSE file. */\n\n// This code is auto-generated, do not modify
this file!\nconst version = '3.11.0';\nexport {version};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All
Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND,\n * either express or implied.\n * See the License for the specific language governing
permissions and\n * limitations under the License.\n *\n *
===== \n
*/\n\nimport './flags_wasm';\n\nimport {registerBackend} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm,
init} from './backend_wasm';\n\nexport {BackendWasm, getThreadsCount, setThreadsCount, setWasmPath,
setWasmPaths} from './backend_wasm';\n\nexport {version as version_wasm} from './version';\n\nconst
WASM_PRIORITY = 2;\nregisterBackend('wasm', async () => {\n  const {wasm} = await init();\n  return new
BackendWasm(wasm);\n},\n  WASM_PRIORITY);\n\n], "names": ["_FusedMatMul", "util", "Abs", "backend_util", "Add", "AddN", "Identity", "setup",

```

"Transpose","All","Any","wasmFunc","ArgMax","AvgPool","Reshape","BatchMatMul","slice_util","buffer","sliceI
mplCPU","Slice","BatchToSpaceND","Cast","Ceil","ClipByValue","concatImplCPU","Concat","Conv2D","Conv2
DBackpropInput","Cos","Cosh","CropAndResize","Cumsum","DepthToSpace","DepthwiseConv2dNative","Elu","s
upportsFullBroadcast","Equal","Exp","ExpandDims","Fill","FlipLeftRight","Floor","FloorDiv","FusedBatchNorm",
"FusedConv2D","FusedDepthwiseConv2D","GatherNd","gather_util","GatherV2","Greater","GreaterEqual","setup
Func","LeakyRelu","Less","LessEqual","Log","LogicalAnd","Max","Maximum","MaxPool","Mean","Min","Mini
mum","MirrorPad","Multiply","Neg","NonMaxSuppressionV3","NonMaxSuppressionV4","NonMaxSuppressionV5
","kernelFunc","NotEqual","OneHot","OnesLike","Pack","PadV2","Pow","Prelu","Prod","rangeImplCPU","Range"
,"RealDiv","Relu","Relu6","ResizeBilinear","Reverse","RotateWithOffset","Round","Rsqrt","ScatterNd","scatter_u
til","Select","Sigmoid","Sin","Softmax","SpaceToBatchND","SplitV","Sqrt","Square","SquaredDifference","Step","
StridedSlice","Sub","Sum","Tan","Tanh","Tile","TopK","Transform","Unpack","ZerosLike","registerKernel","env"
,"require\$\$0","require\$\$1","require\$\$2","global","require\$\$3","require\$\$4","KernelBackend","DataStorage","engin
e","wasmFactoryThreadedSimd","wasmFactory","deprecationWarn","registerBackend"],"mappings":";;;;;;;;;;;;
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KAAR,QAAQ,QAMnB;EAED;EACA,IAAY,iBAQX;EARD,WAAY,iBAaIB;MAC3B,6DAAU,CAAA;MACV,y
DAAQ,CAAA;MACR,2DAAS,CAAA;MACT,2DAAS,CAAA;MACT,mEAAa,CAAA;MACb,+DAAW,CAAA;M
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O,EAAE,KAAC,EAAC,GAAG,IAAI,CAAC;MACTc,MAAM,EAAC,CAAC,EAAE,CAAC,EAAE,IAAI,EAAE,sB
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CAAC;MAE/C,IAAI,MAAM,GAAG,CAAC,CAAC;MACf,IAAI,IAAI,IAAI,IAAI,EAAE;UACHB,MAAM,QAAQ
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AE,CAAC;OACtB;MACD,MAAM,wBAAwB,GAAG,sBAAsB,IAAI,IAAI;UAC3D,CAAC;UACD,OAAO,CAAC,
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SAAS,CAAC,GAAG,CAAC,CAAC,CAAC,MAAM,CAAC,CAAC,EAAE,CAAC;UAC/C,MAAM,GAAG,GAAG,
OAAO,CAAC,UAAU,CAAC,CAAC,CAAC,KAAK,EAAE,OAAO,IAAI,CAAC,CAAC,KAAK,CAAC,CAAC;UA
C5D,MAAM,KAAK,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,GAAG,CAAC,MAAM,CAAC,CAAC,E
AAE,CAAC;;UAGnD,IAAIC,aAAI,CAAC,aAAa,CAAC,GAAG,CAAC,KAAK,CAAC,KAAK,CAAC,EAAE;cAC
vC,OAAO,GAAG,CAAC;WACZ;UAED,QAAQ,CAAC,GAAG,EAAE,QAAQ,CAAC,CAAC,CAAC,KAAK,CAA
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CAAC,MAAM,EAAE,SAAS,EAAE,CAAC,CAAC,CAAC;MACxE,MAAM,gBAAGB,GAAG,MAAM,CAAC,CAAC,CAAC,CAAC;MACnC,MAAM,YAAY,GAAG,MAAM,CAAC,CAAC,CAAC,CAAC;MAC/B,MAAM,eAAe,GAAG,MAAM,CAAC,CAAC,CAAC,CAAC;MACIC,MAAM,aAAa,GAAG,MAAM,CAAC,CAAC,CAAC,CAAC;;MAEHc,OAAO,CAAC,IAAI,CAAC,KAAK,CAAC,SAAS,CAAC,CAAC;MAC9B,OAAO,EAAc,gBAAGB,EAAE,YAAY,EAAE,eAAe,EAAE,aAAa,EAAc,CAAC;EACIE;;ECxCA;,,,,,,,,,,,,,;EAuBA,IAAI,UAED,CAAC;EAE5D,SAASJ,OAAK,CAAC,OAAoB;MACjCI,UAAQ,GAAG,OAAO,CAAC,IAAI,CAAC,KAAK,CACzBuD,4BAAmB,EACnB,QAAQ;MACR;UACE,QAAQ;UACR,QAAQ;UACR,QAAQ;UACR,QAAQ;UACR,QAAQ;UACR,QAAQ;OACT,CAAC,CAAC;EACT,CAAC;EAED,SAAS,UAAU,CAAC,IAInB;MACC,MAAM,EAAc,OAAO,EAAE,MAAM,EAAE,KAAK,EAAc,GAAG,IAAI,CAAC;MACtC,MAAM,EAAc,YAAY,EAAE,aAAa,EAAE,cAAc,EAAc,GAAG,KAAK,CAAC;MAC5D,MAAM,EAAc,KAAK,EAAE,MAAM,EAAc,GAAG,MAAM,CAAC;MAE/B,MAAM,OAAO,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,KAAK,CAAC,MAAM,CAAC,CAAC,EAAE,CAAC;MACvD,MAAM,QAAQ,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,MAAM,CAAC,MAAM,CAAC,CAAC,EAAE,CAAC;MAEzD,MAAM,SAAS,GACxvD,UAAQ,CAAC,OAAO,EAAE,QAAQ,EAAE,aAAa,EAAE,YAAY,EAAE,cAAc,CAAC,CAAC;MAE7E,MAAM,EAAc,gBAAGB,EAAE,YAAY,EAAE,eAAe,EAAE,aAAa,EAAc,GACIE,iBAAiB,CAAC,OAAO,EAAE,SAAS,CAAC,CAAC;;MAG1C,OAAO,CAAC,IAAI,CAAC,KAAK,CAAC,eAAe,CAAC,CAAC;MACpC,OAAO,CAAC,IAAI,CAAC,KAAK,CAAC,aAAa,CAAC,CAAC;MAEIC,MAAM,qBAaQb,GACvB,OAAO,CAAC,UAAU,CAAC,CAAC,YAAY,CAAC,EAAE,OAAO,EAAE,gBAAGB,CAAC,CAAC;MAEIE,OAAO,qBAaQb,CAAC;EAC/B,CAAC;EAEM,MAAM,yBAaYb,GAaiB;MACrD,UAAU,EAAEuD,4BAAmB;MAC/B,WAaw,EAAE,MAAM;MACnB,SAAS,EAAE5D,OAAK;MAChB,UAAU,EAAE,UAA8B;GAC3C;;ECzED;,,,,,,,,,,,,,;EAuBA,IAAI,UAGsC,CAAC;EAE3C,SAASJ,OAAK,CAAC,OAAoB;MACjCI,UAAQ,GAAG,OAAO,CAAC,IAAI,CAAC,KAAK,CACzBwD,4BAAmB,EACnB,QAAQ;MACR;UACE,QAAQ;UACR,QAAQ;UACR,QAAQ;UACR,QAAQ;UACR,QAAQ;UACR,QAAQ;UACR,QAAQ;UACR,QAAQ;OACT,CAAC,CAAC;EACT,CAAC;EAED,SAAS,mBAAmB,CAAC,IAI5B;MACC,MAAM,EAAc,OAAO,EAAE,MAAM,EAAE,KAAK,EAAc,GAAG,IAAI,CAAC;MACtC,MAAM,EAAc,YAAY,EAAE,aAAa,EAAE,cAAc,EAAE,kBAakB,EAAc,GACnE,KAAK,CAAC;MACvD,MAAM,EAAc,KAAK,EAAE,MAAM,EAAc,GAAG,MAAM,CAAC;MAE/B,MAAM,OAAO,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,KAAK,CAAC,MAAM,CAAC,CAAC,EAAE,CAAC;MACvD,MAAM,QAAQ,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,MAAM,CAAC,MAAM,CAAC,CAAC,EAAE,CAAC;MAEzD,MAAM,SAAS,GAAGxD,UAAQ,CACtB,OAAO,EAAE,QAAQ,EAAE,aAAa,EAAE,YAAY,EAAE,cAAc,EAC9D,kBAakB,CAAC,CAAC;MAExB,MAAM,EAAc,gBAAGB,EAAE,YAAY,EAAE,eAAe,EAAE,aAAa,EAAc,GACIE,iBAAiB,CAAC,OAAO,EAAE,SAAS,CAAC,CAAC;;MAG1C,OAAO,CAAC,IAAI,CAAC,KAAK,CAAC,eAAe,CAAC,CAAC;MAEpC,MAAM,qBAaQb,GACvB,OAAO,CAAC,UAAU,CAAC,CAAC,YAAY,CAAC,EAAE,OAAO,EAAE,gBAAGB,CAAC,CAAC;MAEIE,MAAM,kBAakB,GAAG,OAAO,CAAC,UAAU,CAAC,EAAE,EAAE,OAAO,EAAE,aAAa,CAAC,CAAC;MAEIE,OAAO,CAAC,qBAaQb,EAAE,kBAakB,CAAC,CAAC;EACrD,CAAC;EAEM,MAAM,yBAaYb,GAaiB;MACrD,UAAU,EAAEwD,4BAAmB;MAC/B,WAaw,EAAE,MAAM;MACnB,SAAS,EAAE5D,OAAK;MAChB,UAAU,EAAE,mBAAuC;GACpD;;EC9ED;,,,,,,,,,,,,,;EAuBA,IAAI,UAGU,CAAC;EAEf,SAASJ,OAAK,CAAC,OAAoB;MACjCI,UAAQ,GAAG,OAAO,CAAC,IAAI,CAAC,KAAK,CACzByD,4BAAmB,EACnB,QAAQ;MACR;UACE,QAAQ;UACR,QAAQ;UACR,QAAQ;UACR,QAAQ;UACR,QAAQ;UACR,QAAQ;UACR,QAAQ;UACR,QAAQ;OACT,CAAC,CAAC;EACT,CAAC;EAED,SAAS,YAAU,CAAC,IAInB;MACC,MAAM,EAAc,OAAO,EAAE,MAAM,EAAE,KAAK,EAAc,GAAG,IAAI,CAAC;MACtC,MAAM,EAAc,YAAY,EAAE,aAAa,EAAE,cAAc,EAAE,YAAY,EAAc,GAAG,KAAK,CAAC;MACIE,MAAM,EAAc,KAAK,EAAE,MAAM,EAAc,GAAG,MAAM,CAAC;MAE/B,MAAM,OAAO,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,KAAK,CAAC,MAAM,CAAC,CAAC,EAAE,CAAC;MACvD,MAAM,QAAQ,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,MAAM,CAAC,MAAM,CAAC,CAAC,EAAE,CAAC;MAEzD,MAAM,SAAS,GAAGID,UAAQ,CACtB,OAAO,EAAE,QAAQ,EAAE,aAAa,EAAE,YAAY,EAAE,cAAc,EAC9D,YAAY,CAAC,CAAC;MAEIB,MAAM,EAAc,gBAAGB,EAAE,YAAY,EAAE,eAAe,EAAE,aAAa,EAAc,GACIE,iBAAiB,CAAC,OAAO,EAAE,SAAS,CAAC,CAAC;;MAIIC,OAAO,CAAC,IAAI,CAAC,KAAK,CAAC,aAAa,CAAC,CAAC;MAEIC,MAAM,qBAaQb,GACvB,OAAO,CAAC,UAAU,CAAC,CAAC,YAAY,CAAC,EAAE,OAAO,EAAE,gBAAGB,CAAC,CAAC;MACIE,MAAM,oBAaOB,GACtB,OAAO,CAAC,UAAU,CAAC,CAAC,YAAY,CAAC,EAAE,SAAS,EAAE,eAAe,CAAC

,CAAC;MAEnE,OAAO,CAAC,qBAAqB,EAAE,oBAAoB,CAAC,CAAC;EACvD,CAAC;EAEM,MAAM,yBAAyB,GAAiB;MACrD,UAAU,EAAEyD,4BAAmB;MAC/B,WAAW,EAAE,MAAM;MACnB,SAAS,EAAE7D,OAAK;MACHb,UAAU,EAAE8D,YAA8B;GAC3C;;EC9ED;;;;;;;;;;EAmBA,MAAMIC,uBAAqB,GAAG,KAAK,CAAC;EAC7B,MAAM,cAAc,GACvB,wBAAwB,CAACmC,iBAAQ,EAAEnC,uBAAqB,EAAE,MAAM,CAAC;;ECrBrE;;;;;;;;;;EAqBA,IAAI,UAESB,CAAC;EAE3B,SAAS5B,OAAK,CAAC,OAAoB;MACjC,UAAU,GAAG,OAAO,CAAC,IAAI,CAAC,KAAK,CAACgE,eAAM,EAAE,IAAI,aAAa;UACvD,QAAQ;UACR,QAAQ;UACR,QAAQ;UACR,QAAQ;UACR,QAAQ;OACT,CAAC,CAAC;EACL,CAAC;EAED,SAAS,MAAM,CACX,IAAsE;MACxE,MAAM,EAAC,MAAM,EAAE,OAAO,EAAE,KAAK,EAAC,GAAG,IAAI,CAAC;MACtC,MAAM,EAAC,OAAO,EAAC,GAAG,MAAM,CAAC;MACzB,MAAM,EAAC,KAAK,EAAE,OAAO,EAAE,QAAQ,EAAC,GAAG,KAAK,CAAC;MAEzC,MAAM,GAAG,GAAG,OAAO,CAAC,UAAU,CAAC,CAAC,GAAG,OAAO,CAAC,KAAK,EAAC,KAAK,CAAC,EAAE,OAAO,CAAC,CAAC;MACnE,MAAM,KAAK,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,GAAG,CAAC,MAAM,CAAC,CAAC,EAAE,CAAC;MAEnD,MAAM,WAAW,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,OAAO,CAAC,MAAM,CAAC,CAAC;MACiD,MAAM,SAAS,GAAG,WAAW,CAAC,C,EAAE,CAAC;MAEjC,UAAU,CAAC,SAAS,EAAE,KAAK,EAAE,OAAO,EAAE,QAAQ,EAAE,KAAK,CAAC,CAAC;MAEvD,OAAO,GAAG,CAAC;EACb,CAAC;EAEM,MAAM,YAAY,GAAiB;MACxC,UAAU,EAAEA,eAAM;MACiB,WAAW,EAAE,MAAM;MACnB,SAAS,EAAEH,e,OAAK;MACHb,UAAU,EAAE,MAA0B;GACvC;;ECzDD;;;;;;;;;;EAqBA,SAAS,QAAQ,CAAC,IAAoD;MACpE,MAAM,EAAC,MAAM,EAAE,EAAC,CAAC,EAAE,EAAE,OAAO,EAAC,GAAG,IAAI,CAAC;MACpC,MAAM,GAAG,GAAG,OAAO,CAAC,UAAU,CAAC,CAAC,CAAC,KAAK,EAAE,CAAC,CAAC,KAAK,CAAC,CAAC;MACjD,MAAM,OAAO,GAAG,OAAO,CAAC,kBAAkB,CAAC,GAAG,CAAC,CAAC;MACHd,OAAO,CAAC,IAAI,CAAC,CAAC,CAAC,CAAC;MACHb,OAAO,GAAG,CAAC;EACb,CAAC;EAEM,MAAM,cAAc,GAAiB;MACiC,UAAU,EAAEiE,iBAAQ;MACpB,WAAW,EAAE,MAAM;MACnB,UAAU,EAAE,QAA4B;GACzC;;ECjCD;;;;;;;;;;WAuBgB,IAAI,CACHb,IAAkE;MAEpE,MAAM,EAAC,MAAM,EAAE,OAAO,EAAE,KAAK,EAAC,GAAG,IAAI,CAAC;MACtC,MAAM,EAAC,IAAI,EAAC,GAAG,KAAK,CAAC;MAErB,IAAI,MAAM,CAAC,MAAM,KAAK,CAAC,EAAE;UACvB,OAAO,UAAU,CACb,EAAC,MAAM,EAAE,EAAC,KAAK,EAAE,MAAM,CAAC,CAAC,CAAC,EAAC,EAAE,OAAO,EAAE,KAAK,EAAE,EAAC,GAAG,EAAE,IAAI,EAAC,EAAC,CAAC,CAAC;OACHE;MAED,MAAM,KAAK,GAAG,MAAM,CAAC,CAAC,CAAC,CAAC,KAAK,CAAC;MAC9B,MAAM,KAAK,GAAG,MAAM,CAAC,CAAC,CAAC,CAAC,KAAK,CAAC;MAE9B,MAAM,CAAC,OAAO,CAAC,CAAC;UACdvE,aAAI,CAAC,iBAAiB,CACiB,KAAK,EAAE,CAAC,CAAC,KAAK,EACd,uDAAuD,CAAC,CAAC;UAC7DA,aAAI,CAAC,MAAM,CACP,KAAK,KAAK,CAAC,CAAC,KAAK,EACjB,MAAM,uDAAuD,CAAC,CAAC;OACpE,CAAC,CAAC;MAEH,MAAM,uBAuB,GAAiB,EAAE,CAAC;MACjD,MAAM,eAAe,GAAG,MAAM,CAAC,GAAG,CAAC,CAAC;UACiC,MAAM,SAAS,GACX,UAAU,CAAC,EAAC,MAAM,EAAE,EAAC,KAAK,EAAE,CAAC,EAAC,EAAE,OAAO,EAAE,KAAK,EAAE,EAAC,GAAG,EAAE,IAAI,EAAC,EAAC,CAAC,CAAC;UACiE,uBAAuB,CAAC,IAAI,CAAC,SAAS,CAAC,CAAC;UACxC,OAAO,SAAS,CAAC;OACiB,CAAC,CAAC;MAEH,MAAM,MAAM,GAAG,MAAM,C AAC,EAAC,MAAM,EAAE,eAAe,EAAE,OAAO,EAAE,KAAK,EAAE,EAAC,IAAI,EAAC,EAAC,CAAC,CAAC;MAEzE,uBAAuB,CAAC,OAAO,CAAC,CAAC,IAAI,OAAO,CAAC,WAAW,CAAC,CAAC,CAAC,MAAM,CAAC,CAAC,CAAC;MAEpE,OAAO,MAAM,CAAC;EACHB,CAAC;EAEM,MAAM,UAAU,GAAiB;MACtC,UAAU,EAAEW,e,aAAI;MACHb,WAAW,EAAE,MAAM;MACnB,UAAU,EAAE,IAAwB;GACrC;;ECjED;;;;;;;;;;EAYBA,IAAI,SAG6C,CAAC;EAEID,SAASIE,OAAK,CAAC,OAAoB;MACjC,SAAS,GAAG,OAAO,CAAC,IAAI,CAAC,KAAK,CAACmE,cAAK,EAAE,IAAI,aAAa;UACrD,QAAQ;UACR,OAAO;UACP,QAAQ;UACR,QAAQ;UACR,OAAO;UACP,OAAO;UACP,QAAQ;UACR,QAAQ;OACT,CAAC,CAAC;EACL,CAAC;EAED,SAAS,GAAG,CACR,IAAoE;MACiE,MAAM,EAAC,MAAM,EAAE,EAAC,CAAC,EAAC,EAAE,OAAO,EAAE,KAAK,EAAE,EAAC,QAAQ,EAAE,aAAa,EAAC,EAAC,GAAG,IAAI,CAAC;MAEtE,MAAM,QAAQ,GAAG,QAAQ,CAAC,GAAG,CACzB,CAAC,CAAC,EAAE,CAAC,KAAK,CAAC,CAAC,CAAC,CAAC,mBAAmB,CAAC,CAAC,KAAK,CAAC,CAAC,CAAC,GAAG,CAAC,CAAC,CAAC,CAAC,gBAAgB,CAAC;MAEvE,IAAIzE,aAAI,CAAC,aAAa,CAAC,CAAC,CAAC,KAAK,CAAC,KAAK,CAAC,EAAE;;;UAGrC,OAAO,IAAI,CAAC;cACV,OAAO;cACP,KAAK,EAAE,EAAC,KAAK,EAAE,QAAQ,EAAE,KAAK,EAAE,aAAa,EAAE,KAAK,EAAE,CAAC,CAAC,KAAK,EAAC;WAC/D,CAAC,CAAC;OACJ;MAED,MAAM,GAAG,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG,CAA

C,CAAC,CAAC,MAAM,CAAC,CAAC,EAAE,CAAC;MAC/C,MAAM,GAAG,GAAG,OAAO,CAAC,UAAU,CAAC,QAAQ,EAAE,CAAC,CAAC,KAAC,CAAC,CAAC;MACID,MAAM,aAAa,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,GAAG,CAAC,MAAM,CAAC,CAAC;MACxD,MAAM,KAAC,GAAG,aAAa,CAAC,EAAE,CAAC;MAE/B,MAAM,WAAG,GAAG,IAAI,UAAU,CAAC,IAAI,UAAU,CAAC,CAAC,CAAC,KAAC,CAAC,CAAC,MAAM,CAAC,CAAC;MAEnE,MAAM,eAAe,GAAG,QAAQ,CAAC,GAAG,CAAC,QAAQ,IAAI,QAAQ,CAAC,CAAC,CAAC,CAAC;MAC9D,MAAM,gBAAGB,GAAG,QAAQ,CAAC,GAAG,CAAC,QAAQ,IAAI,QAAQ,CAAC,CAAC,CAAC,CAAC,CAAC;MAC/D,MAAM,gBAAGB,GACIB,IAAI,UAAU,CAAC,IAAI,UAAU,CAAC,eAAe,CAAC,CAAC,MAAM,CAAC,CAAC;MAC3D,MAAM,iBAaIB,GACnB,IAAI,UAAU,CAAC,IAAI,UAAU,CAAC,gBAAGB,CAAC,CAAC,MAAM,CAAC,CAAC;MAE5D,SAAS,CACL,GAAG,EAAE,WAAG,EAAE,CAAC,CAAC,KAAC,CAAC,MAAM,EAAE,QAAQ,CAAC,CAAC,CAAC,KAAC,CAAC,EAAE,gBAAGB,EACrE,iBAaIB,EAAE,aAAa,EAAE,KAAC,CAAC,CAAC;MAC7C,OAAO,GAAG,CAAC;EACb,CAAC;EAEM,MAAM,WAAG,GAAiB;MACvC,UAAU,EAAEyE,cAAK;MACjB,WAAG,EAAE,MAAM;MACnB,UAAU,EAAE,GAuB;MACnC,SAAS,EAAEnE,OAAK;GACjB;;ECpFD;;;;;;;;;;;;;EAmBA,MAAM4B,uBAaQB,GAAG,KAAC,CAAC;EAC7B,MAAM,SAAS,GACIB,wBAaWB,CAACwC,YAAG,EAAExC,uBAaQB,CAAC;;ECrBxD;;;;;;;;;;;;;EAuBA,IAAI,SAaKE,CAAC;EAEvE,SAAS5B,OAAK,CAAC,OAAoB;MACjC,SAAS,GAAG,OAAO,CAAC,IAAI,CAAC,KAAC,CAACqE,cAAK,EAAE,IAAI,aAAa;UACrD,QAAQ;UACR,QAAQ;UACR,QAAQ;OACT,CAAC,CAAC;EACL,CAAC;EAED,SAAS,KAAC,CAAC,IAAiD;MAC9D,MAAM,EAAC,MAAM,EAAE,OAAO,EAAC,GAAG,IAAI,CAAC;MAC/B,MAAM,EAAC,CAAC,EAAE,KAAC,EAAC,GAAG,MAAM,CAAC;MAC1B,MAAM,GAAG,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,CAAC,CAAC,MAAM,CAAC,CAAC,EAAE,CAAC;MAC/C,MAAM,SAAS,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,KAAC,CAAC,MAAM,CAAC,CAAC,EAAE,CAAC;MAEzD,IAAI,OAAO,GAAG,GAAG,CAAC;MACIB,MAAM,KAAC,GAAG,CAAC,CAAC;MACHB,IAAI,WAAG,GAAG,KAAC,CAAC;MACxB,IAAI,KAAC,CAAC,KAAC,KAAC,SAAS,EAAE;UAC7B,WAAG,GAAG,IAAI,CAAC,EAAC,OAAO,EAAE,MAAM,EAAE,EAAC,CAAC,EAAC,EAAE,KAAC,EAAE,EAAC,KAAC,EAAE,SAAS,EAAC,EAAC,CAAC,CAAC;UACtE,OAAO,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,WAAG,CAAC,MAAM,CAAC,CAAC,EAAE,CAAC;OACxD;MAED,MAAM,GAAG,GAAG,OAAO,CAAC,UAAU,CAAC,CAAC,CAAC,KAAC,EAAE,SAAS,CAAC,CAAC;MACnD,MAAM,KAAC,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,GAAG,CAAC,MAAM,CAAC,CAAC,EAAE,CAAC;MACnD,SAAS,CAAC,OAAO,EAAE,SAAS,EAAE,KAAC,CAAC,CAAC;MAErC,IAAI,KAAC,CAAC,KAAC,KAAC,SAAS,EAAE;UAC7B,OAAO,CAAC,WAAG,CAAC,WAAG,CAAC,MAAM,CAAC,CAAC;OACzC;MACD,OAAO,GAAG,CAAC;EACb,CAAC;EAEM,MAAM,WAAG,GAAiB;MACvC,UAAU,EAAEA,cAAK;MACjB,WAAG,EAAE,MAAM;MACnB,SAAS,EAAErE,OAAK;MACHB,UAAU,EAAE,KAAyB;GACtC;;EC9DD;;;;;;;;;;;;;EAyBA,IAAI,QAEqC,CAAC;EAE1C,SAASA,OAAK,CAAC,OAAoB;MACjC,QAAQ,GAAG,OAAO,CAAC,IAAI,CAAC,KAAC,CAACsE,aAAI,EAAE,IAAI,WAAG;UACjD,QAAQ;UACR,QAAQ;UACR,QAAQ;UACR,QAAQ;OACT,CAAC,CAAC;EACL,CAAC;EAED,SAAS,IAAI,CAAC,IAIb;MACC,MAAM,EAAC,OAAO,EAAE,MAAM,EAAE,KAAC,EAAC,GAAG,IAAI,CAAC;MACtC,MAAM,EAAC,IAAI,EAAE,QAAQ,EAAC,GAAG,KAAC,CAAC;MAC/B,MAAM,EAAC,CAAC,EAAC,GAAG,MAAM,CAAC;MACnB,MAAM,GAAG,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,CAAC,CAAC,MAAM,CAAC,CAAC,EAAE,CAAC;MAC/C,IAAI,OAAO,GAAG,GAAG,CAAC;MACIB,IAAI,KAAC,GAAG,CAAC,CAAC;MAEd,MAAM,EAAC,UAAU,EAAE,IAAI,EAAE,YAAY,EAAE,kBAaKB,EAAC,GACtD,uBAaUB,CAAC,CAAC,EAAE,IAAI,EAAE,OAAO,CAAC,CAAC;MAE9C,IAAI,aAAa,GAAG,IAAI,CAAC;MACzB,IAAI,kBAaKB,EAAE;UACtB,MAAM,YAAY,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,UAAU,CAAC,MAAM,CAAC,CAAC,EAAE,CAAC;UACjE,IAAI,YAAY,KAAC,GAAG,EAAE;;;cAGxB,KAAC,GAAG,UAAU,CAAC;cACnB,OAAO,GAAG,YAAY,CAAC;cACvB,aAAa,GAAG1E,qBAAY,CAAC,gBAAGB,CACzC,aAAa,CAAC,MAAM,EAAE,KAAC,CAAC,KAAC,CAAC,MAAM,CAAC,CAAC;WAC/C;OACF;MAEDA,qBAAY,CAAC,0BAA0B,CACnC,MAAM,EAAE,aAAa,EAAE,KAAC,CAAC,KAAC,CAAC,MAAM,CAAC,CAAC;MAC/C,MAAM,CAAC,QAAQ,EAAE,WAAG,CAAC,GACzBA,qBAAY,CAAC,yBAAYB,CAAC,KAAK,CAAC,KAAC,EAAE,aAAa,CAAC,CAAC;MACvE,MAAM,UAAU,GAAGF,aAAI,CAAC,aAAa,CAAC,WAAG,CAAC,CAAC;MAEnD,MAAM,GAAG,GAAG,OAAO,CAAC,UAAU,CAAC,QAAQ,EAAE,KAAC,CAAC,KAAC,CAAC,CAAC;MACtD,IAAIA,aAAI,CAAC,aAAa,CAAC,KAAC,CAAC,KAAC,CAAC,KAAC,CAAC,EA

AE;UACzC,MAAM,KAAK,GAAG,OAAO,CAAC,SAAS,CAAC,GAAG,CAAC,GAAG,CAAC,MAAM,CAAC,C
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,UAAU,CAAC,MAAM,CAAC,CAAC;OACxC;MAED,IAAI,QAAQ,EAAE;;UAEZ,MAAM,QAAQ,GAAGE,qBA
AY,CAAC,oBAAoB,CAAC,GAAG,CAAC,KAAK,EAAE,YAAY,CAAC,CAAC;UAC5E,GAAG,CAAC,KAAK,G
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in path(s):

* /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/tf-backend-wasm.es2017.js.map

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```
=====
*\n\nimport {KernelConfig, KernelFunc, Softmax, SoftmaxAttrs, SoftmaxInputs, TensorInfo, util} from
'@tensorflow/tfjs-core';\n\nimport {BackendWasm} from './backend_wasm';\n\nlet wasmFunc: (xId: number, outId:
number, channels: number, batch: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n
wasmFunc = backend.wasm.cwrap(Softmax, null /* void */, [\n 'number', // xId\n 'number', // outId\n
'number', // channels\n 'number' // batch\n ]);\n\nfunction softmax(\n args: {backend: BackendWasm,
inputs: SoftmaxInputs, attrs: SoftmaxAttrs}): \n TensorInfo {\n const {backend, inputs: {logits}, attrs: {dim}} =
args;\n const xId = backend.dataIdMap.get(logits.dataId).id;\n const out = backend.makeOutput(logits.shape,
logits.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n const channels = logits.shape[dim];\n
const batch = util.sizeFromShape(logits.shape) / channels;\n\n // Short-circuit
zero-sized tensors.\n if (util.sizeFromShape(out.shape) === 0) {\n return out;\n }\n\n wasmFunc(xId, outId,
channels, batch);\n return out;\n }\n\nexport const softmaxConfig: KernelConfig = {\n kernelName: Softmax,\n
backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: softmax as { } as KernelFunc\n};\n\n"]}
```

Found in path(s):

* /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Softmax.js.map

No license file was found, but licenses were detected in source scan.

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```

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```
=====
*\n\nimport './flags_wasm';\n\nimport {registerBackend} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm,
init} from './backend_wasm';\n\nexport {BackendWasm, getThreadsCount, setThreadsCount, setWasmPath,
setWasmPaths} from './backend_wasm';\n\nexport {version as version_wasm} from './version';\n\nconst
WASM_PRIORITY = 2;\nregisterBackend('wasm', async () => {\n const {wasm} = await init();\n return new
BackendWasm(wasm);\n }, WASM_PRIORITY);\n\n"]}
```

Found in path(s):

* /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/base.js.map

No license file was found, but licenses were detected in source scan.

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law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
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the specific language governing permissions and\n * limitations under the License.\n *
=====]\n
*\n\nimport { KernelConfig, KernelFunc, PadV2, PadV2Attrs, PadV2Inputs, util } from '@tensorflow/tfjs-
core';\n\nimport
{ BackendWasm } from '../backend_wasm';\n\nimport { fill } from './Fill';\n\nimport { CppDType } from
'./types';\n\nlet wasmPadV2: (\n  xId: number, xShapeBytes: Uint8Array, xShapeLength: number, xDtype:
number,\n  prePaddingsBytes: Uint8Array, postPaddingsBytes: Uint8Array,\n  constantValue: number, outId:
number) => void;\n\nfunction setup(backend: BackendWasm) {\n  wasmPadV2 = backend.wasm.cwrap(PadV2, null
/* void */, [\n    'number', // xId\n    'array', // x.shape\n    'number', // x.shape.length\n    'number', // x.dtype\n    'array', // pre-paddings\n    'array', // post-paddings\n    'number', // constantValue\n    'number', // outId\n  ]);\n\n  function pad(\n    args: { inputs: PadV2Inputs, backend: BackendWasm, attrs: PadV2Attrs }) {\n    const
{ inputs: { x }, backend, attrs: { paddings, constantValue } } = args;\n\n    const outShape = paddings.map((\n      (p, i) =>
p[0] /* beforePad */ + x.shape[i] + p[1] /* afterPad */);\n\n    if (util.sizeFromShape(x.shape)
```

```

==== 0) {\n // Short-circuit the computation, since x doesn't have value, only\n // the shape is used to compute
output shape to pad.\n return fill({\n backend,\n attrs: {shape: outShape, value: constantValue, dtype:
x.dtype}\n });\n }\n\n const xId = backend.dataIdMap.get(x.dataId).id;\n const out =
backend.makeOutput(outShape, x.dtype);\n const outTensorData = backend.dataIdMap.get(out.dataId);\n const
outId = outTensorData.id;\n\n const xShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);\n\n const
prePaddingsFlat = paddings.map(padTuple => padTuple[0]);\n const postPaddingsFlat = paddings.map(padTuple
=> padTuple[1]);\n const prePaddingsBytes =\n new Uint8Array(new Int32Array(prePaddingsFlat).buffer);\n\n
const postPaddingsBytes =\n new Uint8Array(new Int32Array(postPaddingsFlat).buffer);\n\n wasmPadV2(\n
xId, xShapeBytes, x.shape.length, CppDType[x.dtype], prePaddingsBytes,\n postPaddingsBytes, constantValue,
outId);\n\n return out;\n}\n\n\nexport const padV2Config: KernelConfig = {\n kernelName: PadV2,\n backendName: 'wasm',\n
kernelFunc: pad as {} as KernelFunc,\n setupFunc: setup\n};\n}

```

Found in path(s):

* /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/PadV2.js.map

No license file was found, but licenses were detected in source scan.

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","../src/kernels/Mean.ts","../src/kernels/Min.ts","../src/kernels/Minimum.ts","../src/kernels/MirrorPad.ts","../src/kern
els/Multiply.ts","../src/kernels/Neg.ts","../src/kernels/NonMaxSuppression_util.ts","../src/kernels/NonMaxSuppressi
onV3.ts","../src/kernels/NonMaxSuppressionV4.ts","../src/kernels/NonMaxSuppressionV5.ts","../src/kernels/NotEqu
al.ts","../src/kernels/OneHot.ts","../src/kernels/OnesLike.ts","../src/kernels/Pack.ts","../src/kernels/PadV2.ts","../src/k
ernels/Pow.ts","../src/kernels/Prelu.ts","../src/kernels/Prod.ts","../src/kernels/Range.ts","../node_modules/@tensorflow
w/tfjs-backend-
cpu/dist/kernels/Range_impl.js","../src/kernels/RealDiv.ts","../src/kernels/Relu.ts","../src/kernels/Relu6.ts","../src/kern
els/ResizeBilinear.ts","../src/kernels/Reverse.ts","../src/kernels/RotateWithOffset.ts","../src/kernels/Round.ts","../sr
c/kernels/Rsqrt.ts","../src/kernels/ScatterNd.ts","../src/kernels/Select.ts","../src/kernels/Sigmoid.ts","../src/kernels/Sin
.ts","../src/kernels/Softmax.ts","../src/kernels/SpaceToBatchND.ts","../src/kernels/SplitV.ts","../src/kernels/Sqrt.ts",".
../src/kernels/Square.ts","../src/kernels/SquaredDifference.ts","../src/kernels/Step.ts","../src/kernels/StridedSlice.ts","..
../src/kernels/Sub.ts","../src/kernels/Sum.ts","../src/kernels/Tan.ts","../src/kernels/Tanh.ts","../src/kernels/Tile.ts","../sr
c/kernels/TopK.ts","../src/kernels/Transform.ts","../src/kernels/ZerosLike.ts","../src/register_all_kernels.ts","../src/ke
rnels/Unpack.ts","../src/flags_wasm.ts","../wasm-out/tfjs-backend-wasm-threaded-simd.js","../wasm-out/tfjs-

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backend-wasm.js", "../src/backend_wasm.ts", "../wasm-out/tfjs-backend-wasm-threaded-
simd.worker.js", "../src/version.ts", "../src/base.ts"], "sourcesContent": ["/**\n
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2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT
WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific
language governing permissions and\n * limitations under the License.\n *
=====
\n
*/\n\n// This enum must align with the enum defined in cc/backend.h.\nexport enum CppDType {\n float32 = 0,\n
int32 = 1,\n bool = 2,\n string = 3,\n complex64 = 4\n}\n\n// Must match enum in cc/fusable_activations.h.\nexport
enum FusableActivation {\n linear = 0,\n relu = 1,\n relu6 = 2,\n prelu = 3,\n leakyrelu = 4,\n sigmoid = 5,\n elu
= 6\n}\n\n", "/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache
License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You
may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required
by applicable law or agreed to in writing, software\n
 * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR
CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing
permissions and\n * limitations under the License.\n *
=====
\n
*/\n\nimport { _FusedMatMul, _FusedMatMulAttrs, _FusedMatMulInputs, KernelConfig, KernelFunc } from
'@tensorflow/tfjs-core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nimport { FusableActivation } from
'./types';\n\nlet wasmFusedMatMul: (\n  aId: number, aShape: Uint8Array, aShapeSize: number, bId: number,\n
bShape: Uint8Array, bShapeSize: number, transposeA: boolean,\n  transposeB: boolean, activation: number,\n
biasId: number,\n  preluActivationWeightsId: number, leakyreluAlpha: number, outId: number) =>\n
void;\n\nfunction setup(backend: BackendWasm) {\n  wasmFusedMatMul = backend.wasm.cwrap(_FusedMatMul,\n
null /* void */, [\n
    'number', // a_id\n    'array', // a_shape\n    'number', // a_shape.length\n    'number', // b_id\n    'array', //
b_shape\n    'number', // b_shape.length\n    'number', // transpose_a\n    'number', // transpose_b\n    'number', //
activation\n    'number', // biasId\n    'number', // preluActivationWeightsId\n    'number', // leakyreluAlpha\n
    'number' // out_id\n  ]);\n\n  function fusedBatchMatMul(args: {\n    inputs: _FusedMatMulInputs,\n    backend:
BackendWasm,\n    attrs: _FusedMatMulAttrs\n  }) {\n    const {inputs, backend, attrs} = args;\n    const {a, b, bias,\n    preluActivationWeights} = inputs;\n\n    if (a.dtype !== 'float32' || b.dtype !== 'float32') {\n      throw new Error(\n
`_FusedMatMul for non non-float32 tensors not yet supported.`);\n    }\n\n    const {transposeA, transposeB,\n    activation, leakyreluAlpha} = attrs;\n    const aId = backend.dataIdMap.get(a.dataId).id;\n    const bId =
backend.dataIdMap.get(b.dataId).id;\n\n    let biasId = 0;\n    if (bias !== null)\n      {\n        const biasData = backend.dataIdMap.get(bias.dataId);\n        if (biasData.shape.length !== 1) {\n          throw new
Error(\n            `_FusedMatMul only supports rank-1 bias but got ` +\n              `rank ${biasData.shape.length}`);\n        }\n        biasId = biasData.id;\n      }\n\n    const preluActivationWeightsId = preluActivationWeights == null ?\n      0 : \n      backend.dataIdMap.get(preluActivationWeights.dataId).id;\n\n    const fusedActivation =\n      FusableActivation[activation as {}] as keyof typeof FusableActivation;\n\n    if (fusedActivation == null) {\n      throw
new Error(\n        `${activation} activation not yet supported for FusedConv2D ` +\n          `in the wasm backend.`);\n    }\n\n    const leftDim = transposeA ? a.shape[2] : a.shape[1];\n    const rightDim = transposeB ? b.shape[1] :
b.shape[2];\n    const batchDim = a.shape[0];\n\n    const out = backend.makeOutput([batchDim, leftDim, rightDim],\n
a.dtype);\n    const outId = backend.dataIdMap.get(out.dataId).id;\n\n    const aShapeBytes = new Uint8Array(new
Int32Array(a.shape).buffer);\n    const bShapeBytes = new Uint8Array(new Int32Array(b.shape).buffer);\n\n    wasmFusedMatMul(\n      aId, aShapeBytes, a.shape.length, bId, bShapeBytes, b.shape.length,\n      transposeA,

```

```

transposeB, fusedActivation, biasId, preluActivationWeightsId,\n    leakyreluAlpha || 0, outId);\n\n return
out;\n}\n\nexport const fusedMatMulConfig: KernelConfig = {\n  kernelName: '_FusedMatMul',\n  backendName:
'wasm',\n  setupFunc: setup,\n  kernelFunc: fusedBatchMatMul as { } as KernelFunc\n};\n\n", "/**\n * @license\n *
Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
'License');\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an 'AS IS' BASIS,\n *
WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport { DataType, KernelConfig, TensorInfo, UnaryInputs, util } from '@tensorflow/tfjs-core';\n\nimport
{ BackendWasm } from '../backend_wasm';\n\nimport { CppDType } from './types';\n\nexport function
createUnaryKernelConfig(\n  kernelName: string, outType?: DataType): KernelConfig {\n  let wasmFunc: (xId:
number, dtype: number, outId: number) => void;\n\n  function setupFunc(backend: BackendWasm): void {\n
wasmFunc = backend.wasm.cwrap(kernelName, null /* void */, [\n    'number', // x_id\n    'number', // dtype\n    'number', // out_id\n  ]);\n\n  function kernelFunc(args: { backend: BackendWasm, inputs: UnaryInputs }):\n    TensorInfo {\n    const { backend, inputs: { x } } = args;\n    const xId = backend.dataIdMap.get(x.dataId).id;\n
    const out = backend.makeOutput(x.shape, outType || x.dtype);\n    const outId =
backend.dataIdMap.get(out.dataId).id;\n\n    // Short-circuit zero-sized tensors.\n    if (util.sizeFromShape(out.shape)
=== 0) {\n      return out;\n    }\n\n    wasmFunc(xId, CppDType[x.dtype], outId);\n    return out;\n  }\n\n  return
{ kernelName, backendName: 'wasm', setupFunc, kernelFunc };\n}\n\n", "/**\n * @license\n * Copyright 2019 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the 'License');\n * you may not
use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an 'AS IS' BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions
and\n * limitations under the License.\n *
=====\n
*/\n\nimport { Abs, KernelConfig } from '@tensorflow/tfjs-core';\n\nimport { createUnaryKernelConfig } from
'./unary_kernel';\n\nexport const absConfig: KernelConfig = createUnaryKernelConfig(Abs);\n\n", "/**\n * @license\n *
Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
'License');\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an 'AS IS' BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*/\n\nimport { backend_util, BinaryInputs, DataType, KernelConfig, TensorInfo, util } from '@tensorflow/tfjs-
core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nimport { CppDType } from './types';\n\nexport
function createBinaryKernelConfig(\n  kernelName: string, supportsFullBroadcast: boolean,\n  dtype?:
DataType): KernelConfig {\n  let wasmFunc:\n    (aId: number, aShape: Uint8Array, aShapeLen: number, bId:
number,\n    bShape: Uint8Array, bShapeLen: number, dtype: number, outId: number) =>\n      void;\n\n  function setupFunc(backend: BackendWasm): void {\n    wasmFunc = backend.wasm.cwrap(kernelName, null /*
void */, [\n      'number', // a_id,\n      'array', // a_shape\n      'number', // a_shape.length\n      'number', // b_id\n      'array', // b_shape\n      'number', // b_shape.length\n      'number', // dtype\n      'number', // out_id\n    ]);\n\n  function kernelFunc(args: { backend: BackendWasm, inputs:

```

```
BinaryInputs}):  
TensorInfo {  
  const {backend, inputs} = args;  
  const {a, b} = inputs;  
  const aId =  
    backend.dataIdMap.get(a.dataId).id;  
  const bId = backend.dataIdMap.get(b.dataId).id;  
  const outputType =  
    dtype != null ? dtype : a.dtype;  
  const newShape = backend_util.assertAndGetBroadcastShape(a.shape,  
    b.shape);  
  const out = backend.makeOutput(newShape, outputType);  
  // Short-circuit zero-sized tensors.  
  if (util.sizeFromShape(newShape) === 0) {  
    return out;  
  }  
  const aShapeBytes = new Uint8Array(new  
    Int32Array(a.shape).buffer);  
  const bShapeBytes = new Uint8Array(new Int32Array(b.shape).buffer);  
  const  
    outId = backend.dataIdMap.get(out.dataId).id;  
  const kernelFunc = () => wasmFunc(  
    aId, aShapeBytes,  
    a.shape.length, bId, bShapeBytes, b.shape.length,  
    CppDType[a.dtype], outId);  
  // Currently only some  
  float operations support full broadcast.  
  if (supportsFullBroadcast && a.dtype ===  
    'float32') {  
    kernelFunc();  
    return out;  
  }  
  const aBroadcastDims =  
    backend_util.getBroadcastDims(a.shape, newShape);  
  const bBroadcastDims =  
    backend_util.getBroadcastDims(b.shape, newShape);  
  const loopsOverAllOfA = aBroadcastDims.every((v, i) =>  
    v === i);  
  const loopsOverAllOfB = bBroadcastDims.every((v, i) => v === i);  
  if (loopsOverAllOfA &&  
    loopsOverAllOfB) {  
    kernelFunc();  
    return out;  
  } else {  
    throw new Error(  
      `Broadcasting  
      along outer dims is not yet` +  
      `supported for ${a.dtype} ${kernelName}.`);  
  }  
  return  
    {kernelName, backendName: 'wasm', setupFunc, kernelFunc};  
}  
  
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 * you may not  
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 * http://www.apache.org/licenses/LICENSE-2.0  
 * Unless  
 * required by applicable law or agreed to in writing, software  
 * distributed under the License is distributed on an  
 * "AS IS"  
 * BASIS,  
 * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.  
 * See the License for the specific language governing permissions and  
 * limitations under the License.  
 */  
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```
=====\\n
*\\n\\nimport {Identity, IdentityInputs, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';\\nimport
{TensorInfo} from '@tensorflow/tfjs-core';\\n\\nimport {BackendWasm} from '../backend_wasm';\\n\\nexport function
identity(args: {inputs: IdentityInputs, backend: BackendWasm}):\\n  TensorInfo {\\n  const {inputs: {x}, backend} =
args;\\n  const out = backend.makeOutput(x.shape, x.dtype);\\n  const inVals = backend.toArrayFromHeap(x);\\n
const outVals = backend.toArrayFromHeap(out);\\n  outVals.set(inVals);\\n  return out;\\n}\\n\\nexport const
identityConfig: KernelConfig = {\\n  kernelName: Identity,\\n  backendName: 'wasm',\\n
  kernelFunc: identity as { } as KernelFunc,\\n};\\n", "/*\\n * @license\\n * Copyright 2019 Google LLC. All Rights
Reserved.\\n * Licensed under the Apache License, Version 2.0 (the \"License\");\\n * you may not use this file
except in compliance with the License.\\n * You may obtain a copy of the License at\\n *
http://www.apache.org/licenses/LICENSE-2.0\\n * Unless required by applicable law or agreed to in writing,
software\\n * distributed under the License is distributed on an \"AS IS\" BASIS,\\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\\n * See the License for the specific language
governing permissions and\\n * limitations under the License.\\n *
```

```
=====\\n
*\\n\\nimport {KernelConfig, KernelFunc, TensorInfo, Transpose, TransposeAttrs, TransposeInputs} from
'@tensorflow/tfjs-core';\\nimport {BackendWasm} from '../backend_wasm';\\nimport {identity} from
'./Identity';\\nimport {CppType}
from './types';\\n\\nlet wasmTranspose: (\\n  xId: number, xShape: Uint8Array, xShapeLength: number, dtype:
CppType,\\n  outId: number, perm: Uint8Array, permLength: number) => void;\\n\\nfunction setup(backend:
BackendWasm) {\\n  wasmTranspose = backend.wasm.cwrap(Transpose, null /* void */, [\\n    'number', // xId\\n
'array', // x.shape\\n    'number', // x.shape.length\\n    'number', // dtype\\n    'number', // outId\\n
'array', // perm\\n    'number', // perm.length\\n  ]);\\n}\\n\\nexport function transpose(\\n  args: {\\n    {inputs: TransposeInputs, backend:
BackendWasm, attrs: TransposeAttrs}):\\n  TensorInfo {\\n  const {inputs, backend, attrs} = args;\\n  // Reduce any
dimensions with size one. Lower-rank transpose kernel performs\\n  // better due to simpler memory access pattern.\\n
const [reducedShape, perm] = removeOneSizeDims(inputs.x.shape, attrs.perm);\\n\\n  let permIsNoOp = true;\\n  for
(let i = 0; i < perm.length; i++) {\\n    if (perm[i] !== i) {\\n      permIsNoOp
= false;\\n    }\\n  }\\n  const outShape = computeOutShape(inputs.x.shape, attrs.perm);\\n  const x = {\\n    dataId:
inputs.x.dataId,\\n    shape: reducedShape,\\n    dtype: inputs.x.dtype\\n  };\\n  if (permIsNoOp) {\\n    const cloned =
identity({inputs, backend});\\n    cloned.shape = outShape;\\n    return cloned;\\n  }\\n  const out =
backend.makeOutput(outShape, x.dtype);\\n  const xId = backend.dataIdMap.get(x.dataId).id;\\n  const outId =
backend.dataIdMap.get(out.dataId).id;\\n  const permBytes = new Uint8Array(new Int32Array(perm).buffer);\\n
const xShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);\\n  wasmTranspose(\\n    xId,
xShapeBytes, x.shape.length, CCppType[x.dtype], outId, permBytes,\\n    perm.length);\\n  return
out;\\n}\\n\\nfunction computeOutShape(inShape: number[], perm: number[]): number[] {\\n  const outShape = new
Array(inShape.length);\\n  for (let i = 0; i < outShape.length; i++) {\\n    outShape[i] = inShape[perm[i]];\\n  }\\n
return outShape;\\n}\\n\\nfunction
removeOneSizeDims(\\n  shape: number[], perm: number[]): [number[], number[]] {\\n  const newShape: number[]
= [];\\n  const newPerm: number[] = [];\\n  for (let i = 0; i < shape.length; ++i) {\\n    if (shape[i] !== 1) {\\n
newShape.push(shape[i]);\\n    }\\n    if (shape[perm[i]] !== 1) {\\n      newPerm.push(perm[i]);\\n    }\\n  }\\n  for (let i =
0; i < newPerm.length; ++i) {\\n    let minValIdx = -1;\\n    for (let j = 0; j < newPerm.length; ++j) {\\n      if
(newPerm[j] >= i && (minValIdx === -1 || newPerm[minValIdx] > newPerm[j])) {\\n        minValIdx = j;\\n
      }\\n    }\\n    newPerm[minValIdx] = i;\\n  }\\n  return [newShape, newPerm];\\n}\\n\\nexport const transposeConfig:
KernelConfig = {\\n  kernelName: Transpose,\\n  backendName: 'wasm',\\n  kernelFunc: transpose as { } as
```

KernelFunc,\n setupFunc: setup,\n};\n", "/*\n * @license\n * Copyright 2020 Google Inc. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *

```
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*\n\nimport {backend_util, TensorInfo, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from\n'./backend_wasm';\nimport {transpose} from './Transpose';\n\n/*\n * Compute permutation axes and do a transpose\n if necessary.\n *\n * Used by reduction ops.\n *\n * @param x input TensorInfo\n * @param axis reduction axes\n * @param backend wasm backend instance\n */\nexport function permuteAxesAndTranspose(\n  x: TensorInfo,\n  axis: number|number[],\n  backend: BackendWasm): {\n  transposed: TensorInfo|null,\n  axes: number[],\n  originalAxes: number[],\n  inputWasTransposed: boolean\n} {\n  const xShape = x.shape;\n  const xRank = x.shape.length;\n\n  const originalAxes = util.parseAxisParam(axis, xShape);\n  let axes = originalAxes;\n  const permutedAxes =\n    backend_util.getAxesPermutation(axes, xRank);\n  let xTransposed = null;\n  let inputWasTransposed = false;\n  if (permutedAxes != null) {\n    const newShape: number[] = new Array(xRank);\n    for (let i = 0; i <\n      newShape.length; i++) {\n      newShape[i] = xShape[permutedAxes[i]];\n    }\n\n    axes =\n      backend_util.getInnerMostAxes(axes.length, xRank);\n    xTransposed =\n      transpose({inputs: {x}, attrs: {perm:\n        permutedAxes}, backend});\n\n    const xId = backend.dataIdMap.get(x.dataId).id;\n    const transposedId =\n      backend.dataIdMap.get(xTransposed.dataId).id;\n    if (transposedId !== xId) {\n      inputWasTransposed = true;\n    }\n  }\n\n  return {transposed:\n    xTransposed, originalAxes, axes, inputWasTransposed};\n}\n\n/*\n * @license\n * Copyright 2021 Google LLC.\n All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this\n file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\n OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n governing permissions and\n * limitations under the License.\n *
```

```
=====
*\n\nimport {All, AllAttrs, AllInputs, backend_util, KernelConfig, KernelFunc, TensorInfo, util} from\n'@tensorflow/tfjs-core';\nimport {BackendWasm} from './backend_wasm';\nimport\n{permuteAxesAndTranspose} from\n'./kernel_utils';\n\nlet wasmAll: (xId: number, reduceSize: number, outId: number) => void;\n\nfunction\nsetup(backend: BackendWasm): void {\n  wasmAll = backend.wasm.cwrap(All, null /*void*/, ['number, number,\n    number']);\n\n  function all(args: {backend: BackendWasm, inputs: AllInputs, attrs: AllAttrs}): TensorInfo {\n    const {backend, inputs, attrs} = args;\n    const {axis, keepDims} = attrs;\n    const {x} = inputs;\n    const xId =\n      backend.dataIdMap.get(x.dataId).id;\n    let inputId = xId;\n    let input = x;\n\n    const {transposed, axes, originalAxes,\n      inputWasTransposed} =\n      permuteAxesAndTranspose(x, axis, backend);\n\n    if (inputWasTransposed) {\n      const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n      input = transposed;\n      inputId =\n        transposedId;\n    }\n\n    const inputRank = input.shape.length;\n    backend_util.assertAxesAreInnerMostDims('all',\n      axes, inputRank);\n    const [outShape, reduceShape] =\n      backend_util.computeOutAndReduceShapes(input.shape,\n        axes);\n    const reduceSize = util.sizeFromShape(reduceShape);\n\n    const out = backend.makeOutput(outShape,\n      x.dtype);\n    if (util.sizeFromShape(input.shape) !== 0) {\n      const outId = backend.dataIdMap.get(out.dataId).id;\n      wasmAll(inputId, reduceSize, outId);\n    }\n\n    if (inputWasTransposed) {\n      // dispose of the transposed tensor.\n      backend.disposeData(transposed.dataId);\n    }\n\n    if (keepDims) {\n      // reshape\n      const newShape =
```

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backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n  out.shape = newShape;\n }\n\n return
out;\n}\n\nexport const allConfig: KernelConfig = {\n  kernelName: All,\n  backendName: 'wasm',\n  setupFunc:
setup,\n  kernelFunc: all as {} as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2021 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n
*\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is
distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n *
=====
*\n\nimport { Any, AnyAttrs, AnyInputs, backend_util, KernelConfig, KernelFunc, TensorInfo, util } from
'@tensorflow/tfjs-core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nimport
{ permuteAxesAndTranspose } from '../kernel_utils';\n\nlet wasmAny: (xId: number, reduceSize: number, outId:
number) => void;\n\nfunction setup(backend: BackendWasm): void {\n  wasmAny = backend.wasm.cwrap(Any,
null /*void*/, ['number, number, number']);\n}\n\nfunction any(args: { backend: BackendWasm, inputs: AnyInputs,
attrs: AnyAttrs }):\n  TensorInfo {\n  const { backend,
inputs, attrs } = args;\n  const { axis, keepDims } = attrs;\n  const { x } = inputs;\n  const xId =
backend.dataIdMap.get(x.dataId).id;\n  let inputId = xId;\n  let input = x;\n\n  const { transposed, axes, originalAxes,
inputWasTransposed } =\n    permuteAxesAndTranspose(x, axis, backend);\n\n  if (inputWasTransposed) {\n
const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n  input = transposed;\n  inputId =
transposedId;\n  }\n\n  const inputRank = input.shape.length;\n  backend_util.assertAxesAreInnerMostDims('any',
axes, inputRank);\n  const [outShape, reduceShape] =\n
backend_util.computeOutAndReduceShapes(input.shape, axes);\n  const reduceSize =
util.sizeFromShape(reduceShape);\n\n  const out = backend.makeOutput(outShape, x.dtype);\n  if
(util.sizeFromShape(input.shape) !== 0) {\n    const outId = backend.dataIdMap.get(out.dataId).id;\n
wasmAny(inputId, reduceSize, outId);\n  }\n\n  if (inputWasTransposed) {\n    // dispose of the transposed tensor.\n
backend.disposeData(transposed.dataId);\n  }\n\n  if (keepDims) {\n    // reshape\n    const newShape =
backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n    out.shape = newShape;\n  }\n\n  return
out;\n}\n\nexport const anyConfig: KernelConfig = {\n  kernelName: Any,\n  backendName: 'wasm',\n  setupFunc:
setup,\n  kernelFunc: any as {} as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the
License.\n *
=====
*\n\nimport { ArgMax, ArgMaxAttrs, ArgMaxInputs, KernelConfig, KernelFunc, util } from '@tensorflow/tfjs-
core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nimport { permuteAxesAndTranspose } from
'../kernel_utils';\n\nimport { CppDType } from '../types';\n\nlet wasmFunc: (\n  xId: number, dtype: number, outerSize:
number, innerSize: number,\n  outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n
wasmFunc = backend.wasm.cwrap(ArgMax, null /* void */, [\n  'number', // x_id\n  'number', // dtype\n  'number', // outer_size\n  'number', // inner_size\n  'number' // out_id\n]);\n}\n\nfunction argmax(\n  args:
{ inputs: ArgMaxInputs, backend: BackendWasm, attrs: ArgMaxAttrs }) {\n  const { backend, inputs, attrs } = args;\n
const { axis } = attrs as {} as ArgMaxAttrs;\n  const { x } = inputs as {} as ArgMaxInputs;\n  const xId =
backend.dataIdMap.get(x.dataId).id;\n  let

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inputId = xId; \n let input = x; \n \n const {transposed, axes, inputWasTransposed} = \n\npermuteAxesAndTranspose(x, axis, backend); \n \n if (inputWasTransposed) {\n   const transposedId =\nbackend.dataIdMap.get(transposed.dataId).id; \n   if (transposedId !== xId) {\n     // transpose was not a no-op. We\nwill need to dispose of this\n     // once we are done.\n     input = transposed; \n     inputId = transposedId; \n   }\n}\n\n const outShape = input.shape.slice(0, -1); \n const out = backend.makeOutput(outShape, 'int32'); \n const\noutId = backend.dataIdMap.get(out.dataId).id; \n const outerSize = util.sizeFromShape(out.shape); \n const\ninnerSize = input.shape[axes[0]]; \n const wasmFunc(inputId, CppDType[input.dtype], outerSize, innerSize, outId); \n \n \n if\n(inputWasTransposed) {\n   // dispose of the transposed tensor.\n   backend.disposeData(transposed.dataId); \n }\n\n return out; \n } \n \n\nexport const argMaxConfig: KernelConfig = {\n  kernelName: ArgMax,\n  backendName:\n'wasm',\n\n  kernelFunc: argmax as {} as KernelFunc,\n  setupFunc: setup\n}; \n\n\n\", \"/*\n * @license\n * Copyright 2019 Google\nLLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not\nuse this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *  
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,\nsoftware\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\nOR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\ngoverning permissions and\n * limitations under the License.\n *\n\n\n===== \n\n*\nimport {AvgPool, AvgPoolAttrs, AvgPoolInputs, backend_util, KernelConfig, KernelFunc, Tensor4D} from\n '@tensorflow/tfjs-core'; \n\nimport {BackendWasm} from './backend_wasm'; \n\nlet wasmAvgPool: (\n  xId: number, batchSize: number, inputHeight: number, inputWidth: number, \n  filterHeight: number, filterWidth:\nnumber, padTop: number, padRight: number, \n  padBottom: number, padLeft: number, strideHeight: number, \nstrideWidth: number, channels: number, outId: number) => void; \n\nfunction setup(backend: BackendWasm) {\n  wasmAvgPool = backend.wasm.cwrap(AvgPool, null /* void */, [\n    'number', // xId\n    'number', // batchSize\n    'number', // inputHeight\n    'number', // inputWidth\n    'number', // filterHeight\n    'number', // filterWidth\n    'number', // padTop\n    'number', // padRight\n    'number', // padBottom\n    'number', // padLeft\n    'number', // strideHeight\n    'number', // strideWidth\n    'number', // channels\n    'number', // outId\n  ]);\n\n\nfunction\navgPool(\n  args: {inputs: AvgPoolInputs, backend: BackendWasm, attrs: AvgPoolAttrs}) {\n    const {inputs, attrs,\nbackend} = args;\n    const x = inputs.x as Tensor4D;\n    const xId =\nbackend.dataIdMap.get(x.dataId).id;\n    const {filterSize, strides, pad, dimRoundingMode} = attrs;\n    const\nconvInfo = backend_util.computePool2DInfo((\n      x.shape, filterSize, strides, 1 /* dilations */ , pad,\ndimRoundingMode);\n    const filterHeight = convInfo.filterHeight;\n    const filterWidth = convInfo.filterWidth;\n    const padTop = convInfo.padInfo.top;\n    const padRight = convInfo.padInfo.right;\n    const padBottom =\nconvInfo.padInfo.bottom;\n    const padLeft = convInfo.padInfo.left;\n    const strideHeight = convInfo.strideHeight;\nconst strideWidth = convInfo.strideWidth;\nconst channels = convInfo.inChannels;\n    if (convInfo.dataFormat\n!== 'channelsLast') {\n      throw new Error(`\n      `wasm backend does not support dataFormat:` +\n`${convInfo.dataFormat}`. Please use 'channelsLast'.`);\n    }\n    if (convInfo.dilationWidth !== 1 ||\nconvInfo.dilationHeight !== 1) {\n      throw new Error(`\n      `was backend only supports average pooling with\ndilation = [1, 1],\n\n    ` +\n      `got [{${convInfo.dilationHeight}], ${convInfo.dilationWidth}]`.);\n    }\n    const out =\nbackend.makeOutput(convInfo.outShape, 'float32'); \n    const outId = backend.dataIdMap.get(out.dataId).id;\n    \n    wasmAvgPool(\n      xId, x.shape[0], x.shape[1], x.shape[2], filterHeight, filterWidth, \n      padTop, padRight,\npadBottom, padLeft, strideHeight, strideWidth, channels, \n      outId);\n    return out;\n  }\n\n\nexport const\navgPoolConfig: KernelConfig = {\n  kernelName: AvgPool,\n  backendName: 'wasm',\n  setupFunc: setup,\n  kernelFunc: avgPool as {} as KernelFunc\n}; \n\n\n\", \"/*\n * @license\n * Copyright 2019 Google LLC. All Rights\nReserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file\nexcept in compliance with the License.\n * You may obtain a copy of the License at\n *\n *  
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
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software\n * distributed under the License is distributed

on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *

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=====
*\n\nimport { KernelConfig, KernelFunc, Reshape, ReshapeAttrs, ReshapeInputs, util } from '@tensorflow/tfjs-core';
\n\nimport { BackendWasm } from '../backend_wasm';
\n\nexport function reshape(\n  args: { inputs: ReshapeInputs, attrs: ReshapeAttrs, backend: BackendWasm }) {\n  const { inputs, attrs } = args;\n  const { x } = inputs;\n  const { shape } = attrs;\n  const xSize = util.sizeFromShape(x.shape);\n  const $shape = util.inferFromImplicitShape(shape, xSize);\n  const util.assert(\n    xSize === util.sizeFromShape($shape),\n    () => `new shape: ${$shape}, old shape: ${x.shape}. New shape and old ` +\n      `shape must have the same number of elements.`);\n  // Backend needs to track refCount\n  for the dataId for reshape op\n  args.backend.incref(x.dataId);\n  return { dataId: x.dataId, shape: $shape, dtype: x.dtype };\n}\n\nexport const reshapeConfig: KernelConfig = {\n  kernelName: Reshape,\n  backendName: 'wasm',\n  kernelFunc: reshape as { } as KernelFunc\n};\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

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=====
*\n\nimport { BatchMatMul, BatchMatMulAttrs, BatchMatMulInputs, KernelConfig, KernelFunc, util } from '@tensorflow/tfjs-core';
\n\nimport { BackendWasm } from '../backend_wasm';
\n\nimport { reshape } from './Reshape';
\n\nlet wasmBatchMatMul: (\n  aId: number, aShape: Uint8Array, aShapeSize: number, bId: number, bShape: Uint8Array, bShapeSize: number, transposeA: boolean, transposeB: boolean, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n  wasmBatchMatMul = backend.wasm.cwrap(BatchMatMul, null /* void */, [\n    'number', // a_id\n    'array', // a_shape\n    'number', // a_shape.length\n    'number', // b_id\n    'array', // b_shape\n    'number', // b_shape.length\n    'number', // transpose_a\n    'number', // transpose_b\n    'number' // out_id\n  ]);\n\n  function batchMatMul(args: {\n    inputs: BatchMatMulInputs,\n    backend: BackendWasm,\n    attrs: BatchMatMulAttrs\n  }) {\n    const { inputs, backend, attrs } = args;\n    const { a, b } = inputs;\n    const { transposeA, transposeB } = attrs;\n\n    if (a.dtype !== 'float32' || b.dtype !== 'float32') {\n      throw new Error(`BatchMatMul for non float32 tensors not yet supported.`);\n    }\n\n    const aRank = a.shape.length;\n    const bRank = b.shape.length;\n    const innerShapeA = transposeA ? a.shape[aRank - 2] : a.shape[aRank - 1];\n    const innerShapeB = transposeB ? b.shape[bRank - 1] : b.shape[bRank - 2];\n    const outerShapeA = transposeA ? a.shape[aRank - 1] : a.shape[aRank - 2];\n    const outerShapeB = transposeB ? b.shape[bRank - 2] : b.shape[bRank - 1];\n    const outerDimsA = a.shape.slice(0, -2);\n    const outerDimsB = b.shape.slice(0, -2);\n    const batchDimA = util.sizeFromShape(outerDimsA);\n    const batchDimB = util.sizeFromShape(outerDimsB);\n    const batchDimsCompatible =\n      batchDimA === batchDimB || batchDimA === 1 || batchDimB === 1;\n    util.assert(\n      aRank >= 2 && bRank >= 2 && batchDimsCompatible,\n      () => `Error in matMul: the input batch dimensions must either be the ` +\n        `same or at least one input batch dimension must be 1. Got input ` +\n        `batch dimensions of (${outerDimsA}) and (${outerDimsB}).`);\n    const outShapeOuterDims =\n      batchDimA > batchDimB ? a.shape.slice(0, -2) : b.shape.slice(0, -2);\n    const outShape =\n      outShapeOuterDims.concat([outerShapeA, outerShapeB]);\n    util.assert(\n      innerShapeA === innerShapeB,\n      () => `Error in matMul: inner shapes (${innerShapeA}) and ` +\n        `${innerShapeB} of Tensors with shapes ${a.shape} and ` +\n        `${b.shape} and transposeA=${transposeA} ` +\n        `and transposeB=${transposeB}`
```


[illegible]


```
slicing_util.computeFlatOffset(begin_, xStrides);\n\n if (x.dtype === 'string') {\n   outData.stringBytes =\n(xVals as Uint8Array[])\n      .slice(flatOffset, flatOffset + util.sizeFromShape(size_));\n } else {\n   const\noutVals = backend.typedArrayFromHeap(out);\n   outVals.set(\n     (xVals as TypedArray)\n    \n.subarray(flatOffset, flatOffset + util.sizeFromShape(size_)));\n }\n\n return out;\n }\n\n if (x.dtype ===\n'string') {\n   const res = sliceImplCPU(xVals, begin_, size_, x.shape, x.dtype);\n   outData.stringBytes = res as\nUint8Array[];\n   return out;\n }\n\n const outVals = backend.typedArrayFromHeap(out);\n const\nrank = x.shape.length;\n if (rank === 2) {\n   slice2d(\n     xVals as TypedArray, xStrides[0], outVals, begin_\nas [number, number],\n     size_\as [number, number]);\n }\n } else if (rank === 3) {\n   slice3d(\n     xVals as\nTypedArray, xStrides[0], xStrides[1], outVals,\n     begin_\as [number, number, number], size_\as [number,\nnumber, number]);\n }\n } else if (rank === 4) {\n   slice4d(\n     xVals as TypedArray, xStrides[0], xStrides[1],\nxStrides[2], outVals,\n     begin_\as [number, number, number, number],\n     size_\as [number, number, number,\nnumber]);\n }\n }\n } else {\n   const res =\nsliceImplCPU(xVals, begin_, size_, x.shape, x.dtype) as TypedArray;\n   outVals.set(res);\n }\n}\n\nreturn out;\n}\n\nfunction slice2d(\n  xVals: backend_util.TypedArray, xStride:\nnumber,\n  outVals: backend_util.TypedArray, begin: [number, number],\nsize: [number, number]): void {\n  let\noutOffset = 0;\n  const beginI = begin[0];\n  const beginJ = begin[1];\n\n  const endI = beginI + size[0];\n  for (let i = beginI; i < endI; i++) {\n    const xOffset = i * xStride + beginJ;\n    outVals.set(xVals.subarray(xOffset, xOffset + size[1]),\noutOffset);\n    outOffset += size[1];\n  }\n}\n\nfunction\nslice3d(\n  xVals: backend_util.TypedArray, xStride1: number, xStride2: number,\n  outVals:\nbackend_util.TypedArray, begin: [number, number, number],\nsize: [number, number, number]): void {\n  let\noutOffset = 0;\n  const beginI = begin[0];\n  const beginJ = begin[1];\n  const beginK = begin[2];\n  const endI =\nbegInI + size[0];\n  const endJ = beginJ + size[1];\n  for (let i = beginI; i < endI; i++) {\n    for (let j = beginJ; j <\nextendJ; j++) {\n      const xOffset = i * xStride1 + j * xStride2 + beginK;\n      outVals.set(xVals.subarray(xOffset,\noxOffset + size[2]), outOffset);\n      outOffset += size[2];\n    }\n  }\n}\n\nfunction slice4d(\n  xVals:\nbackend_util.TypedArray, xStride1: number, xStride2: number,\n  xStride3: number, outVals:\nbackend_util.TypedArray,\nbegin: [number, number, number, number],\nsize: [number, number, number, number]): void {\n  let\noutOffset = 0;\n  const beginI = begin[0];\n  const beginJ = begin[1];\n  const beginK = begin[2];\n  const endl = beginI +\nsize[0];\n  const endJ = beginJ + size[1];\n  const endK = beginK + size[2];\n  const beginL = begin[3];\n\n  for (let i = beginI; i < endl; i++) {\n    for (let j = beginJ; j < nextendJ; j++) {\n      for (let k = beginK; k < nextendK; k++) {\n        const xOffset = i * xStride1 + j * xStride2 + k * xStride3 + beginL;\n        outVals.set(xVals.subarray(xOffset,\noxOffset + size[3]), outOffset);\n        outOffset += size[3];\n      }\n    }\n  }\n}\n\nexport const sliceConfig:\nKernelConfig = {\n  kernelName: Slice,\n  backendName: 'wasm',\n  kernelFunc: slice as { } as\nKernelFunc,\n};\n","**\n*\n @license\n *\n Copyright 2021 Google LLC. All Rights Reserved.\n *\n Licensed under the\nApache License, Version 2.0 (the \"License\");\n *\n you may not use\nthis file except in compliance with the License.\n *\n You may obtain a copy of the License at\n *\n\nhttp://www.apache.org/licenses/LICENSE-2.0\n *\n\n unless required by applicable law or agreed to in writing,\nsoftware\n *\n distributed under the License is distributed on an \"AS IS\" BASIS,\n *\n WITHOUT WARRANTIES\nOR CONDITIONS OF ANY KIND, either express or implied.\n *\n See the License for the specific language\n governing permissions and\n limitations under the License.\n *\n\n=====\n\n*/\nimport {backend_util, BatchToSpaceND, BatchToSpaceNDAattrs, BatchToSpaceNDInputs, KernelConfig,\nKernelFunc} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nimport\n{reshape} from './Reshape';\nimport {slice} from './Slice';\nimport {transpose} from './Transpose';\n\nfunction\nbatchToSpaceND(args: {\ninputs: BatchToSpaceNDInputs,\nbackend: BackendWasm,\nattribs:\nBatchToSpaceNDAattrs\n}) {\nconst\n{\ninputs, backend, attribs\n}= args;\nconst {x} = inputs;\nconst {blockShape, crops} = attribs;\n\nconst prod =\nblockShape.reduce((a, b) => a * b);\n\nconst reshaped = backend_util.getReshaped(x.shape, blockShape, prod);\n\nconst permuted = backend_util.getPermuted(reshaped.length, blockShape.length);\nconst reshapedPermuted =
```

```

backend_util.getReshapedPermuted(x.shape, blockShape, prod);
const sliceBeginCoords =
backend_util.getSliceBeginCoords(crops, blockShape.length);
const sliceSize =
backend_util.getSliceSize(reshapedPermuted, crops, blockShape.length);
const xReshaped = reshape({inputs:
{x}, backend, attrs: {shape: reshaped}});
const xTransposed =
transpose({inputs: {x: xReshaped}, backend,
attrs: {perm: permuted}});
const xTransposedReshaped = reshape(
{inputs: {x: xTransposed}, backend,
attrs: {shape: reshapedPermuted}});
const result = slice(
{inputs: {x: xTransposedReshaped}, backend,
attrs: {begin: sliceBeginCoords,
size: sliceSize}});
backend.disposeData(xReshaped.dataId);
backend.disposeData(xTransposed.dataId);
backend.disposeData(xReshaped.dataId);
return result;
}
export const batchToSpaceNDConfig:
KernelConfig = {
kernelName: BatchToSpaceND,
backendName: 'wasm',
kernelFunc: batchToSpaceND as
{} as KernelFunc
};
/**
 * @license
 * Copyright 2019 Google LLC. All Rights Reserved.
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under the Apache License, Version 2.0 (the "License");
 * you may not use this file except in compliance with the
License.
 * You may obtain a copy of the License at
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 * Unless required by applicable law or agreed to in writing, software
 * distributed under the License is distributed
on an "AS IS" BASIS,
 * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.
 * See the License for the specific language governing permissions and
 * limitations under the
License.
 */
=====
*/
import {Cast, CastAttrs, CastInputs, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';
import
{TensorInfo} from '@tensorflow/tfjs-core';
import {BackendWasm} from '../backend_wasm';
export function
cast(
args: {inputs: CastInputs, attrs: CastAttrs, backend: BackendWasm}):
TensorInfo {
const {inputs:
{x}, attrs: {dtype}, backend} = args;
const out = backend.makeOutput(x.shape, dtype);
const inVals =
backend.toArrayFromHeap(x);
const outVals = backend.toArrayFromHeap(out);
outVals.set(inVals);
return out;
}
export const castConfig: KernelConfig = {
kernelName: Cast,
backendName: 'wasm',
kernelFunc: cast as {} as KernelFunc
};
/**
 * @license
 * Copyright 2021 Google LLC. All Rights
Reserved.
 * Licensed under the Apache License, Version 2.0 (the "License");
 * you may not use this file
except in compliance with the License.
 * You may
obtain a copy of the License at
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 * Unless required by
applicable law or agreed to in writing, software
 * distributed under the License is distributed on an "AS IS"
BASIS,
 * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.
 * See the
License for the specific language governing permissions and
 * limitations under the License.
 */
=====
*/
import {KernelConfig, Ceil} from '@tensorflow/tfjs-core';
import {createUnaryKernelConfig} from
'../unary_kernel';
export const ceilConfig: KernelConfig = createUnaryKernelConfig(Ceil);
/**
 *
 * @license
 * Copyright 2019 Google LLC. All Rights Reserved.
 * Licensed under the Apache License, Version
2.0 (the "License");
 * you may not use this file except in compliance with the License.
 * You may obtain a
copy of the License at
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 *
 * Unless required by applicable law or agreed to in writing, software
 * distributed under the License is
distributed on an "AS IS" BASIS,
 * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
express or implied.
 * See the License for the specific language governing permissions and
 * limitations under the
License.
 */
=====
*/
import {ClipByValue, ClipByValueAttrs, ClipByValueInputs, KernelConfig, KernelFunc} from
'@tensorflow/tfjs-core';
import {BackendWasm} from '../backend_wasm';
let wasmClip: (xId: number, min:
number, max: number, outId: number) => void;
function setup(backend: BackendWasm) {
wasmClip =
backend.wasm.cwrap(ClipByValue, null /* void */, [
'number', // x_id
'number', // min
'number', //
max
'number' // out_id
]);
function clip(args: {
inputs: ClipByValueInputs,
backend:
BackendWasm,
attrs: ClipByValueAttrs
}) {
const

```

```

{inputs, backend, attrs} = args;\n const {x} = inputs;\n const {clipValueMin, clipValueMax} = attrs;\n const xId
= backend.dataIdMap.get(x.dataId).id;\n const out = backend.makeOutput(x.shape, x.dtype);\n const outId =
backend.dataIdMap.get(out.dataId).id;\n wasmClip(xId, clipValueMin, clipValueMax, outId);\n return
out;\n}\n\nexport const clipByValueConfig: KernelConfig = {\n  kernelName: ClipByValue,\n  backendName:
'wasm',\n  setupFunc: setup,\n  kernelFunc: clip as { } as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2019
Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you
may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF
ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n *
limitations under the License.\n *
=====
*\n\nimport {backend_util, Concat, ConcatAttrs, ConcatInputs, KernelConfig, KernelFunc, util} from
'@tensorflow/tfjs-core';\n\nimport {BackendWasm} from './backend_wasm';\nimport {concatImplCPU} from
'./kernel_utils/shared';\nimport {identity} from './Identity';\nimport {reshape} from './Reshape';\n\nexport function
concat(\n  args: {inputs: ConcatInputs, backend: BackendWasm, attrs: ConcatAttrs}) {\n  const {inputs, backend}
= args;\n\n  const axis = util.parseAxisParam(args.attrs.axis, inputs[0].shape)[0];\n  let outShape =
backend_util.computeOutShape(inputs.map(t => t.shape), axis);\n\n  // Keep only non-empty tensors (ignore tensors
with 0 in their shape).\n  const $inputs = inputs.filter(t => util.sizeFromShape(t.shape) > 0);\n  if ($inputs.length ===
1) {\n    return identity({inputs: {x: $inputs[0]}, backend});\n  }\n\n  const out = backend.makeOutput(outShape,
inputs[0].dtype);\n\n  if (util.sizeFromShape(outShape) === 0) {\n    return out;\n  }\n\n  const shapes =
$inputs.map(t => t.shape);\n  backend_util.assertParamsConsistent(shapes, axis);\n\n  if ($inputs[0].dtype ===
'string') {\n    // Any concat of n-dimensional tensors across any axis can be reduced to\n    // a concatenation of two-
dimensional tensors across the axis 1 by first\n    // partitioning the axes of the original tensors into those less than
the\n    // axis to be concatenated and the rest. Then reshape the tensors\n    // into a two-dimensional tensor by
collapsing these two sets of axes and\n    // concatenate the resulting matrices across the axis 1, finally reshaping\n
// the result to have the proper shape.\n    const inputs2D = $inputs.map(t => {\n      const innerSize =
util.sizeFromShape(t.shape.slice(axis));\n      const shape = [-1, innerSize];\n\n      return reshape({inputs: {x: t}, backend, attrs: {shape}});\n    });\n\n    const inputsValShapes = inputs2D.map(t
=> {\n      return {vals: backend.readSync(t.dataId), shape: t.shape};\n    });\n\n    // Concat 2d tensors along
axis=1.\n    outShape =\n      backend_util.computeOutShape(inputs2D.map(t => t.shape), 1 /* axis */);\n    const
simplyConcat = inputs2D[0].shape[0] === 1;\n    const outVals = concatImplCPU(\n      inputsValShapes, outShape, inputs[0].dtype,\n      simplyConcat) as string[];\n\n    const finalOutShape
=\n      backend_util.computeOutShape($inputs.map(t => t.shape), axis);\n\n    out.shape = finalOutShape;\n\n    const outData = backend.dataIdMap.get(out.dataId);\n    outData.stringBytes =
backend_util.fromStringArrayToUint8(outVals);\n\n    inputs2D.forEach(t => backend.disposeData(t.dataId));\n\n    return out;\n  }\n\n  const batchDim = util.sizeFromShape($inputs[0].shape.slice(0, axis));\n  let sumInnerDims =
0;\n  const innerDims = $inputs.map(input => {\n    const innerDim =
util.sizeFromShape(input.shape.slice(axis));\n    sumInnerDims += innerDim;\n    return innerDim;\n  });\n  const
inVals = $inputs.map(input => backend.toArrayFromHeap(input));\n  const outVals =
backend.toArrayFromHeap(out);\n  for (let b = 0; b < batchDim; b++) {\n    let outOffset = b * sumInnerDims;\n    for (let i = 0; i < inVals.length; i++) {\n      const innerDim = innerDims[i];\n      const inOffset = b * innerDim;\n      const vals = inVals[i].subarray(inOffset, inOffset + innerDim);\n      outVals.set(vals, outOffset);\n      outOffset +=
innerDim;\n    }\n  }\n  return out;\n}\n\nexport const concatConfig: KernelConfig = {\n  kernelName: Concat,\n  backendName: 'wasm',\n  kernelFunc: concat as { } as KernelFunc,\n};\n\n"/**\n * @license\n * Copyright 2020
Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you
may not use this file except in compliance

```



```

backend.dataIdMap.get(x.dataId).id;\n const filterId = backend.dataIdMap.get(filter.dataId).id;\n\n const {strides,
dilations, pad, dimRoundingMode, dataFormat} = attrs;\n const $dataFormat =
backend_util.convertConv2DDataFormat(dataFormat);\n const convInfo = backend_util.computeConv2DInfo(\n
(x as Tensor4D).shape, (filter as Tensor4D).shape, strides, dilations,\n   pad, dimRoundingMode, false,
$dataFormat);\n\n const filterHeight = convInfo.filterHeight;\n const filterWidth = convInfo.filterWidth;\n const
padTop = convInfo.padInfo.top;\n
const padRight = convInfo.padInfo.right;\n const padBottom = convInfo.padInfo.bottom;\n const padLeft =
convInfo.padInfo.left;\n const dilationHeight = convInfo.dilationHeight;\n const dilationWidth =
convInfo.dilationWidth;\n const strideHeight = convInfo.strideHeight;\n const strideWidth =
convInfo.strideWidth;\n const inputChannels = convInfo.inChannels;\n const outputChannels =
convInfo.outChannels;\n const isSamePad = convInfo.padInfo.type === 'SAME' ? 1 : 0;\n\n if
(convInfo.dataFormat !== 'channelsLast') {\n   throw new Error(\n     `wasm backend Conv2D does not support
dataFormat:~` +\n     `${convInfo.dataFormat}`. Please use 'channelsLast'.`);\n };\n\n const out =
backend.makeOutput(convInfo.outShape, 'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n
wasmConv2d(\n   xId, x.shape[0], x.shape[1], x.shape[2], filterId, filterHeight,\n   filterWidth, padTop,
padRight, padBottom, padLeft, isSamePad,\n   dilationHeight,
dilationWidth, strideHeight, strideWidth, inputChannels,\n   outputChannels, outId);\n return out;\n}\n\nexport
const conv2DConfig: KernelConfig = {\n  kernelName: Conv2D,\n  backendName: 'wasm',\n  setupFunc: setup,\n  kernelFunc: conv2d as { } as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *\n
=====
*/\n\nimport
{ backend_util, Conv2DBackpropInput, Conv2DBackpropInputAttrs, Conv2DBackpropInputInputs, KernelConfig,
KernelFunc, TensorInfo, util } from '@tensorflow/tfjs-core';\n\nimport { BackendWasm } from
'./backend_wasm';\n\nlet wasmConv2DBackpropInput: (\n  dyId: number, filterId: number, batchSize: number,
filterHeight: number,\n  filterWidth: number, inHeight: number, inWidth: number, inChannels: number,\n  outHeight: number, outWidth: number, outChannels: number,\n  strideHeight: number, strideWidth: number,
topPad: number, leftPad: number,\n  fltS0: number, fltS1: number, fltS2: number, xBatchStride: number,\n  xRowStride: number, xColStride: number, xChannelStride: number,\n  yBatchStride: number, yRowStride:
number, yColStride: number,\n  yChannelStride: number, outId: number) => void;\n\nfunction setup(backend:
BackendWasm): void {\n  wasmConv2DBackpropInput = backend.wasm.cwrap(Conv2DBackpropInput, null, [\n
'number', // dyId\n 'number', // filterId\n 'number',
// batchSize\n 'number', // filterHeight\n 'number', // filterWidth\n 'number', // inHeight\n 'number', //
inWidth\n 'number', // inChannels\n 'number', // outHeight\n 'number', // outWidth\n 'number', //
outChannels\n 'number', // strideHeight\n 'number', // strideWidth\n 'number', // topPad\n 'number', //
leftPad\n 'number', // fltS0\n 'number', // fltS1\n 'number', // fltS2\n 'number', // xBatchStride\n 'number',
// xRowStride\n 'number', // xColStride\n 'number', // xChannelStride\n 'number', // yBatchStride\n
'number', // yRowStride\n 'number', // yColStride\n 'number', // yChannelStride\n 'number', // outId\n
]);\n}\n\nfunction conv2DBackpropInput(args: {\n  backend: BackendWasm,\n  inputs:
Conv2DBackpropInputInputs,\n  attrs: Conv2DBackpropInputAttrs\n}): TensorInfo {\n  const {backend, inputs,
attrs} = args;\n  const {dy, filter} = inputs;\n  const {strides, pad, dataFormat,
dimRoundingMode, inputShape} = attrs;\n\n  const dilations = 1;\n\n  const $dataFormat =
backend_util.convertConv2DDataFormat(dataFormat);\n  const convInfo = backend_util.computeConv2DInfo(\n

```

```
inputShape, filter.shape as [number, number, number, number], strides,\n    dilations, pad, dimRoundingMode,\nfalse /* depthwise */, $dataFormat);\n const {\n    batchSize,\n    filterHeight,\n    filterWidth,\n    inChannels,\n    inHeight,\n    inWidth,\n    outChannels,\n    outHeight,\n    outWidth,\n    strideHeight,\n    strideWidth\n } =\nconvInfo;\n\n const topPad = filterHeight - 1 - convInfo.padInfo.top;\n const leftPad = filterWidth - 1 -\nconvInfo.padInfo.left;\n\n const isChannelsLast = convInfo.dataFormat === 'channelsLast';\n const dxStrides =\nutil.computeStrides(convInfo.inShape);\n const dyStrides = util.computeStrides(dy.shape);\n const [fltS0, fltS1,\nfltS2] = util.computeStrides(filter.shape);\n const xBatchStride = dxStrides[0];\n const xRowStride =\nisChannelsLast\n\n ? dxStrides[1] : dxStrides[2];\n const xColStride = isChannelsLast ? dxStrides[2] : 1;\n const xChannelStride =\nisChannelsLast ? 1 : dxStrides[1];\n const yBatchStride = dyStrides[0];\n const yRowStride = isChannelsLast ?\ndyStrides[1] : dyStrides[2];\n const yColStride = isChannelsLast ? dyStrides[2] : 1;\n const yChannelStride =\nisChannelsLast ? 1 : dyStrides[1];\n\n const out = backend.makeOutput(convInfo.inShape, 'float32');\n const outId\n= backend.dataIdMap.get(out.dataId).id;\n const dyId = backend.dataIdMap.get(dy.dataId).id;\n const filterId =\nbackend.dataIdMap.get(filter.dataId).id;\n\n wasmConv2DBackpropInput(\n    dyId, filterId, batchSize,\nfilterHeight, filterWidth, inHeight, inWidth,\n    inChannels, outHeight, outWidth, outChannels, strideHeight,\nstrideWidth,\n    topPad, leftPad, fltS0, fltS1, fltS2, xBatchStride, xRowStride,\n    xColStride, xChannelStride,\nyBatchStride, yRowStride, yColStride,\n    yChannelStride, outId);\n return out; }\n\nexport\nconst conv2DBackpropInputConfig: KernelConfig = {\n kernelName: Conv2DBackpropInput,\n backendName:\n'wasm',\n setupFunc: setup,\n kernelFunc: conv2DBackpropInput as {} as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2021 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\n * License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or\n * agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n * the specific language governing permissions and\n * limitations under the License.\n */\n\n=====\n*/\nimport { Cos, KernelConfig } from '@tensorflow/tfjs-core';\nimport { createUnaryKernelConfig }\nfrom './unary_kernel';\n\nexport const cosConfig: KernelConfig = createUnaryKernelConfig(Cos);\n\n"/**\n * @license\n * Copyright 2021 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version\n * 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a\n * copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable\n * law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n * the specific language governing permissions and\n * limitations under the License.\n */\n\n=====\n*/\nimport { Cosh, KernelConfig } from '@tensorflow/tfjs-core';\nimport { createUnaryKernelConfig } from\n'./unary_kernel';\n\nexport const coshConfig: KernelConfig = createUnaryKernelConfig(Cosh);\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version\n * 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a\n * copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable\n * law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n * the specific language governing permissions and\n * limitations under the License.\n */\n\n=====\n*/\nimport { CropAndResize, CropAndResizeAttrs, CropAndResizeInputs, KernelConfig, KernelFunc,\nTensorInfo } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nimport { cast }\nfrom './Cast';\n\n// Must match enum in CropAndResize.cc\nenum
```

```

InterpolationMethod {\n bilinear = 0,\n nearest = 1\n}\n\nlet wasmCropAndResize: (\n  imagesId: number,\n  boxesId: number, boxIndId: number, numBoxes: number,\n  imagesShape: Uint8Array, cropHeight: number,\n  cropWidth: number,\n  method: number, extrapolationValue: number, outId: number) => void;\n\nfunction\n  setup(backend: BackendWasm): void {\n    wasmCropAndResize = backend.wasm.cwrap(CropAndResize, null\n    /*void*/, [\n      'number', // imagesId\n      'number', // boxesId\n      'number', // boxIndId\n      'number', // numBoxes\n      'array', // images shape\n      'number', // cropHeight\n      'number', // cropWidth\n      'number', // method\n      'number', // extrapolation value\n      'number' // out id\n    ]);\n  }\n\nfunction cropAndResize(args: {\n  backend: BackendWasm,\n  inputs: CropAndResizeInputs,\n  attrs: CropAndResizeAttrs\n}): TensorInfo {\n  const {backend, inputs, attrs} = args;\n  const {method, extrapolationValue, cropSize} = attrs;\n  const {image, boxes, boxInd} = inputs;\n  const numBoxes = boxes.shape[0];\n  const [cropHeight, cropWidth] = cropSize as [number, number];\n  const outShape = [numBoxes, cropHeight, cropWidth, image.shape[3]];\n  let imagesData = backend.dataIdMap.get(image.dataId);\n  let castedData;\n  if (image.dtype !== 'float32') {\n    castedData = cast({backend, inputs: {x: image}, attrs: {dtype: 'float32'}});\n    imagesData = backend.dataIdMap.get(castedData.dataId);\n  }\n  const imagesId = imagesData.id;\n  const boxesId = backend.dataIdMap.get(boxes.dataId).id;\n  const boxIndId = backend.dataIdMap.get(boxInd.dataId).id;\n  const out = backend.makeOutput(outShape, 'float32');\n  const outId = backend.dataIdMap.get(out.dataId).id;\n  const imagesShapeBytes = new Uint8Array(new Int32Array(image.shape).buffer);\n  wasmCropAndResize(\n    imagesId, boxesId, boxIndId, numBoxes, imagesShapeBytes, cropHeight,\n    cropWidth,\n    InterpolationMethod[method as {}] as keyof typeof InterpolationMethod,\n    extrapolationValue, outId);\n  if (castedData != null) {\n    backend.disposeData(castedData.dataId);\n  }\n  return out;\n}\n\nexport const cropAndResizeConfig: KernelConfig = {\n  kernelName: CropAndResize,\n  backendName: 'wasm',\n  setupFunc: setup,\n  kernelFunc: cropAndResize as {} as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\")\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n\n\n\nimport {backend_util, KernelConfig, KernelFunc, Cumsum, CumsumAttrs, CumsumInputs, TensorInfo, util}\nfrom '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nimport {CppType} from './types';\nimport {transpose} from './Transpose';\n\nlet wasmCumsum: (xId: number, exclusive: number, reverse: number,\n  finalDim: number, outId: number, dtype: CppDType) => void;\n\nfunction setup(backend: BackendWasm) {\n  wasmCumsum = backend.wasm.cwrap(Cumsum, null /* void */, [\n    'number', // x_id\n    'number', // exclusive\n    'number', // reverse\n    'number', // final_dim\n    'number', // out_id\n    'number' // dtype\n  ]);\n}\n\nexport function cumsum(\n  args: {\n    inputs: CumsumInputs, backend: BackendWasm, attrs: CumsumAttrs\n  }): TensorInfo {\n  const {inputs, backend, attrs} = args;\n  const {x} = inputs;\n  const {axis, exclusive, reverse} = attrs;\n  const xRank = x.shape.length;\n  util.assert(x.dtype === 'float32' || x.dtype === 'int32',\n    () => `cumsum does not support ${x.dtype} tensors in the WASM backend`);\n  // permute required axis to inner most axis\n  const permutation = backend_util.getAxesPermutation([axis], xRank);\n  let permutedX = x;\n  if (permutation !== null) {\n    permutedX = transpose({inputs: {x}, attrs: {perm: permutation}, backend});\n  }\n  const permutedAxis = backend_util.getInnerMostAxes(1, xRank)[0];\n  backend_util.assertAxesAreInnerMostDims('cumsum', [permutedAxis], xRank);\n  const permutedOut = backend.makeOutput(permutedX.shape, permutedX.dtype);\n  const finalDim = permutedX.shape[permutedAxis];\n  const permutedXId = backend.dataIdMap.get(permutedX.dataId).id;\n  const permutedOutId = backend.dataIdMap.get(permutedOut.dataId).id;\n  wasmCumsum(permutedXId, exclusive ? 1 : 0, reverse ? 1 : 0, finalDim,\n    permutedOutId, CppDType[x.dtype]);\n  // transpose data back if permuted\n  let out =

```

```

permutedOut;\n if (permutation
!= null) {\n  const undoPermutation = backend_util.getUndoAxesPermutation(permutation);\n  out =
transpose(\n    {inputs: {x: permutedOut}, attrs: {perm: undoPermutation}, backend});\n
backend.disposeData(permutedX.dataId);\n  backend.disposeData(permutedOut.dataId);\n }\n return
out;\n}\n\nexport const cumsumConfig: KernelConfig = {\n  kernelName: Cumsum,\n  backendName: 'wasm',\n  setupFunc: setup,\n  kernelFunc: cumsum as { } as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2019 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not
use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n
* See the License for the specific language governing permissions and\n * limitations under the License.\n *
=====
\n
*/\n\nimport {DepthToSpace, DepthToSpaceAttrs, DepthToSpaceInputs, KernelConfig, KernelFunc, TensorInfo,
util} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nlet wasmDepthToSpace:
(\n  xId: number, blockSize: number, channelsLast: number, xStrides: Uint8Array,\n  xStridesLength: number,
outputShape: Uint8Array, outputStrides: Uint8Array,\n  outSize: number, outId: number) => void;\n\nfunction
setup(backend: BackendWasm): void {\n  wasmDepthToSpace = backend.wasm.cwrap(DepthToSpace, null
/*void*/, [\n    'number', // xId\n    'number', // blockSize\n    'number', // channelsLast\n    'array', // xStrides\n
'number', // xStridesLength\n    'array', // outputShape\n    'array', // outputStrides\n    'number', // outSize\n
'number', // outId\n
  ]);\n}\n\nexport function depthToSpace(args: {\n  backend: BackendWasm,\n  inputs: DepthToSpaceInputs,\n
attrs: DepthToSpaceAttrs\n}): TensorInfo {\n  const {backend, inputs, attrs} = args;\n  const {x} = inputs;\n  const
{blockSize, dataFormat} = attrs;\n  const batchSize = x.shape[0];\n  const inputHeight = (dataFormat ===
'NHWC') ? x.shape[1] : x.shape[2];\n  const inputWidth = (dataFormat === 'NHWC') ? x.shape[2] : x.shape[3];\n
const inputDepth = (dataFormat === 'NHWC') ? x.shape[3] : x.shape[1];\n  const outputHeight = inputHeight *
blockSize;\n  const outputWidth = inputWidth * blockSize;\n  const outputDepth = inputDepth / (blockSize *
blockSize);\n  const outputShape = (dataFormat === 'NHWC') ?\n    [batchSize, outputHeight, outputWidth,
outputDepth] :\n    [batchSize, outputDepth, outputHeight, outputWidth];\n  const out =
backend.makeOutput(outputShape, 'float32');\n  const xData = backend.dataIdMap.get(x.dataId);\n  const xId =
xData.id;\n  const xStridesBytes
= \n    new Uint8Array(new Int32Array(util.computeStrides(x.shape)).buffer);\n  const outputShapeBytes = new
Uint8Array(new Int32Array(outputShape).buffer);\n  const outStridesBytes = \n    new Uint8Array(new
Int32Array(util.computeStrides(outputShape)).buffer);\n  const outId = backend.dataIdMap.get(out.dataId).id;\n
const channelsLast = dataFormat === 'NHWC' ? 1 : 0;\n  wasmDepthToSpace(\n    xId, blockSize, channelsLast,
xStridesBytes, x.shape.length - 1,\n    outputShapeBytes, outStridesBytes, outputShape.length, outId);\n  return
out;\n}\n\nexport const depthToSpaceConfig: KernelConfig = {\n  kernelName: DepthToSpace,\n  backendName:
'wasm',\n  setupFunc: setup,\n  kernelFunc: depthToSpace as { } as KernelFunc\n};\n", "/*\n * @license\n *
Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
\"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License
at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in
writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT
WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific
language governing permissions and\n * limitations under the License.\n *
=====
\n
*/\n\nimport {backend_util, DepthwiseConv2dNative, DepthwiseConv2dNativeAttrs,
DepthwiseConv2dNativeInputs, KernelConfig, KernelFunc, Tensor4D} from '@tensorflow/tfjs-core';\n\nimport

```

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{BackendWasm} from '../backend_wasm';\n\nlet wasmDepthwiseConv2d: (\n  xId: number, batchSize: number,
inputHeight: number, inputWidth: number,\n  filterId: number, filterHeight: number, filterWidth: number, padTop:
number,\n  padRight: number, padBottom: number, padLeft: number, isSamePad: number,\n  dilationHeight:
number, dilationWidth:
number, strideHeight: number,\n  strideWidth: number, inputChannels: number, outputChannels: number,\n
outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n  wasmDepthwiseConv2d =\n  backend.wasm.cwrap(DepthwiseConv2dNative, null /* void */, [\n    'number', // xId\n    'number', //
batchSize\n    'number', // inputHeight\n    'number', // inputWidth\n    'number', // filterId\n    'number', //
filterHeight\n    'number', // filterWidth\n    'number', // padTop\n    'number', // padRight\n    'number', //
padBottom\n    'number', // padLeft\n    'number', // isSamePad\n    'number', // dilationHeight\n
'number', // dilationWidth\n    'number', // strideHeight\n    'number', // strideWidth\n    'number', //
inputChannels\n    'number', // outputChannels\n    'number', // outId\n  ]);\n}\n\nfunction
depthwiseConv2d(args: {\n  inputs: DepthwiseConv2dNativeInputs,\n
  backend: BackendWasm,\n  attrs: DepthwiseConv2dNativeAttrs\n}) {\n  const {inputs, attrs, backend} = args;\n\n
const {x, filter} = inputs;\n  const xId = backend.dataIdMap.get(x.dataId).id;\n  const filterId =
backend.dataIdMap.get(filter.dataId).id;\n\n  const {strides, dilations, pad, dimRoundingMode} = attrs;\n\n
const $dilations = dilations === null ? [1, 1] : dilations;\n\n  const convInfo = backend_util.computeConv2DInfo(\n    (x as
Tensor4D).shape, (filter as Tensor4D).shape, strides,\n    ($dilations as number | [number, number]), pad,
dimRoundingMode,\n    true /* depthwise */);\n\n  const filterHeight = convInfo.filterHeight;\n  const filterWidth =
convInfo.filterWidth;\n  const padTop = convInfo.padInfo.top;\n  const padRight = convInfo.padInfo.right;\n  const
padBottom = convInfo.padInfo.bottom;\n  const padLeft = convInfo.padInfo.left;\n  const dilationHeight =
convInfo.dilationHeight;\n  const dilationWidth = convInfo.dilationWidth;\n  const strideHeight =
convInfo.strideHeight;\n\n
  const strideWidth = convInfo.strideWidth;\n  const inputChannels = convInfo.inChannels;\n  const outputChannels
= convInfo.outChannels;\n  const isSamePad = convInfo.padInfo.type === 'SAME' ? 1 : 0;\n\n  if
(convInfo.dataFormat !== 'channelsLast') {\n    throw new Error(\n      `wasm backend DepthwiseConv2dNative
does not support dataFormat: ` +\n      `${convInfo.dataFormat}`. Please use 'channelsLast'.`);\n  }\n\n  const out =
backend.makeOutput(convInfo.outShape, 'float32');\n  const outId = backend.dataIdMap.get(out.dataId).id;\n\n
wasmDepthwiseConv2d(\n    xId, x.shape[0], x.shape[1], x.shape[2], filterId, filterHeight,\n    filterWidth,
padTop, padRight, padBottom, padLeft, isSamePad,\n    dilationHeight, dilationWidth, strideHeight, strideWidth,
inputChannels,\n    outputChannels, outId);\n  return out;\n}\n\nexport const depthwiseConv2dNativeConfig:
KernelConfig = {\n  kernelName: DepthwiseConv2dNative,\n  backendName: 'wasm',\n  setupFunc: setup,\n
  kernelFunc: depthwiseConv2d as { } as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2021 Google LLC. All
Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n */\n
=====\n\n
*/\nimport {Elu, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from
'./unary_kernel';\n\nexport const eluConfig: KernelConfig = createUnaryKernelConfig(Elu);\n\n"/**\n * @license\n *
Copyright\n * \n * 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n *
you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language

```

governing permissions and\n * limitations under the License.\n *

```
=====\n\n*\nimport {Equal, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from\n './binary_kernel';\n\nconst supportsFullBroadcast = false;\n\nexport const equalConfig: KernelConfig = {\n  createBinaryKernelConfig(Equal, supportsFullBroadcast, 'bool');\n};\n\n"/**\n * @license\n * Copyright\n 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES\n OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n governing permissions and\n * limitations under the License.\n */\n
```

```
=====\n\n*\nimport {Exp, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from\n './unary_kernel';\n\nexport const expConfig: KernelConfig = {\n  createUnaryKernelConfig(Exp, 'float32');\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache\n License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You\n may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required\n by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS"\n BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the\n License for the specific language governing permissions and\n * limitations under the License.\n */\n
```

```
=====\n\n*\n\nimport {ExpandDims, ExpandDimsAttrs, ExpandDimsInputs, KernelConfig, KernelFunc, util} from\n '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nimport {reshape} from\n './Reshape';\n\nexport function expandDims(args: {\n  inputs: ExpandDimsInputs,\n  attrs: ExpandDimsAttrs,\n  backend: BackendWasm\n}) {\n  const {inputs, attrs, backend} = args;\n  const\n    {input} = inputs;\n  const {dim} = attrs;\n\n  const inputRank = input.shape.length;\n  const newShape =\n    input.shape.slice();\n  let $dim = dim;\n  if (dim < 0) {\n    // Negative value is counted from the tail of rank.\n    util.assert(\n      -(inputRank + 1) <= dim,\n      () => `Axis must be in the interval [${- (inputRank + 1)}, ${\n        inputRank\n      }`);\n    $dim = inputRank + dim + 1;\n  }\n  newShape.splice($dim, 0, 1);\n\n  return reshape({inputs:\n    {x: input}, backend, attrs: {shape: newShape}});\n}\n\nexport const expandDimsConfig: KernelConfig = {\n  kernelName: ExpandDims,\n  backendName: 'wasm',\n  kernelFunc: expandDims as {} as KernelFunc,\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version\n 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a\n copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless\n required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an\n "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n
```

```
=====\n\n*\n\nimport {KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';\nimport {Fill, FillAttrs} from\n '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\n\nexport function fill(args: {\n  attrs: FillAttrs, backend: BackendWasm\n}) {\n  const {attrs: {shape, value, dtype}, backend} = args;\n  const out =\n    backend.makeOutput(shape, dtype);\n  const outVals = backendtypedArrayFromHeap(out);\n  outVals.fill(value as\n    number);\n  return out;\n}\n\nexport const fillConfig: KernelConfig = {\n  kernelName: Fill,\n  backendName:\n    'wasm',\n  kernelFunc: fill as {} as KernelFunc,\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version\n 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a\n copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable\n law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n */\n
```

WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *

```
=====\n\n*\n\nimport {FlipLeftRight, FlipLeftRightInputs, KernelConfig, KernelFunc, TensorInfo} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\n\nlet wasmFlipLeftRight: (\n  xId: number, batch: number, imageHeight: number, imageWidth: number,\n  numChannels: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n  wasmFlipLeftRight = backend.wasm.cwrap(FlipLeftRight, null /* void */, [\n    'number', // xId\n    'number', // batch\n    'number', // imageHeight\n    'number', // imageWidth\n    'number', // numChannels\n    'number', // outId\n  ]);\n\n  export function flipLeftRight(\n    args: {inputs: FlipLeftRightInputs, backend: BackendWasm}): TensorInfo {\n    const {inputs, backend} = args;\n    const {image} = inputs;\n    const out = backend.makeOutput(image.shape, image.dtype);\n    const imageId = backend.dataIdMap.get(image.dataId).id;\n    const outId = backend.dataIdMap.get(out.dataId).id;\n    const [batch, imageHeight, imageWidth, numChannels] = image.shape;\n    wasmFlipLeftRight(\n      imageId, batch, imageHeight, imageWidth, numChannels, outId);\n    return out;\n  }\n\n  export const flipLeftRightConfig: KernelConfig = {\n    kernelName: FlipLeftRight,\n    backendName: 'wasm',\n    kernelFunc: flipLeftRight as\n      {} as KernelFunc,\n    setupFunc: setup\n  };\n\n  /**\n   * @license\n   * Copyright 2020 Google LLC. All Rights Reserved.\n   * Licensed under the Apache License, Version 2.0 (the 'License');\n   * you may not use this file except in compliance with the License.\n   * You may obtain a copy of the License at\n   * \n   * http://www.apache.org/licenses/LICENSE-2.0\n   * \n   * Unless required by applicable law or agreed to in writing, software\n   * distributed under the License is distributed on an 'AS IS' BASIS,\n   * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n   * See the License for the specific language governing permissions and\n   * limitations under the License.\n   */\n}
```

```
=====\n\n*\n\nimport {Floor, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from '../unary_kernel';\n\nexport const floorConfig: KernelConfig = createUnaryKernelConfig(Floor);\n\n/**\n * @license\n * Copyright 2019\n *\n * Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the 'License');\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an 'AS IS' BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */
```

```
=====\n\n*\n\nimport {FloorDiv, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from '../binary_kernel';\n\nconst supportsFullBroadcast = false;\n\nexport const floorDivConfig: KernelConfig =\n  createBinaryKernelConfig(FloorDiv, supportsFullBroadcast);\n\n/**\n * @license\n * Copyright 2019\n *\n * Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the 'License');\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an 'AS IS' BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */
```

```
=====\n\n*\n\nimport {FusedBatchNorm, FusedBatchNormAttrs, FusedBatchNormInputs, KernelConfig, KernelFunc, TensorInfo, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\n\nlet wasmBatchNorm: (\n  xId: number, meanId: number, varianceId: number, offsetId: number,\n  scaleId: number,
```

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varianceEpsilon: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n
wasmBatchNorm = backend.wasm.cwrap(\n    FusedBatchNorm, null /* void */,\n    ['number', 'number',
'number', 'number', 'number', 'number', 'number']);\n}\n\nfunction fusedBatchNorm(args: {\n backend:
BackendWasm,\n inputs: FusedBatchNormInputs,\n attrs: FusedBatchNormAttrs\n}): TensorInfo {\n const
{backend, inputs, attrs} = args;\n const {varianceEpsilon} = attrs;\n const {x, mean, variance, offset, scale} =
inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const meanId =
backend.dataIdMap.get(mean.dataId).id;\n const varianceId = backend.dataIdMap.get(variance.dataId).id;\n const
offsetId = offset != null ? backend.dataIdMap.get(offset.dataId).id : 0;\n const scaleId = scale != null ?
backend.dataIdMap.get(scale.dataId).id : 0;\n\n const out = backend.makeOutput(x.shape, x.dtype);\n // Short-
circuit zero-sized tensors.\n if (util.sizeFromShape(x.shape) ===
0) {\n    return out;\n }\n\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n wasmBatchNorm(\n    xId,
meanId, varianceId, offsetId, scaleId, varianceEpsilon, outId);\n return out;\n}\n\nexport const
fusedBatchNormConfig: KernelConfig = {\n kernelName: FusedBatchNorm,\n backendName: 'wasm',\n
setupFunc: setup,\n kernelFunc: fusedBatchNorm as {} as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2019
Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you
may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations
under the License.\n */
=====\\n
*/\\n\\nimport {backend_util, FusedConv2D, FusedConv2DAttrs, FusedConv2DInputs, KernelConfig, KernelFunc,
Tensor4D} from '@tensorflow/tfjs-core';\\n\\nimport {BackendWasm} from '../backend_wasm';\\n\\nimport
{FusableActivation} from './types';\\n\\nlet wasmFusedConv2d:\\n    (xId: number, batchSize: number, inputHeight:
number, inputWidth: number,\\n    filterId: number, filterHeight: number, filterWidth: number,\\n    biasId: number,
padTop: number, padRight: number, padBottom: number,\\n    padLeft: number, isSamePad: number,
dilationHeight: number,\\n    dilationWidth: number, strideHeight: number, strideWidth: number,\\n
inputChannels: number, outputChannels: number, activation: number,\\n    preluActivationWeightsId: number,
leakyreluAlpha: number, outId: number) =>\\n    void;\\n\\nfunction setup(backend: BackendWasm) {\n
wasmFusedConv2d = backend.wasm.cwrap(FusedConv2D, null /*
void */, [\n    'number', // xId\\n    'number', // batchSize\\n    'number', // inputHeight\\n    'number', // inputWidth\\n
'number', // filterId\\n    'number', // filterHeight\\n    'number', // filterWidth\\n    'number', // biasId\\n    'number', //
padTop\\n    'number', // padRight\\n    'number', // padBottom\\n    'number', // padLeft\\n    'number', // isSamePad\\n
'number', // dilationHeight\\n    'number', // dilationWidth\\n    'number', // strideHeight\\n    'number', //
strideWidth\\n    'number', // inputChannels\\n    'number', // outputChannels\\n    'number', // activation\\n    'number',
// preluActivationWeightsId\\n    'number', // leakyreluAlpha\\n    'number', // outId\\n ]);\n}\\n\\nfunction
fusedConv2d(args: {\n inputs: FusedConv2DInputs,\\n backend: BackendWasm,\\n attrs: FusedConv2DAttrs\n})
{\n    const {inputs, attrs, backend} = args;\n    const {x, filter, bias, preluActivationWeights} = inputs;\n    const {\n
strides,\\n    pad,\\n    dilations,\\n    dataFormat,\\n
dimRoundingMode,\\n    activation,\\n    leakyreluAlpha\\n } = attrs;\n\n    const convInfo =
backend_util.computeConv2DInfo(\n        (x as Tensor4D).shape, (filter as Tensor4D).shape, strides, dilations,\\n
pad, dimRoundingMode);\n\n    const fusedActivation =\\n        FusableActivation[activation as {} as keyof typeof
FusableActivation];\n    if (fusedActivation === null) {\n        throw new Error(\n            ` ${activation} activation not yet
supported for FusedConv2D ` +\\n            `in the wasm backend.`);\n    }\n\n    const xId =
backend.dataIdMap.get(x.dataId).id;\n    const filterId = backend.dataIdMap.get(filter.dataId).id;\n\n    const
outputChannels = convInfo.outChannels;\n\n    let biasId = 0;\n    if (bias != null) {\n        const biasData =
backend.dataIdMap.get(bias.dataId);\n        if (biasData.shape.length !== 1) {\n            throw new Error(\n

```



```

`FusedConv2D only supports rank-1 bias but got ` +\n      `rank ${biasData.shape.length}.`);\n    }\n    if
(biasData.shape[0] !== outputChannels)
    {\n      throw new Error(\n        `FusedConv2D bias shape (${biasData.shape}) does not ` +\n        `match the
number of output channels (${outputChannels})`);\n    }\n    biasId = biasData.id;\n    }\n\n    const filterHeight =
convInfo.filterHeight;\n    const filterWidth = convInfo.filterWidth;\n    const padTop = convInfo.padInfo.top;\n    const
padRight = convInfo.padInfo.right;\n    const padBottom = convInfo.padInfo.bottom;\n    const padLeft =
convInfo.padInfo.left;\n    const dilationHeight = convInfo.dilationHeight;\n    const dilationWidth =
convInfo.dilationWidth;\n    const strideHeight = convInfo.strideHeight;\n    const strideWidth =
convInfo.strideWidth;\n    const inputChannels = convInfo.inChannels;\n    const isSamePad = convInfo.padInfo.type
=== 'SAME' ? 1 : 0;\n    const batchSize = convInfo.batchSize;\n    const inHeight = convInfo.inHeight;\n    const
inWidth = convInfo.inWidth;\n\n    if (dataFormat !== 'NHWC') {\n      throw new Error(\n        `wasm backend
FusedConv2D does not
support dataFormat:` +\n        `${dataFormat}'. Please use 'NHWC'.`);\n    }\n\n    const out =
backend.makeOutput(convInfo.outShape, 'float32');\n    const outId = backend.dataIdMap.get(out.dataId).id;\n    const
preluActivationWeightsId = preluActivationWeights == null ?\n      0 :\n    backend.dataIdMap.get(preluActivationWeights.dataId).id;\n\n    wasmFusedConv2d(\n      xId, batchSize, inHeight,
inWidth, filterId, filterHeight, filterWidth,\n      biasId, padTop, padRight, padBottom, padLeft, isSamePad,
dilationHeight,\n      dilationWidth, strideHeight, strideWidth, inputChannels, outputChannels,\n      fusedActivation,
preluActivationWeightsId, leakyreluAlpha || 0, outId);\n\n    return out;\n  }\n\n  export const fusedConv2DConfig:
KernelConfig = {\n    kernelName: FusedConv2D,\n    backendName: 'wasm',\n    setupFunc: setup,\n    kernelFunc:
fusedConv2d as {} as KernelFunc\n  };
\n  /**\n   * @license\n   * Copyright 2019 Google LLC. All Rights
Reserved.\n   * Licensed under the Apache License, Version
2.0 (the \"License\");\n   * you may not use this file except in compliance with the License.\n   * You may obtain a
copy of the License at\n   * http://www.apache.org/licenses/LICENSE-2.0\n   * Unless required by applicable
law or agreed to in writing, software\n   * distributed under the License is distributed on an \"AS IS\" BASIS,\n   *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n   * See the License for
the specific language governing permissions and\n   * limitations under the License.\n   */
\n  =====\n  *\n  \n  import {backend_util, FusedDepthwiseConv2D, FusedDepthwiseConv2DAttrs,
FusedDepthwiseConv2DInputs, KernelConfig, KernelFunc, Tensor4D} from '@tensorflow/tfjs-core';\n  \n  import
{BackendWasm} from '../backend_wasm';\n  \n  import {FusableActivation} from './types';\n  \n  let
wasmFusedDepthwiseConv2d:\n    (xId: number, batchSize: number, inputHeight: number, inputWidth: number,\n    filterId: number,
filterHeight: number, filterWidth: number,\n    biasId: number, padTop: number, padRight: number, padBottom:
number,\n    padLeft: number, isSamePad: number, dilationHeight: number,\n    dilationWidth: number,
strideHeight: number, strideWidth: number,\n    inputChannels: number, outputChannels: number, activation:
number,\n    preluActivationWeightsId: number, leakyreluAlpha: number, outId: number) =>\n    void;\n  \n  function setup(backend: BackendWasm) {\n    wasmFusedDepthwiseConv2d =\n    backend.wasm.cwrap(FusedDepthwiseConv2D, null /* void */, [\n      'number', // xId\n      'number', //
batchSize\n      'number', // inputHeight\n      'number', // inputWidth\n      'number', // filterId\n      'number', //
filterHeight\n      'number', // filterWidth\n      'number', // biasId\n      'number', // padTop\n      'number', //
padRight\n      'number', // padBottom\n      'number', // padLeft\n      'number', // isSamePad\n      'number', //
dilationHeight\n      'number', // dilationWidth\n      'number', // strideHeight\n      'number', // strideWidth\n
      'number', // inputChannels\n      'number', // outputChannels\n      'number', // activation\n      'number', //
preluActivationWeightsId\n      'number', // leakyreluAlpha\n      'number', // outId\n    ]);\n  }\n  \n  function
fusedDepthwiseConv2d(args: {\n    inputs: FusedDepthwiseConv2DInputs,\n    backend: BackendWasm,\n    attrs:
FusedDepthwiseConv2DAttrs\n  }) {\n    const {inputs, attrs, backend} = args;\n    const {x, filter, bias,
preluActivationWeights} = inputs;\n    const {\n      strides,\n      pad,\n      dilations,\n      dataFormat,\n

```

```

dimRoundingMode,\n  activation,\n  leakyreluAlpha\n } = attrs;\n\n const convInfo =
backend_util.computeConv2DInfo(\n  (x as Tensor4D).shape, (filter as Tensor4D).shape, strides, dilations,\n  pad, dimRoundingMode, true /* depthwise */);\n\n const fusedActivation =\n  FusableActivation[activation
as { } as keyof typeof FusableActivation];\n  if (fusedActivation == null) {\n    throw new Error(\n
`${activation} activation not yet supported for FusedDepthwiseConv2D` +\n      `in the wasm backend.`);\n  }\n\n const xId = backend.dataIdMap.get(x.dataId).id;\n  const filterId = backend.dataIdMap.get(filter.dataId).id;\n\n const outputChannels = convInfo.outChannels;\n\n let biasId = 0;\n  if (bias != null) {\n    const biasData =
backend.dataIdMap.get(bias.dataId);\n    if (biasData.shape.length !== 1) {\n      throw new Error(\n
`FusedDepthwiseConv2D only supports rank-1 bias but got` +\n        `rank ${biasData.shape.length}.`);\n    }\n
if (biasData.shape[0] !== outputChannels) {\n      throw new Error(\n
`FusedDepthwiseConv2D bias shape
(${biasData.shape}) does not` +\n        `match the number of output channels (${outputChannels})`);\n    }\n
biasId = biasData.id;\n  }\n\n const filterHeight = convInfo.filterHeight;\n  const
filterWidth = convInfo.filterWidth;\n  const padTop = convInfo.padInfo.top;\n  const padRight =
convInfo.padInfo.right;\n  const padBottom = convInfo.padInfo.bottom;\n  const padLeft = convInfo.padInfo.left;\n
const dilationHeight = convInfo.dilationHeight;\n  const dilationWidth = convInfo.dilationWidth;\n  const
strideHeight = convInfo.strideHeight;\n  const strideWidth = convInfo.strideWidth;\n  const inputChannels =
convInfo.inChannels;\n  const isSamePad = convInfo.padInfo.type === 'SAME' ? 1 : 0;\n  const batchSize =
convInfo.batchSize;\n  const inHeight = convInfo.inHeight;\n  const inWidth = convInfo.inWidth;\n\n  if
(dataFormat !== 'NHWC') {\n    throw new Error(\n
`wasm backend FusedDepthwiseConv2D does not support
dataFormat:` +\n      `${dataFormat}`. Please use 'NHWC'.`);\n  }\n\n  const out =
backend.makeOutput(convInfo.outShape, 'float32');\n  const outId = backend.dataIdMap.get(out.dataId).id;\n  const
preluActivationWeightsId = preluActivationWeights ==
null ?\n    0 :\n    backend.dataIdMap.get(preluActivationWeights.dataId).id;\n\n  wasmFusedDepthwiseConv2d(\n
xId, batchSize, inHeight, inWidth, filterId, filterHeight, filterWidth,\n  biasId, padTop, padRight, padBottom, padLeft, isSamePad, dilationHeight,\n    dilationWidth, strideHeight,
strideWidth, inputChannels, outputChannels,\n    fusedActivation, preluActivationWeightsId, leakyreluAlpha || 0,
outId);\n\n  return out;\n}\n\nexport const fusedDepthwiseConv2DConfig: KernelConfig = {\n  kernelName:
FusedDepthwiseConv2D,\n  backendName: 'wasm',\n  setupFunc: setup,\n  kernelFunc: fusedDepthwiseConv2d as
{ } as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed
under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * \n *
Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport { gather_util, GatherNd, GatherNdInputs, KernelConfig, TensorInfo } from '@tensorflow/tfjs-
core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nimport { CppDType } from './types';\n\nlet
wasmGatherNd: (\n  xId: number, dtype: CppDType, indicesId: number, numSlices: number,\n  sliceRank:
number, sliceSize: number, strides: Uint8Array, outId: number) =>\n  void;\n\nfunction setup(backend:
BackendWasm): void {\n  wasmGatherNd = backend.wasm.cwrap(GatherNd, null /*void*/, [\n    'number', // xId\n    'number', // dtype\n    'number', // indicesId\n    'number', // numSlices\n    'number', // sliceRank\n    'number', // sliceSize\n    'array', // strides\n    'number' // outId\n  ]);\n}\n\nfunction gatherNd(args: { backend:
BackendWasm, inputs: GatherNdInputs }):\n  TensorInfo {\n  const { backend, inputs } = args;\n  const { params,
indices } = inputs;\n\n  const [resultShape, numSlices, sliceSize, strides] =\n
gather_util.prepareAndValidate(params, indices);\n\n  const out = backend.makeOutput(resultShape,
params.dtype);\n  if (numSlices === 0) {\n    return out;\n  }\n\n  const indicesShape = indices.shape;\n  const
sliceRank = indicesShape[indicesShape.length - 1];\n\n  const xData = backend.dataIdMap.get(params.dataId);\n

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const xId = xData.id;\n const indicesData = backend.dataIdMap.get(indices.dataId);\n const indicesId =
indicesData.id;\n\n const stridesBytes = new Uint8Array(new Int32Array(strides).buffer);\n\n const outId =
backend.dataIdMap.get(out.dataId).id;\n wasmGatherNd(\n    xId, CppDType[params.dtype], indicesId,
numSlices, sliceRank, sliceSize,\n
    stridesBytes, outId);\n\n return out;\n}\n\nexport const gatherNdConfig: KernelConfig = {\n kernelName:
GatherNd,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: gatherNd\n};\n\n", "/*\n * @license\n *
Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport { backend_util, GatherV2, GatherV2Attrs, GatherV2Inputs, KernelConfig,
KernelFunc, Tensor, TensorInfo, TypedArray, util } from '@tensorflow/tfjs-core';\n\nimport { BackendWasm } from
'./backend_wasm';\n\nimport { reshape } from './Reshape';\n\nimport { CppDType } from './types';\n\nlet wasmGather:
(\n    xId: number, dtype: CppDType, xStrides: Uint8Array, stridesSize: number,\n    indicesId: number, batchSize:
number, outStrides: Uint8Array,\n    outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n
wasmGather = backend.wasm.cwrap('Gather', null /*void*/, [\n    'number', // xId\n    'number', // dtype\n    'array',
// xStrides\n    'number', // stridesSize\n    'number', // indicesId\n    'number', // batchSize\n    'array', //
outStrides\n    'number' // outId\n ]);\n}\n\nfunction gatherV2(\n    args: { backend: BackendWasm, inputs:
GatherV2Inputs, attrs: GatherV2Attrs }):\n    TensorInfo {\n    const { backend, inputs, attrs } = args;\n    const { x,
indices } = inputs;\n    const { axis, batchDims } = attrs;\n\n    // Throw error when any
index is out of bound.\n    const parsedAxis = util.parseAxisParam(axis, x.shape)[0];\n    const indicesVals =
backend.readSync(indices.dataId) as TypedArray;\n    const axisDim = x.shape[parsedAxis];\n    for (let i = 0; i <
indicesVals.length; ++i) {\n        const index = indicesVals[i];\n        util.assert(\n            index <= axisDim - 1 && index >=
0,\n            () =>`\n            GatherV2: the index value ${index} is not in [0, ${axisDim - 1}]`);\n    }\n\n    const
shapeInfo = backend_util.segment_util.collectGatherOpShapeInfo(\n        x as Tensor, indices as Tensor, parsedAxis,
batchDims);\n\n    const flattenX = reshape({\n        inputs: { x },\n        attrs: {\n            shape: [\n                shapeInfo.batchSize,
shapeInfo.outerSize, shapeInfo.dimSize,\n                shapeInfo.sliceSize\n            ],\n            backend\n        });\n    const
indicesSize = util.sizeFromShape(indices.shape);\n    const flattenIndex = reshape({\n        inputs: { x: indices },\n        attrs:
{ shape: [shapeInfo.batchSize, indicesSize / shapeInfo.batchSize] },\n        backend\n    });\n    const flattenOutputShape = [\n        shapeInfo.batchSize, shapeInfo.outerSize, indicesSize /
shapeInfo.batchSize,\n        shapeInfo.sliceSize\n    ];\n\n    const out = backend.makeOutput(flattenOutputShape,
x.dtype);\n    if (util.sizeFromShape(x.shape) === 0) {\n        return out;\n    }\n    const stridesSize = flattenX.shape.length
- 1;\n\n    const xData = backend.dataIdMap.get(flattenX.dataId);\n    const xId = xData.id;\n\n    const indicesData =
backend.dataIdMap.get(flattenIndex.dataId);\n    const indicesId = indicesData.id;\n\n    const outId =
backend.dataIdMap.get(out.dataId).id;\n\n    const xStridesBytes = new Uint8Array(\n        new
Int32Array(util.computeStrides(flattenX.shape)).buffer);\n    const outStridesBytes = new Uint8Array(\n        new
Int32Array(util.computeStrides(flattenOutputShape)).buffer);\n\n    wasmGather(\n        xId, CppDType[x.dtype],
xStridesBytes, stridesSize, indicesId,\n        shapeInfo.batchSize, outStridesBytes, outId);\n\n    backend.disposeData(flattenX.dataId);\n\n    backend.disposeData(flattenIndex.dataId);\n\n    // reshape\n    out.shape = shapeInfo.outputShape;\n    return
out;\n}\n\nexport const gatherV2Config: KernelConfig = {\n    kernelName: GatherV2,\n    backendName: 'wasm',\n    setupFunc: setup,\n    kernelFunc: gatherV2 as { } as KernelFunc\n};\n\n", "/*\n * @license\n * Copyright 2019 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not
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```

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```
=====\n\n *\\nimport { Greater, KernelConfig } from '@tensorflow/tfjs-core';\\n\\nimport { createBinaryKernelConfig } from\n './binary_kernel';\\n\\nconst supportsFullBroadcast = false;\\nexport const greaterConfig: KernelConfig =\\n createBinaryKernelConfig(Greater, supportsFullBroadcast, 'bool');\\n", "/*\\n * @license\\n * Copyright 2019 Google\n LLC. All Rights Reserved.\\n * Licensed under the Apache License, Version 2.0 (the \"License\");\\n * you may not\n use this file except in compliance with the License.\\n * You may obtain a copy of the License at\\n *\\n *\n http://www.apache.org/licenses/LICENSE-2.0\\n *\\n * Unless required by applicable law or agreed to in writing,\n software\\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\n OR CONDITIONS OF ANY KIND, either express or implied.\\n * See the License for the specific language\n governing permissions and\\n * limitations under the License.\\n *
```

```
=====\n\n *\\nimport { GreaterEqual, KernelConfig } from '@tensorflow/tfjs-core';\\n\\nimport { createBinaryKernelConfig }\n from './binary_kernel';\\n\\nconst supportsFullBroadcast = false;\\nexport const greaterEqualConfig: KernelConfig =\\n createBinaryKernelConfig(GreaterEqual, supportsFullBroadcast, 'bool');\\n", "/*\\n * @license\\n * Copyright 2019\n Google LLC. All Rights Reserved.\\n * Licensed under the Apache License, Version 2.0 (the \"License\");\\n * you\n may not use this file except in compliance with the License.\\n * You may obtain a copy of the License at\\n *\\n *\n http://www.apache.org/licenses/LICENSE-2.0\\n *\\n * Unless required by applicable law or agreed to in writing,\n software\\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\n OR CONDITIONS OF ANY KIND, either express or implied.\\n * See the License for the specific language\n governing permissions and\\n * limitations under the License.\\n *
```

```
=====\n\n *\\n\\nimport { KernelConfig, KernelFunc, LeakyRelu, LeakyReluAttrs, LeakyReluInputs, TensorInfo, util } from\n '@tensorflow/tfjs-core';\\n\\nimport { BackendWasm } from '../backend_wasm';\\n\\nimport { CppDType } from\n './types';\\n\\nlet wasmFunc: (\\n  xId: number, dtype: number, leakyreluAlpha: number, outId: number) =>\n void;\\n\\nfunction setupFunc(backend: BackendWasm): void {\\n  wasmFunc = backend.wasm.cwrap(LeakyRelu,\n null /* void */, [\\n  'number', // x_id\\n  'number', // dtype\\n  'number', // leakyrelu_alpha\\n  'number', //\n out_id\\n  ]);\\n\\n\\nexport function leakyRelu(\\n  args: {\\n    inputs: LeakyReluInputs, attrs: LeakyReluAttrs,\n backend: BackendWasm});\\n  TensorInfo {\\n    const { inputs: { x }, attrs: { alpha }, backend } = args;\\n\\n    const xId =\n backend.dataIdMap.get(x.dataId).id;\\n    // According to TF API, LeakyRelu returns float32 when input is either\n float32\\n    // or int32.\\n    const out = backend.makeOutput(x.shape, 'float32');\\n\\n    if (util.sizeFromShape(x.shape)\n !== 0) {\\n      const outId = backend.dataIdMap.get(out.dataId).id;\\n      wasmFunc(xId, CppDType[x.dtype], alpha,\n outId);\\n    }\\n\\n    return out;\\n  }\\n\\n\\nexport const leakyReluConfig: KernelConfig = {\\n  kernelName: LeakyRelu,\\n\n backendName: 'wasm',\\n  setupFunc,\\n  kernelFunc: leakyRelu as { } as KernelFunc,\\n};\\n", "/*\\n * @license\\n * \n Copyright 2019 Google LLC. All Rights Reserved.\\n * Licensed under the Apache License, Version 2.0 (the\n \"License\");\\n * you may not use this file except in compliance with the License.\\n * You may obtain a copy of the\n License at\\n *\\n * http://www.apache.org/licenses/LICENSE-2.0\\n *\\n * Unless required by applicable law or\n agreed to in writing, software\\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * \n WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\\n * See the License for\n the specific language governing permissions and\\n * limitations under the License.\\n *
```

```
=====\n\n *\\nimport { KernelConfig, Less } from '@tensorflow/tfjs-core';\\n\\nimport { createBinaryKernelConfig } from\n './binary_kernel';\\n\\nconst supportsFullBroadcast = false;\\nexport const lessConfig: KernelConfig =\\n\n createBinaryKernelConfig(Less, supportsFullBroadcast, 'bool');\\n", "/*\\n * @license\\n * Copyright 2019 Google\n LLC. All Rights Reserved.\\n * Licensed under the Apache License, Version 2.0 (the \"License\");\\n * you may not\n use this file except in compliance with the License.\\n * You may obtain a copy of the License at\\n *\\n *
```

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```
=====
*/\n\nimport {KernelConfig, LessEqual} from '@tensorflow/tfjs-core';\n\nimport {createBinaryKernelConfig} from
'./binary_kernel';\n\nconst supportsFullBroadcast = false;\n\nexport const lessEqualConfig: KernelConfig =\ncreateBinaryKernelConfig(LessEqual, supportsFullBroadcast, 'bool');\n\n"/**\n * @license\n * Copyright 2019
Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you
may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0 Unless required by applicable law or agreed to in writing,
software distributed under the License is distributed on an "AS IS" BASIS, WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and limitations under the License.\n *
```

```
=====
*/\n\nimport {KernelConfig, Log} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from
'./unary_kernel';\n\nexport const logConfig: KernelConfig = createUnaryKernelConfig(Log);\n\n"/**\n * @license\n *
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"License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
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http://www.apache.org/licenses/LICENSE-2.0 Unless required by applicable law or
agreed to in writing, software distributed under the License is distributed on an "AS IS" BASIS,
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and limitations under the License.\n *
```

```
=====
*/\n\nimport {KernelConfig, LogicalAnd}
from '@tensorflow/tfjs-core';\n\nimport {createBinaryKernelConfig} from './binary_kernel';\n\nconst
supportsFullBroadcast = false;\n\nexport const logicalAndConfig: KernelConfig =\ncreateBinaryKernelConfig(LogicalAnd, supportsFullBroadcast, 'bool');\n\n"/**\n * @license\n * Copyright 2019
Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you
may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
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software distributed under the License is distributed on an "AS IS" BASIS, WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and limitations under the License.\n *
```

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=====
*/\n\nimport {backend_util,
KernelConfig, KernelFunc, Max, MaxAttrs, MaxInputs, TensorInfo, util} from '@tensorflow/tfjs-core';\n\nimport
{BackendWasm} from '../backend_wasm';\n\nimport {permuteAxesAndTranspose} from './kernel_utils';\n\nimport
{CppDType} from './types';\n\nlet wasmMax: (xId: number, dtype: number, reduceSize: number, outId: number)
=> void;\n\nfunction setup(backend: BackendWasm): void {\n  wasmMax = backend.wasm.cwrap(Max, null,
/*void*/, [\n    'number', // x_id\n    'number', // dtype\n    'number', // reduce_size\n    'number', // out_id\n  ]);\n\n  function max(args: {backend: BackendWasm, inputs: MaxInputs, attrs: MaxAttrs}): TensorInfo {\n    const {backend, inputs, attrs} = args;\n    const {reductionIndices: axis, keepDims} = attrs;\n    const {x} = inputs;\n    const xId = backend.dataIdMap.get(x.dataId).id;\n    let inputId = xId;\n    let input = x;\n\n    const {transposed, axes, originalAxes, inputWasTransposed} =\n      permuteAxesAndTranspose(x, axis, backend);\n\n    if (inputWasTransposed) {\n      const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n      input = transposed;\n      inputId = transposedId;\n    }\n\n    const inputRank = input.shape.length;\n    backend_util.assertAxesAreInnerMostDims('max',
```



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convInfo.dilationHeight;\n const dilationWidth = convInfo.dilationWidth;\n const strideHeight =
convInfo.strideHeight;\n const strideWidth = convInfo.strideWidth;\n const inputChannels =
convInfo.inChannels;\n const outputChannels = convInfo.outChannels;\n\n if (convInfo.dataFormat !==
'channelsLast') {\n   throw new Error(\n     `wasm backend does not support dataFormat:` +\n
`${convInfo.dataFormat}`. Please use 'channelsLast'.`);\n } \n\n const out =
backend.makeOutput(convInfo.outShape, 'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n
wasmMaxPool(\n   xId, x.shape[0], x.shape[1], x.shape[2], filterHeight, filterWidth,\n   padTop, padRight,
padBottom, padLeft, dilationHeight, dilationWidth,\n   strideHeight, strideWidth, inputChannels, outputChannels,
outId);\n return out;\n}\n\nexport const maxPoolConfig: KernelConfig = {\n  kernelName: MaxPool,\n
backendName: 'wasm',\n  setupFunc: setup,\n  kernelFunc: maxPool as { } as KernelFunc\n};\n"/**\n * @license\n
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n */
===== \n
*/\n\nimport { backend_util, KernelConfig, KernelFunc, Mean, MeanAttrs, MeanInputs,
TensorInfo, util } from '@tensorflow/tfjs-core';\n\nimport { BackendWasm } from './backend_wasm';\n\nimport { cast }
from './Cast';\n\nimport { permuteAxesAndTranspose } from './kernel_utils';\n\nlet wasmMean: (xId: number,
reduceSize: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n  wasmMean =\n    backend.wasm.cwrap(Mean, null /*void*/, ['number, number, number']);\n}\n\nexport function mean(\n  args:
{ backend: BackendWasm, inputs: MeanInputs, attrs: MeanAttrs }):\n  TensorInfo {\n    const { backend, inputs,
attrs } = args;\n    const { axis, keepDims } = attrs;\n    const { x } = inputs;\n    const xId =
backend.dataIdMap.get(x.dataId).id;\n    let inputId = xId;\n    let input = x;\n\n    const { transposed, axes, originalAxes,
inputWasTransposed } =\n      permuteAxesAndTranspose(x, axis, backend);\n\n    let reductionAxes = axes;\n    if
(inputWasTransposed) {\n      const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n      if (transposedId
!== xId) {\n
        // transpose was not a no-op. We will need to dispose of this\n        // once we are done.\n        input = transposed;\n
inputId = transposedId;\n        reductionAxes = backend_util.getInnerMostAxes(\n          reductionAxes.length,
input.shape.length);\n      }\n    }\n\n    backend_util.assertAxesAreInnerMostDims(\n      'mean', reductionAxes,
input.shape.length);\n    const [outShape, reduceShape] =\n      backend_util.computeOutAndReduceShapes(input.shape, reductionAxes);\n    const reduceSize =
util.sizeFromShape(reduceShape);\n    let castedInput = input;\n    if (input.dtype !== 'float32') {\n      castedInput =\n        cast({ backend, inputs: { x: input }, attrs: { dtype: 'float32' }});\n      inputId =
backend.dataIdMap.get(castedInput.dataId).id;\n    }\n\n    const out = backend.makeOutput(outShape, 'float32');\n    if
(util.sizeFromShape(input.shape) !== 0) {\n      const outId = backend.dataIdMap.get(out.dataId).id;\n      wasmMean(inputId, reduceSize, outId);\n    }\n\n    if (inputWasTransposed) {\n
      // dispose of the transposed tensor.\n      backend.disposeData(transposed.dataId);\n    }\n\n    if (keepDims) {\n      //
reshape\n      const newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n      out.shape =
newShape;\n    }\n\n    if (input.dtype !== 'float32') {\n      backend.disposeData(castedInput.dataId);\n    }\n\n    return
out;\n}\n\nexport const meanConfig: KernelConfig = {\n  kernelName: Mean,\n  backendName: 'wasm',\n
setupFunc: setup,\n  kernelFunc: mean as { } as KernelFunc\n};\n"/**\n * @license\n
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http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
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=====\n
*/\n\nimport { backend_util, KernelConfig, KernelFunc, Min, MinAttrs, MinInputs, TensorInfo, util } from
'@tensorflow/tfjs-core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nimport
{ permuteAxesAndTranspose } from './kernel_utils';\n\nimport { CppDType } from './types';\n\nlet wasmMin: (xId:
number, dtype: number, reduceSize: number, outId: number) =>\n void;\n\nfunction setup(backend:
BackendWasm): void {\n  wasmMin = backend.wasm.cwrap(Min, null /*void*/, [\n    'number', // x_id\n
'number', // dtype\n    'number', // reduce_size\n    'number', // out_id\n  ]);\n\n  function min(args: { backend:
BackendWasm, inputs: MinInputs, attrs: MinAttrs }):\n    TensorInfo {\n    const { backend, inputs, attrs } = args;\n
const { axis, keepDims } = attrs;\n    const { x }\n      = inputs;\n    const xId = backend.dataIdMap.get(x.dataId).id;\n    let inputId = xId;\n    let input = x;\n\n    const
{ transposed, axes, originalAxes, inputWasTransposed } =\n      permuteAxesAndTranspose(x, axis, backend);\n\n    if
(inputWasTransposed) {\n      const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n      if (transposedId
!== xId) {\n        // transpose was not a no-op. We will need to dispose of this\n        // once we are done.\n        input =
transposed;\n        inputId = transposedId;\n      }\n    }\n\n    const inputRank = input.shape.length;\n\n    backend_util.assertAxesAreInnerMostDims('min', axes, inputRank);\n    const [outShape, reduceShape] =\n      backend_util.computeOutAndReduceShapes(input.shape, axes);\n    const reduceSize =
util.sizeFromShape(reduceShape);\n\n    const out = backend.makeOutput(outShape, input.dtype);\n    if
(util.sizeFromShape(input.shape) !== 0) {\n      const outId = backend.dataIdMap.get(out.dataId).id;\n      wasmMin(inputId, CppDType[x.dtype], reduceSize,\n        outId);\n    }\n\n    if (inputWasTransposed) {\n      // dispose of the transposed tensor.\n
backend.disposeData(transposed.dataId);\n    }\n\n    if (keepDims) {\n      // reshape\n      const newShape =
backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n      out.shape = newShape;\n    }\n\n    return
out;\n  }\n\n  export const minConfig: KernelConfig = {\n    kernelName: Min,\n    backendName: 'wasm',\n    setupFunc:
setup,\n    kernelFunc: min as { } as KernelFunc\n  };,\n  "/**\n * @license\n * Copyright 2019 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n
}

=====\n
*/\n\nimport { KernelConfig, Minimum } from '@tensorflow/tfjs-core';\n\nimport { createBinaryKernelConfig } from
'../binary_kernel';\n\nconst supportsFullBroadcast = false;\n\nexport const minimumConfig: KernelConfig =\n  createBinaryKernelConfig(Minimum, supportsFullBroadcast);\n  "/**\n * @license\n * Copyright 2021 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not
use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n
}

=====\n
*/\n\nimport { KernelConfig, KernelFunc, MirrorPad, MirrorPadAttrs, MirrorPadInputs } from '@tensorflow/tfjs-
core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nimport { CppDType } from './types';\n\n// Must match
enum in MirrorPad.cc\nenum MirrorPaddingMode {\n  reflect = 0,\n  symmetric = 1\n}\n\nlet wasmMirrorPad: (\n
xId: number, xShapeBytes: Uint8Array, xShapeLength: number, xDtype: number,\n  prePaddingsBytes:
Uint8Array, postPaddingsBytes: Uint8Array, mode: number,\n  outId: number) => void;\n\nfunction
```



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setup(backend: BackendWasm) {\n  wasmMirrorPad = backend.wasm.cwrap(MirrorPad, null /* void */, [\n
'number', // xId\n  'array', // x.shape\n  'number', // x.shape.length\n  'number', // x.dtype\n  'array', // pre-
paddings\n  'array', // post-paddings\n  'number', //
mode\n  'number', // outId\n  ]);\n}\n\nfunction mirrorPad(args: {\n  inputs: MirrorPadInputs,\n  backend:
BackendWasm,\n  attrs: MirrorPadAttrs\n}) {\n  const {inputs: {x}, backend, attrs: {paddings, mode}} = args;\n\n
const outShape = paddings.map(\n    (p, i) => p[0] /* beforePad */ + x.shape[i] + p[1] /* afterPad */);\n  const xId =
backend.dataIdMap.get(x.dataId).id;\n  const out = backend.makeOutput(outShape, x.dtype);\n  const outId =
backend.dataIdMap.get(out.dataId).id;\n  const xShapeBytes = new Uint8Array(new
Int32Array(x.shape).buffer);\n\n  const prePaddingsFlat = paddings.map(padTuple => padTuple[0]);\n  const
postPaddingsFlat = paddings.map(padTuple => padTuple[1]);\n  const prePaddingsBytes =\n    new
Uint8Array(new Int32Array(prePaddingsFlat).buffer);\n  const postPaddingsBytes =\n    new Uint8Array(new
Int32Array(postPaddingsFlat).buffer);\n\n  wasmMirrorPad(\n    xId, xShapeBytes, x.shape.length,
CppDType[x.dtype], prePaddingsBytes,\n    postPaddingsBytes,
MirrorPaddingMode[mode], outId);\n  return out;\n}\n\n\nexport const mirrorPadConfig: KernelConfig = {\n
kernelName: MirrorPad,\n  backendName: 'wasm',\n  kernelFunc: mirrorPad as { } as KernelFunc,\n  setupFunc:
setup\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the
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on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n */
=====
\n
*/\n\nimport {KernelConfig, Multiply} from '@tensorflow/tfjs-core';\n\nimport
{createBinaryKernelConfig} from './binary_kernel';\n\nconst supportsFullBroadcast = true;\n\nexport const
multiplyConfig: KernelConfig =\n  createBinaryKernelConfig(Multiply, supportsFullBroadcast);\n\n"/**\n *
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2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific
language governing permissions and\n * limitations under the License.\n */
=====
\n
*/\n\nimport {KernelConfig, Neg} from '@tensorflow/tfjs-core';\n\nimport
{createUnaryKernelConfig} from './unary_kernel';\n\nexport const negConfig: KernelConfig =
createUnaryKernelConfig(Neg);\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n *
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software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n */
=====
\n
*/\n\nimport {BackendWasm} from '../backend_wasm';\n\n// Analogous to `struct Result` in
`non_max_suppression_impl.h`\n\ninterface Result {\n
  pSelectedIndices: number;\n  selectedSize: number;\n  pSelectedScores: number;\n  pValidOutputs:
number;\n}\n\n/**\n * Parse the result of the c++ method, which has the shape equivalent to\n * `Result`\n */\n\nexport
function parseResultStruct(\n  backend: BackendWasm, resOffset: number): Result {\n  const result = new

```

```

Int32Array(backend.wasm.HEAPU8.buffer, resOffset, 4);\n const pSelectedIndices = result[0];\n const
selectedSize = result[1];\n const pSelectedScores = result[2];\n const pValidOutputs = result[3];\n // Since the
result was allocated on the heap, we have to delete it.\n backend.wasm._free(resOffset);\n return
{pSelectedIndices, selectedSize, pSelectedScores, pValidOutputs};\n}\n", "/*\n * @license\n * Copyright 2019
Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you
may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n
*\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is
distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n *
=====
*\n\nimport { KernelConfig, KernelFunc, NonMaxSuppressionV3, NonMaxSuppressionV3Attrs,
NonMaxSuppressionV3Inputs, TensorInfo } from '@tensorflow/tfjs-core';\n\nimport { BackendWasm } from
'./backend_wasm';\n\nimport { parseResultStruct } from './NonMaxSuppression_util';\n\nlet wasmFunc: (\n
boxesId: number, scoresId: number, maxOutputSize: number,\n iouThreshold: number, scoreThreshold: number)
=> number;\n\nfunction setup(backend: BackendWasm): void {\n  wasmFunc = backend.wasm.cwrap(\n
NonMaxSuppressionV3,\n    'number', // Result*\n    [\n
    'number', // boxesId\n    'number', // scoresId\n    'number', // maxOutputSize\n    'number', //
iouThreshold\n    'number', // scoreThreshold\n    ]);\n\n  function kernelFunc(args: {\n    backend:
BackendWasm,\n    inputs: NonMaxSuppressionV3Inputs,\n    attrs: NonMaxSuppressionV3Attrs\n  }): TensorInfo {\n
const { backend, inputs, attrs } = args;\n  const { iouThreshold, maxOutputSize, scoreThreshold } = attrs;\n  const
{ boxes, scores } = inputs;\n\n  const boxesId = backend.dataIdMap.get(boxes.dataId).id;\n  const scoresId =
backend.dataIdMap.get(scores.dataId).id;\n\n  const resOffset =\n    wasmFunc(boxesId, scoresId, maxOutputSize,
iouThreshold, scoreThreshold);\n\n  const { pSelectedIndices, selectedSize, pSelectedScores, pValidOutputs } =\n
parseResultStruct(backend, resOffset);\n\n  // Since we are not using scores for V3, we have to delete it from the
heap.\n  backend.wasm._free(pSelectedScores);\n  backend.wasm._free(pValidOutputs);\n\n  const
selectedIndicesTensor
    =\n    backend.makeOutput([selectedSize], 'int32', pSelectedIndices);\n\n  return
selectedIndicesTensor;\n}\n\nexport const nonMaxSuppressionV3Config: KernelConfig = {\n  kernelName:
NonMaxSuppressionV3,\n  backendName: 'wasm',\n  setupFunc: setup,\n  kernelFunc: kernelFunc as { } as
KernelFunc,\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the
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on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
=====
*\n\nimport { KernelConfig, KernelFunc, NonMaxSuppressionV4, NonMaxSuppressionV4Attrs,
NonMaxSuppressionV4Inputs, TensorInfo } from '@tensorflow/tfjs-core';\n\nimport { BackendWasm } from
'./backend_wasm';\n\nimport { parseResultStruct } from './NonMaxSuppression_util';\n\nlet wasmFunc: (\n
boxesId: number, scoresId: number, maxOutputSize: number,\n iouThreshold: number, scoreThreshold: number,\n
padToMaxOutputSize: boolean) => number;\n\nfunction setup(backend: BackendWasm): void {\n  wasmFunc =
backend.wasm.cwrap(\n    NonMaxSuppressionV4,\n    'number', // Result*\n    [\n    'number', // boxesId\n    'number', // scoresId\n    'number', // maxOutputSize\n    'number', // iouThreshold\n    'number', //
scoreThreshold\n    'bool', // padToMaxOutputSize\n    ]);\n\n  function nonMaxSuppressionV4(args: {\n    backend: BackendWasm,\n    inputs: NonMaxSuppressionV4Inputs,\n    attrs: NonMaxSuppressionV4Attrs\n  }):

```

```
TensorInfo[] {\n const {backend, inputs, attrs} = args;\n const {iouThreshold, maxOutputSize, scoreThreshold,  
padToMaxOutputSize} =\n    attrs;\n const {boxes, scores} = inputs;\n\n const boxesId =  
backend.dataIdMap.get(boxes.dataId).id;\n const scoresId = backend.dataIdMap.get(scores.dataId).id;\n\n const  
resOffset = wasmFunc(\n    boxesId, scoresId, maxOutputSize, iouThreshold, scoreThreshold,\n padToMaxOutputSize);\n\n const {pSelectedIndices, selectedSize, pSelectedScores, pValidOutputs} =\n parseResultStruct(backend, resOffset);\n\n // Since we are not using scores for V4, we have to delete it from the  
heap.\n backend.wasm._free(pSelectedScores);\n\n const selectedIndicesTensor =\n backend.makeOutput([selectedSize], 'int32', pSelectedIndices);\n\n const validOutputsTensor =  
backend.makeOutput([], 'int32', pValidOutputs);\n\n return [selectedIndicesTensor,  
validOutputsTensor];\n}\n\nexport const nonMaxSuppressionV4Config: KernelConfig = {\n kernelName:  
NonMaxSuppressionV4,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: nonMaxSuppressionV4 as  
{ } as KernelFunc,\n};\n","/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed  
under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the  
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed  
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or  
implied.\n * See the License for the specific language governing permissions and\n * limitations under the  
License.\n */
```

```
*\nimport {KernelConfig, KernelFunc, NonMaxSuppressionV5, NonMaxSuppressionV5Attrs,  
NonMaxSuppressionV5Inputs, TensorInfo} from '@tensorflow/tfjs-core';\nimport  
{BackendWasm} from '../backend_wasm';\nimport {parseResultStruct} from './NonMaxSuppression_util';\nlet  
wasMFunc:\n (boxesId: number, scoresId: number, maxOutputSize: number,\n   iouThreshold: number,  
scoreThreshold: number, softNmsSigma: number) =>\n   number;\nfunction setup(backend: BackendWasm):  
void {\n  wasMFunc = backend.wasm.cwrap(\n    NonMaxSuppressionV5,\n    'number', // Result*\n    [\n      'number', // boxesId\n      'number', // scoresId\n      'number', // maxOutputSize\n      'number', //  
iouThreshold\n      'number', // scoreThreshold\n      'number', // softNmsSigma\n    ]);\n}\nfunction  
kernelFunc(args: {\n  backend: BackendWasm,\n  inputs: NonMaxSuppressionV5Inputs,\n  attrs:  
NonMaxSuppressionV5Attrs\n}): TensorInfo[] {\n  const {backend, inputs, attrs} = args;\n  const {iouThreshold,  
maxOutputSize, scoreThreshold, softNmsSigma} = attrs;\n  const {boxes, scores} = inputs;\n\n  const boxesId =  
backend.dataIdMap.get(boxes.dataId).id;\n\n  const scoresId = backend.dataIdMap.get(scores.dataId).id;\n\n  const resOffset = wasMFunc(\n    boxesId,  
scoresId, maxOutputSize, iouThreshold, scoreThreshold,\n    softNmsSigma);\n\n  const {pSelectedIndices,  
selectedSize, pSelectedScores, pValidOutputs} =\n    parseResultStruct(backend, resOffset);\n\n  // Since we are  
not using validOutputs for V5, we have to delete it from the\n  // heap.\n  backend.wasm._free(pValidOutputs);\n\n  const selectedIndicesTensor =\n    backend.makeOutput([selectedSize], 'int32', pSelectedIndices);\n  const  
selectedScoresTensor =\n    backend.makeOutput([selectedSize], 'float32', pSelectedScores);\n\n  return  
[selectedIndicesTensor, selectedScoresTensor];\n}\n\nexport const nonMaxSuppressionV5Config: KernelConfig =  
\n{\n  kernelName: NonMaxSuppressionV5,\n  backendName: 'wasm',\n  setupFunc: setup,\n  kernelFunc: kernelFunc  
as { } as KernelFunc,\n};\n","/**\n * @license\n * Copyright 2020 Google LLC. All Rights  
Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file  
except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,  
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES  
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language  
governing permissions and\n * limitations under the License.\n */
```

```
*\nimport {KernelConfig, NotEqual} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from
```

```

'/binary_kernel';\nconst supportsFullBroadcast = false;\nexport const notEqualConfig: KernelConfig =\ncreateBinaryKernelConfig(NotEqual, supportsFullBroadcast, 'bool');\n", "/*\n * @license\n * Copyright 2020\nGoogle LLC. All\nRights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this\nfile except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *\nhttp://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\nsoftware\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\nOR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\ngoverning permissions and\n * limitations under the License.\n *\n=====\n *\n\nimport { KernelConfig, KernelFunc, OneHot, OneHotAttrs, OneHotInputs } from '@tensorflow/tfjs-\ncore';\nimport { BackendWasm } from '../backend_wasm';\n\nlet wasmOneHot: (\n  indicesId: number, depth:\nnumber, onValue: number, offValue: number,\n  outId: number) => void;\n\nfunction setup(backend:\nBackendWasm) {\n  wasmOneHot\n    = backend.wasm.cwrap(OneHot, null /* void */, [\n      'number', // indices_id\n      'number', // depth,\n      'number', //\nonValue\n      'number', // offValue\n      'number' // out_id\n    ]);\n\n  function oneHot(\n    args: { inputs:\nOneHotInputs, attrs: OneHotAttrs, backend: BackendWasm }) {\n    const { inputs, backend, attrs } = args;\n    const\n      { indices } = inputs;\n    const { depth, onValue, offValue } = attrs;\n\n    const out =\n      backend.makeOutput([...indices.shape, depth], 'int32');\n    const outId = backend.dataIdMap.get(out.dataId).id;\n\n    const indicesData = backend.dataIdMap.get(indices.dataId);\n    const indicesId = indicesData.id;\n\n    wasmOneHot(indicesId, depth, onValue, offValue, outId);\n\n    return out;\n  }\n\n  export const oneHotConfig:\nKernelConfig = {\n  kernelName: OneHot,\n  backendName: 'wasm',\n  setupFunc: setup,\n  kernelFunc: oneHot as\n  { } as KernelFunc,\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed\nunder the Apache License, Version\n2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a\ncopy of the License at\n * \n *\nhttp://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable\nlaw or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\nOR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\nthe specific language governing permissions and\n * limitations under the License.\n *\n=====\n *\n\nimport { KernelConfig, KernelFunc, OnesLike, OnesLikeInputs } from '@tensorflow/tfjs-core';\nimport\n{ BackendWasm } from '../backend_wasm';\n\nfunction onesLike(args: { inputs: OnesLikeInputs, backend:\nBackendWasm }) {\n  const { inputs: { x }, backend } = args;\n  const out = backend.makeOutput(x.shape, x.dtype);\n\n  const outVals = backend.tensorArrayFromHeap(out);\n  outVals.fill(1);\n\n  return\n    out;\n}\n\nexport const onesLikeConfig: KernelConfig = {\n  kernelName: OnesLike,\n  backendName: 'wasm',\n  kernelFunc: onesLike as { } as KernelFunc,\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights\nReserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file\nexcept in compliance with the License.\n * You may obtain a copy of the License at\n * \n *\nhttp://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\nsoftware\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\nOR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\ngoverning permissions and\n * limitations under the License.\n *\n=====\n *\n\nimport { KernelConfig, KernelFunc, Pack, PackAttrs, PackInputs, TensorInfo, util } from '@tensorflow/tfjs-\ncore';\nimport\n{ BackendWasm } from '../backend_wasm';\n\nimport { concat } from './Concat';\nimport { expandDims } from\n './ExpandDims';\n\nexport function pack(\n  args: { inputs: PackInputs, backend: BackendWasm, attrs:\nPackAttrs }):\n  TensorInfo {\n    const { inputs, backend, attrs } = args;\n    const { axis } = attrs;\n\n    if (inputs.length

```

```

=== 1) {\n  return expandDims(\n    {inputs: {input: inputs[0]}, backend, attrs: {dim: axis}});\n }\n\n const
shape = inputs[0].shape;\n const dtype = inputs[0].dtype;\n\n inputs.forEach(t => {\n  util.assertShapesMatch(\n
  shape, t.shape,\n    'All tensors passed to stack must have matching shapes');\n  util.assert(\n    dtype ===
t.dtype,\n    () => 'All tensors passed to stack must have matching dtypes');\n });\n\n const
intermediateTensorInfos: TensorInfo[] = [];\n const expandedTensors = inputs.map(t => {\n  const expandedT =\n
  expandDims({inputs: {input: t}, backend, attrs: {dim: axis}});\n  intermediateTensorInfos.push(expandedT);\n
  return expandedT;\n });\n\n const result = concat({inputs: expandedTensors, backend, attrs: {axis}});\n\n
intermediateTensorInfos.forEach(t => backend.disposeData(t.dataId));\n\n return result;\n}\n\nexport const
packConfig: KernelConfig = {\n  kernelName: Pack,\n  backendName: 'wasm',\n  kernelFunc: pack as {} as
KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
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Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n
* =====\n
*\n\nimport {KernelConfig, KernelFunc, PadV2, PadV2Attrs, PadV2Inputs, util} from '@tensorflow/tfjs-
core';\n\nimport {BackendWasm} from './backend_wasm';\n\nimport {fill} from './Fill';\n\nimport {CppType}
from './types';\n\nlet wasmPadV2: (\n  xId: number, xShapeBytes: Uint8Array, xShapeLength: number, xDtype:
number,\n  prePaddingsBytes: Uint8Array, postPaddingsBytes: Uint8Array,\n  constantValue: number, outId:
number) => void;\n\nfunction setup(backend: BackendWasm) {\n  wasmPadV2 = backend.wasm.cwrap(PadV2, null
/* void */, [\n    'number', // xId\n    'array', // x.shape\n    'number', // x.shape.length\n    'number', // x.dtype\n
'array', // pre-paddings\n    'array', // post-paddings\n    'number', // constantValue\n    'number', // outId\n
]);\n}\n\nfunction pad(\n  args: {inputs: PadV2Inputs, backend: BackendWasm, attrs: PadV2Attrs}) {\n  const
{inputs: {x}, backend, attrs:
{paddings, constantValue}} = args;\n\n  const outShape = paddings.map(\n    (p, i) => p[0] /* beforePad */ +
x.shape[i] + p[1] /* afterPad */);\n\n  if (util.sizeFromShape(x.shape) === 0) {\n    // Short-circuit the computation,
since x doesn't have value, only\n    // the shape is used to compute output shape to pad.\n    return fill({\n
backend,\n    attrs: {shape: outShape, value: constantValue, dtype: x.dtype}\n  });\n }\n\n  const xId =
backend.dataIdMap.get(x.dataId).id;\n  const out = backend.makeOutput(outShape, x.dtype);\n  const
outTensorData = backend.dataIdMap.get(out.dataId);\n  const outId = outTensorData.id;\n\n  const xShapeBytes =
new Uint8Array(new Int32Array(x.shape).buffer);\n\n  const prePaddingsFlat = paddings.map(padTuple =>
padTuple[0]);\n  const postPaddingsFlat = paddings.map(padTuple => padTuple[1]);\n  const prePaddingsBytes =\n
new Uint8Array(new Int32Array(prePaddingsFlat).buffer);\n  const postPaddingsBytes =\n    new
Uint8Array(new
Int32Array(postPaddingsFlat).buffer);\n\n  wasmPadV2(\n    xId, xShapeBytes, x.shape.length,
CppType[x.dtype], prePaddingsBytes,\n    postPaddingsBytes, constantValue, outId);\n  return out;\n}\n\nexport
const padV2Config: KernelConfig = {\n  kernelName: PadV2,\n  backendName: 'wasm',\n  kernelFunc: pad as {} as
KernelFunc,\n  setupFunc: setup\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n
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compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n
* =====\n
*\n\nimport {KernelConfig, Pow} from '@tensorflow/tfjs-core';\n\nimport {createBinaryKernelConfig} from

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'./binary_kernel';\nconst supportsFullBroadcast = false;\nexport const powConfig: KernelConfig =\ncreateBinaryKernelConfig(Pow, supportsFullBroadcast);\n"/**\n * @license\n * Copyright 2019 Google LLC. All\nRights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this\nfile except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *  

http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,\nsoftware\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES  

OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language  

governing permissions and\n * limitations under the License.\n *

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*/\n\nimport { KernelConfig, KernelFunc, Prelu, PreluInputs } from '@tensorflow/tfjs-core';\n\nimport\n{ BackendWasm } from '../backend_wasm';\n\nimport { cast } from './Cast';\n\nlet wasmPrelu: (xId: number,\nweightsId: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n  wasmPrelu =\nbackend.wasm.cwrap(Prelu, null /* void */, [\n  'number', // x_id\n  'number', // weights_id\n  'number' //\nout_id\n]);\n\nfunction prelu(args: { inputs: PreluInputs, backend: BackendWasm }) {\n  const { inputs, backend }\n= args;\n  const { x, alpha } = inputs;\n  const xId = backend.dataIdMap.get(x.dataId).id;\n  const weightsId =\nbackend.dataIdMap.get(alpha.dataId).id;\n\n  let inputId = xId;\n  const input = x;\n  let castedInput = input;\n  if\n(input.dtype !== 'float32') {\n    castedInput = cast({ backend, inputs: { x }, attrs: { dtype: 'float32' }});\n    inputId =\nbackend.dataIdMap.get(castedInput.dataId).id;\n  }\n\n  const out = backend.makeOutput(x.shape, 'float32');\n  const outId = backend.dataIdMap.get(out.dataId).id;\n  wasmPrelu(inputId, weightsId, outId);\n\n  if (input.dtype !== 'float32') {\n    backend.disposeData(castedInput.dataId);\n  }\n  return out;\n}\n\nexport const preluConfig: KernelConfig = {\nkernelName: Prelu,\nbackendName: 'wasm',\nsetupFunc: setup,\nkernelFunc: prelu as {} as\nKernelFunc\n};\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the\nApache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the\nLicense.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed\non an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or\nimplied.\n * See the License for the specific language governing\npermissions and\n * limitations under the License.\n *

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*/\n\nimport { backend_util, KernelConfig, KernelFunc, Prod, ProdAttrs, ProdInputs, TensorInfo, util } from\n '@tensorflow/tfjs-core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nimport\n{ permuteAxesAndTranspose } from './kernel_utils';\n\nimport { CppDType } from './types';\n\nlet wasmProd: (\n xId: number, reduceSize: number,\n dtype: number, outId: number) => void;\n\nfunction setup(backend:\nBackendWasm): void {\n  wasmProd = backend.wasm.cwrap(Prod, null /*void*/, [\n  'number',\n  'number',\n  'number',\n  'number'\n]);\n\nfunction prod(args: {\n  backend: BackendWasm,\n  inputs: ProdInputs,\n  attrs:\nProdAttrs\n}): TensorInfo {\n  const { backend, inputs, attrs } = args;\n  const { axis, keepDims } = attrs;\n  const { x }\n= inputs;\n  const xId = backend.dataIdMap.get(x.dataId).id;\n  let inputId = xId;\n  let input = x;\n\n  const\n{ transposed, axes, originalAxes, inputWasTransposed } =\npermuteAxesAndTranspose(x, axis, backend);\n\n  let reductionAxes = axes;\n  if (inputWasTransposed) {\n    const transposedId =\nbackend.dataIdMap.get(transposed.dataId).id;\n    if (transposedId !== xId) {\n      // transpose was not a no-op. We\nwill need to dispose of this\n      // once we are done.\n      input = transposed;\n      inputId = transposedId;\n    }\n    reductionAxes = backend_util.getInnerMostAxes(\n      reductionAxes.length, input.shape.length);\n  }\n\n  backend_util.assertAxesAreInnerMostDims(\n    'prod', reductionAxes, input.shape.length);\n  const [outShape,\nreduceShape] =\nbackend_util.computeOutAndReduceShapes(input.shape, reductionAxes);\n  const reduceSize\n= util.sizeFromShape(reduceShape);\n\n  const out = backend.makeOutput(outShape, input.dtype);\n  if\n(util.sizeFromShape(input.shape) !== 0) {\n    const outId = backend.dataIdMap.get(out.dataId).id;\n    wasmProd(inputId, reduceSize,\n
```

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CppType[out.dtype], outId);\n }\n\n if (inputWasTransposed) {\n // dispose of the transposed tensor.\n backend.disposeData(transposed.dataId);\n }\n\n if (keepDims) {\n // reshape\n const newShape =\n backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n out.shape = newShape;\n }\n\n return\n out;\n}\n\nexport const prodConfig: KernelConfig = {\n kernelName: Prod,\n backendName: 'wasm',\n setupFunc:\n setup,\n kernelFunc: prod as { } as KernelFunc\n};\n\n","**\n * @license\n * Copyright 2020 Google LLC. All\n Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this\n file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,\n software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\n OR CONDITIONS OF ANY KIND, either\n express or implied.\n * See the License for the specific language governing permissions and\n * limitations under\n the License.\n *

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=====\n
*/\nimport { util } from '@tensorflow/tfjs-core';\nextport function rangeImpl(start, stop, step, dtype) {\n  const\n  sameStartStop = start === stop;\n  const increasingRangeNegativeStep = start < stop && step < 0;\n  const\n  decreasingRangePositiveStep = stop < start && step > 1;\n  if (sameStartStop\n    || increasingRangeNegativeStep ||\n      decreasingRangePositiveStep) {\n    return util.makeZerosTypedArray(0,\n      dtype);\n  }\n  const numElements = Math.abs(Math.ceil((stop - start) / step));\n  const values =\n    util.makeZerosTypedArray(numElements, dtype);\n  if (stop < start && step === 1) {\n    // Auto adjust the\n    step's sign if it hasn't been set\n    // (or was set to 1)\n    step = -1;\n  }\n  values[0] = start;\n  for (let i = 1; i\n    < values.length; i++) {\n    values[i] = values[i - 1] + step;\n  }\n  return values;\n}\n//\nsourceMappingURL=data:application/json;base64,eyJ2ZXJzaW9uIjozLCJmaWxlIjoiUmFuZ2VfaW1wbC5qcycIsIn\nvndXJjZVJvb3QIOiLiLCJzb3VyY2VzIjpblie4uLy4uLy4uLy4uLy4uLy4uLy4uL3RmanMtyMmFja2VuZC1jcHUvc3JlZ2t2c\nm5lbHMvUmFuZ2VfaW1wbC50cyJdLCJuYW1lc3VudD0udUJBQXVCLENBQU7QUFFeEQsTUFB\nTSxVQUFVLFBQVMsQ0FDckIsS0FBYSxFQUFFLEIBQVksRUFBRSxJUUFZLEVbQ3pDLEtBQXdCO0IBQz\nFCLE1BQU0sYUFBYSxHQUFHLEtBQUssS0FBSyxJUUFJLENBQU7SUFDckMsTUFBTSwyQkFBMkIsR0F\nBRyxLQUFLLEDBQUcsSUFBSsxJUUFJLEIBQUksR0FBRyxLQUFDLENBQU7SUFDN0QsTUFBTSwyQkF\nBMkIsR0FBRyxJUUFJLEDBQUcsS0FBSyxJUUFJLEIBQUksR0FBRyxLQUFDLENBQU7SUFFN0QsSUFBS\nxhQUFHLEIBQUksMkJBTJC01FBQzVDLDJCQUEyQixFUUFFO1FBQy9CLE9BQU8sSUFBSsxLQUFDLG1\nCQUFTQixLQUFDLENBQUmsRUFBRSxLQUFLLENBQUmsQ0FBQztLQUMzQztlQUVELE1BQU0sV0FBVy\nxHQUFHLEIBQUksQ0FBQyxHQUFHLENBQUmsSUFBSsxLQUFDLEIBQUksQ0FBQyxLQUFDLEIBQUksR0\nFBRyxLOUFLLENBOUMsR0FBRyxJOUFJLENBOUMsO0FBOyxDOUFDO0IBQv9ELE1BQU0sTUFBTsxHO
```


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=====\n\n*\\nimport { KernelConfig, Relu } from '@tensorflow/tfjs-core';\\n\\nimport { createUnaryKernelConfig } from\n'./unary_kernel';\\nexport const reluConfig: KernelConfig = createUnaryKernelConfig(Relu);\\n\\n\"/*\\n * @license\\n * Copyright 2019 Google LLC. All Rights Reserved.\\n * Licensed under the Apache License, Version 2.0 (the\n'License');\\n * you may not use this file except in compliance with the License.\\n * You may obtain a copy of the\nLicense at\\n *\\n * http://www.apache.org/licenses/LICENSE-2.0\\n *\\n * Unless required by applicable law or\nagreed to in writing, software\\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\\n * See the License for\nthe specific language governing permissions and\\n * limitations under the License.\\n *
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=====\n\n*\\nimport { KernelConfig, Relu6 } from '@tensorflow/tfjs-core';\\n\\nimport\n{ createUnaryKernelConfig } from './unary_kernel';\\nexport const relu6Config: KernelConfig =\ncreateUnaryKernelConfig(Relu6);\\n\\n\"/*\\n * @license\\n * Copyright 2019 Google LLC. All Rights Reserved.\\n * Licensed under the Apache License, Version 2.0 (the\n'License');\\n * you may not use this file except in\ncompliance with the License.\\n * You may obtain a copy of the License at\\n *\\n *\nhttp://www.apache.org/licenses/LICENSE-2.0\\n *\\n * Unless required by applicable law or agreed to in writing,\nsoftware\\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\\n * See the License for the specific language\n governing permissions and\\n * limitations under the License.\\n *
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=====\n\n*\\n\\nimport { KernelConfig, KernelFunc, ResizeBilinear, ResizeBilinearAttrs, ResizeBilinearInputs, TensorInfo,\nutil } from '@tensorflow/tfjs-core';\\n\\nimport\n{ BackendWasm } from './backend_wasm';\\n\\nimport { cast } from './Cast';\\n\\nlet wasmResizeBilinear: (\\n  xId:\nnumber, batch: number, oldHeight: number, oldWidth: number,\\n  numChannels: number, newHeight: number,\nnewWidth: number,\\n  alignCorners: number, halfPixelCenters: number, outId: number) => void;\\n\\nfunction\nsetup(backend: BackendWasm): void {\\n  wasmResizeBilinear = backend.wasm.cwrap(ResizeBilinear, null\n/*void*/, [\\n  'number', // xId\\n  'number', // batch\\n  'number', // oldHeight\\n  'number', // oldWidth\\n\n'number', // numChannels\\n  'number', // newHeight\\n  'number', // newWidth\\n  'number', // alignCorners\\n\n'number', // halfPixelCenters\\n  'number' // outId\\n]);\\n}\\n\\nfunction resizeBilinear(args: {\\n  backend:\nBackendWasm,\\n  inputs: ResizeBilinearInputs,\\n  attrs: ResizeBilinearAttrs\\n}): TensorInfo {\\n  const {backend,\ninputs, attrs} = args;\\n\\n  const {images} = inputs;\\n  const {alignCorners, halfPixelCenters,\nsize} = attrs;\\n  const [newHeight, newWidth] = size;\\n  const [batch, oldHeight, oldWidth, numChannels] =\nimages.shape;\\n  const outShape = [batch, newHeight, newWidth, numChannels];\\n\\n  let xData =\nbackend.dataIdMap.get(images.dataId);\\n  let castedData;\\n  if (xData.dtype !== 'float32') {\\n    castedData =\\n\n  cast({backend, inputs: {x: images}, attrs: {dtype: 'float32'}});\\n  }\\n  xData =\n  backend.dataIdMap.get(castedData.dataId);\\n}\\n  const xId = xData.id;\\n\\n  const out =\n  backend.makeOutput(outShape, 'float32');\\n  if (util.sizeFromShape(images.shape) === 0) {\\n    return out;\\n  }\\n\n  const outId = backend.dataIdMap.get(out.dataId).id;\\n\\n  wasmResizeBilinear(\\n    xId, batch, oldHeight,\noldWidth, numChannels, newHeight, newWidth,\\n    alignCorners ? 1 : 0, halfPixelCenters ? 1 : 0, outId);\\n\\n  if\n(castedData !== null) {\\n    backend.disposeData(castedData.dataId);\\n  }\\n\\n  return out;\\n}\\n}\\n\\nexport const\nresizeBilinearConfig: KernelConfig = {\\n  kernelName: ResizeBilinear,\\n\n  backendName: 'wasm',\\n  setupFunc: setup,\\n  kernelFunc: resizeBilinear as {} as KernelFunc\\n};\\n\\n\"/*\\n * \\n * @license\\n * Copyright 2020 Google LLC. All Rights Reserved.\\n * Licensed under the Apache License, Version\n2.0 (the 'License');\\n * you may not use this file except in compliance with the License.\\n * You may obtain a\ncopy of the License at\\n *\\n * http://www.apache.org/licenses/LICENSE-2.0\\n *\\n * Unless required by applicable
```

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```
=====\\n
*\\n\\nimport { KernelConfig, KernelFunc, Reverse, ReverseAttrs, ReverseInputs, TensorInfo, util } from
'@tensorflow/tfjs-core';\\n\\nimport { BackendWasm } from '../backend_wasm';\\n\\nimport
{ identity } from './Identity';\\nimport { reshape } from './Reshape';\\n\\nlet wasmReverse: (\\n  xId: number, axes:
Uint8Array, axesLength: number, outShape: Uint8Array,\\n  outShapeLength: number, outId: number) =>
void;\\n\\nfunction setup(backend: BackendWasm) {\\n  wasmReverse = backend.wasm.cwrap(Reverse, null, [\\n
'number', // x_id\\n 'array', // axes\\n 'number', // axes_length\\n 'array', // out_shape\\n 'number', //
out_shape_length\\n 'number' // out_id\\n ]);\\n}\\n\\nexport function reverse(\\n  args: { inputs: ReverseInputs,
backend: BackendWasm, attrs: ReverseAttrs }):\\n  TensorInfo {\\n  const { inputs, backend, attrs } = args;\\n  const
{ x } = inputs;\\n  const { dims } = attrs;\\n\\n  const axes = util.parseAxisParam(dims, x.shape);\\n\\n  if (x.shape.length
=== 0) {\\n    return identity({ inputs: { x }, backend });\\n  }\\n\\n  const out = backend.makeOutput(x.shape, x.dtype);\\n
const xId = backend.dataIdMap.get(x.dataId).id;\\n  const outId = backend.dataIdMap.get(out.dataId).id;\\n\\n
  const axesBytes = new Uint8Array(new Int32Array(axes).buffer);\\n  const outShapeBytes = new Uint8Array(new
Int32Array(x.shape).buffer);\\n\\n  wasmReverse(\\n    xId, axesBytes, axes.length, outShapeBytes, x.shape.length,
outId);\\n\\n  const reshaped =\\n    reshape({ inputs: { x: out }, attrs: { shape: x.shape }, backend });\\n\\n
  backend.disposeData(out.dataId);\\n  return reshaped;\\n}\\n\\nexport const reverseConfig: KernelConfig = {\\n
kernelName: Reverse,\\n backendName: 'wasm',\\n kernelFunc: reverse as { } as KernelFunc,\\n setupFunc:
setup\\n};\\n", "/*\\n * @license\\n * Copyright 2019 Google LLC. All Rights Reserved.\\n * Licensed under the
Apache License, Version 2.0 (the \"License\");\\n * you may not use this file except in compliance with the
License.\\n * You may obtain a copy of the License at\\n * \\n * http://www.apache.org/licenses/LICENSE-2.0\\n *\\n *
Unless required by applicable law or agreed to in writing, software\\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\\n * See the License for the specific language governing permissions and\\n * limitations under the
License.\\n *
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=====\\n
*\\n\\nimport { KernelConfig, KernelFunc, RotateWithOffset, RotateWithOffsetAttrs, RotateWithOffsetInputs,
TensorInfo } from '@tensorflow/tfjs-core';\\nimport { backend_util } from '@tensorflow/tfjs-core';\\n\\nimport
{ BackendWasm } from '../backend_wasm';\\n\\nlet wasmRotate: (\\n  xId: number, batch: number, imageHeight:
number, imageWidth: number,\\n  numChannels: number, radians: number, centerX: number, centerY: number,\\n
fillBytes: Uint8Array, fillLength: number, outId: number) => void;\\n\\nfunction setup(backend: BackendWasm) {\\n
wasmRotate = backend.wasm.cwrap(RotateWithOffset, null /* void */, [\\n 'number', // xId\\n 'number', //
batch\\n 'number', // imageHeight\\n 'number', //
imageWidth\\n 'number', // numChannels\\n 'number', // radians\\n 'number', // centerX\\n 'number', //
centerY\\n 'array', // fillBytes\\n 'number', // fillLength\\n 'number', // outId\\n ]);\\n}\\n\\nexport function
rotateWithOffset(args: {\\n  inputs: RotateWithOffsetInputs,\\n  backend: BackendWasm,\\n  attrs:
RotateWithOffsetAttrs\\n}): TensorInfo {\\n  const { inputs, backend, attrs } = args;\\n  const { image } = inputs;\\n  const
{ radians, fillValue, center } = attrs;\\n\\n  const out = backend.makeOutput(image.shape, image.dtype);\\n  const
imageId = backend.dataIdMap.get(image.dataId).id;\\n  const outId = backend.dataIdMap.get(out.dataId).id;\\n\\n
  const [batch, imageHeight, imageWidth, numChannels] = image.shape;\\n\\n  const [centerX, centerY] =\\n
  backend_util.getImageCenter(center, imageHeight, imageWidth);\\n\\n  const fillIsBlack = fillValue === 0;\\n  const
fullOpacityValue = 255;\\n\\n  const fillValues = typeof fillValue === 'number' ?\\n    [fillValue, fillValue, fillValue,
fillIsBlack ? 0 : fullOpacityValue] :\\n    [...fillValue, fullOpacityValue];\\n  const fillBytes = new Uint8Array(new
Int32Array(fillValues).buffer);\\n\\n  wasmRotate(\\n    imageId, batch, imageHeight, imageWidth, numChannels,
radians, centerX,\\n    centerY, fillBytes, fillValues.length, outId);\\n  return out;\\n}\\n\\nexport const
rotateWithOffsetConfig: KernelConfig = {\\n  kernelName: RotateWithOffset,\\n  backendName: 'wasm',\\n
```

kernelFunc: rotateWithOffset as { } as KernelFunc;\n setupFunc: setup\n);\n", "/*\n * @license\n * Copyright 2021 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR

CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *

```
=====\n\n*\\nimport { KernelConfig, Round } from '@tensorflow/tfjs-core';\\n\\nimport { createUnaryKernelConfig } from\n'./unary_kernel';\\n\\nexport const roundConfig: KernelConfig = createUnaryKernelConfig(Round);\\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the\n\nspecific language governing permissions and\n * limitations under the License.\n *
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```
=====\n\n*\\nimport { KernelConfig, Rsqrt } from '@tensorflow/tfjs-core';\\n\\nimport { createUnaryKernelConfig } from\n'./unary_kernel';\\n\\nexport const rsqrtConfig: KernelConfig = createUnaryKernelConfig(Rsqrt);\\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the\n\nspecific language governing permissions and\n * limitations under the License.\n *
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* =====\n\n*\\n\\nimport { KernelConfig, KernelFunc, scatter_util, ScatterNd, ScatterNdAttrs, ScatterNdInputs, TensorInfo, util }\nfrom '@tensorflow/tfjs-core';\\n\\nimport { BackendWasm } from '../backend_wasm';\\n\\nimport { CppDType } from\n'./types';\\n\\nlet wasmScatterNd: (\\n  indicesId: number, updatesId: number, dtype: CppDType, sliceRank:\nnumber,\\n  numUpdates: number, sliceSize: number, strides: Uint8Array,\\n  outputSize: number, outId: number)\n=> void;\\n\\nfunction setup(backend: BackendWasm): void {\\n  wasmScatterNd = backend.wasm.cwrap(ScatterNd,\nnull /*void*/, [\\n  'number', // indicesId\\n  'number', // updatesId\\n  'number', // dtype\\n  'number', //\nsliceRank\\n  'number', // numUpdates\\n  'number', // sliceSize\\n  'array', // strides\\n  'number', // outputSize\\n\n  'number' // outId\\n  ]);\\n}\\n\\nfunction scatterNd(\\n  args: \\n    { backend: BackendWasm, inputs:\nScatterNdInputs, attrs:\nScatterNdAttrs });\\n  TensorInfo {\\n    const { backend, inputs, attrs } = args;\\n    const { indices, updates } = inputs;\\n\nconst { shape } = attrs;\\n\\n    const out = backend.makeOutput(shape, updates.dtype);\\n    if (util.sizeFromShape(shape)\n=== 0) {\\n      return out;\\n    }\\n\\n    const { sliceRank, numUpdates, sliceSize, strides, outputSize } =\\n\nscatter_util.calculateShapes(updates, indices, shape);\\n\\n    const indicesData =\nbackend.dataIdMap.get(indices.dataId);\\n    const indicesId = indicesData.id;\\n\\n    const updatesData =\nbackend.dataIdMap.get(updates.dataId);\\n    const updatesId = updatesData.id;\\n\\n    const stridesBytes = new\nUint8Array(new Int32Array(strides).buffer);\\n\\n    const outId = backend.dataIdMap.get(out.dataId).id;\\n\\n\nwasmScatterNd(\\n      indicesId, updatesId, CppDType[updates.dtype], sliceRank, numUpdates,\\n      sliceSize,\nstridesBytes, outputSize, outId);\\n}\\n\\nexport const scatterNdConfig: KernelConfig = {\\n\nkernelName: ScatterNd,\\n  backendName: 'wasm',\\n
```

setupFunc: setup,\n kernelFunc: scatterNd as { } as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *

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=====\n\n*\n\nimport { KernelConfig, KernelFunc, Select, SelectInputs, util } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nlet wasmSelect: (\n  conditionId: number, tId: number, eId: number, offset: number,\n  outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n  wasmSelect = backend.wasm.cwrap('SelectV2', null, [\n    'number', // conditionId\n    'number', // tId\n    'number', // eId\n    'number', // offset\n    'number', // outId\n  ]);\n\n  function select(args: { inputs: SelectInputs, backend: BackendWasm }) {\n    const { inputs, backend } = args;\n    const { condition, t, e } = inputs;\n    const conditionId = backend.dataIdMap.get(condition.dataId).id;\n    const tId = backend.dataIdMap.get(t.dataId).id;\n    const eId = backend.dataIdMap.get(e.dataId).id;\n    const out = backend.makeOutput(t.shape, t.dtype);\n    const outId = backend.dataIdMap.get(out.dataId).id;\n\n    const cRank = condition.shape.length;\n    const tRank = t.shape.length;\n\n    const offset = cRank === 0 || cRank > 1 || tRank === 1 ?\n      1 : util.sizeFromShape(t.shape.slice(1));\n\n    wasmSelect(conditionId, tId, eId, offset, outId);\n    return out;\n  }\n\n  export const
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selectConfig: KernelConfig = {\n  kernelName: Select,\n  backendName: 'wasm',\n  kernelFunc: select as { } as KernelFunc,\n  setupFunc: setup\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
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=====\n\n*\n\nimport { KernelConfig, KernelFunc, Sigmoid, SigmoidInputs, TensorInfo, util } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nlet wasmFunc: (xId: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n  wasmFunc = backend.wasm.cwrap(Sigmoid, null /* void */, ['number', 'number']);\n\n  function sigmoid(args: { backend: BackendWasm, inputs: SigmoidInputs }): TensorInfo {\n    const { backend, inputs: { x } } = args;\n    const xId = backend.dataIdMap.get(x.dataId).id;\n    const out = backend.makeOutput(x.shape, x.dtype);\n    const outId = backend.dataIdMap.get(out.dataId).id;\n\n    // Short-circuit zero-sized tensors.\n    if (util.sizeFromShape(out.shape) === 0) {\n      return out;\n    }\n\n    wasmFunc(xId, outId);\n    return out;\n  }\n\n  export const sigmoidConfig: KernelConfig = {\n    kernelName: 'Sigmoid',\n    backendName: 'wasm',\n    setupFunc: setup,\n    kernelFunc: sigmoid as { } as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file
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```

```
=====\n\n*\n\nimport { KernelConfig, Sin } from '@tensorflow/tfjs-core';\nimport { createUnaryKernelConfig } from
```

./unary_kernel';\nexport const sinConfig: KernelConfig = createUnaryKernelConfig(Sin);\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\n * License at\n * \n

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=====\n\n*\n\nimport { KernelConfig, KernelFunc, Softmax, SoftmaxAttrs, SoftmaxInputs, TensorInfo, util } from\n '@tensorflow/tfjs-core';\n\nimport { BackendWasm } from './backend_wasm';\n\nlet wasmFunc: (xId: number, outId:\n number, channels: number, batch: number) =>\n void;\n\nfunction setup(backend: BackendWasm): void {\n\n wasmFunc = backend.wasm.cwrap(Softmax, null /* void */, [\n 'number', // xId\n 'number', // outId\n 'number', // channels\n 'number' // batch\n]);\n\n\nfunction softmax(\n args: { backend: BackendWasm,\n inputs: SoftmaxInputs, attrs: SoftmaxAttrs }):\n TensorInfo {\n\n const { backend, inputs: { logits }, attrs: { dim } } =\n args;\n\n const xId = backend.dataIdMap.get(logits.dataId).id;\n\n const out = backend.makeOutput(logits.shape,\n logits.dtype);\n\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n const channels = logits.shape[dim];\n\n const batch = util.sizeFromShape(logits.shape) / channels;\n\n\n // Short-circuit zero-sized tensors.\n\n if\n (util.sizeFromShape(out.shape) === 0) {\n\n return out;\n\n }\n\n\n wasmFunc(xId, outId, channels, batch);\n\n return\n out;\n\n}\n\n\nexport const softmaxConfig: KernelConfig = {\n\n kernelName: Softmax,\n\n backendName: 'wasm',\n\n setupFunc: setup,\n\n kernelFunc: softmax as { } as KernelFunc\n\n};\n", "/*\n * @license\n * Copyright 2021 Google\n * LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not\n * use this file except in compliance with the License.\n * You may obtain a copy of the License at\n

*\n * <http://www.apache.org/licenses/LICENSE-2.0>\n * Unless required by applicable law or agreed to in\n * writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT\n * WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific\n * language governing permissions and\n * limitations under the License.\n *

=====\n\n*\n\nimport { backend_util, KernelConfig, KernelFunc, ReshapeAttrs, ReshapeInputs, SpaceToBatchND,\n SpaceToBatchNDAttrs, SpaceToBatchNDInputs, TensorInfo, TransposeAttrs, TransposeInputs, util } from\n '@tensorflow/tfjs-core';\n\nimport { BackendWasm } from './backend_wasm';\n\nimport { padV2Config } from\n './PadV2';\n\nimport { reshape } from './Reshape';\n\nimport { transpose } from './Transpose';\n\nfunction\n spaceToBatchND(args: {\n\n inputs: SpaceToBatchNDInputs,\n\n backend: BackendWasm,\n\n attrs:\n SpaceToBatchNDAttrs\n\n }) {\n\n const { inputs, backend,\n\n attrs } = args;\n\n const { x } = inputs;\n\n const { blockShape, paddings } = attrs;\n\n\n const prod =\n util.sizeFromShape(blockShape);\n\n const completePaddings: Array<[number, number]> = [[0, 0]];\n\n completePaddings.push(...(paddings as Array<[number, number]>));\n\n for (let i = 1 + blockShape.length; i <\n x.shape.length; ++i) {\n\n completePaddings.push([0, 0]);\n\n }\n\n\n const paddedX = padV2Config.kernelFunc({\n\n inputs: { x },\n\n backend,\n\n attrs: { paddings: completePaddings, constantValue: 0 }\n\n }) as TensorInfo;\n\n\n const\n reshapedPaddedShape =\n\n backend_util.getReshaped(paddedX.shape, blockShape, prod, false);\n\n\n const\n permutedReshapedPaddedPermutation = backend_util.getPermuted(\n\n reshapedPaddedShape.length,\n\n blockShape.length, false);\n\n\n const flattenShape =\n\n backend_util.getReshapedPermuted(paddedX.shape,\n\n blockShape, prod, false);\n\n\n const reshapeInputs: ReshapeInputs = { x: paddedX };\n\n const reshapeAttrs:\n ReshapeAttrs = { shape: reshapedPaddedShape };\n\n\n const paddedXReshaped =\n\n reshape({ inputs: reshapeInputs, backend, attrs: reshapeAttrs });\n\n\n const\n transposeInputs: TransposeInputs = { x: paddedXReshaped };\n\n const transposeAttrs:\n TransposeAttrs = { perm:\n permutedReshapedPaddedPermutation };\n\n const paddedXT =\n\n transpose({ inputs: transposeInputs, backend,\n\n attrs: transposeAttrs });\n\n\n const resultReshapeInputs: ReshapeInputs = { x: paddedXT };\n\n const

```

resultReshapeAttrs: ReshapeAttrs = {shape: flattenShape};\n const result = reshape(\n    {inputs:
resultReshapeInputs, backend, attrs: resultReshapeAttrs});\n\n backend.disposeData(paddedX.dataId);\n
backend.disposeData(paddedXReshaped.dataId);\n backend.disposeData(paddedXT.dataId);\n\n return
result;\n}\n\nexport const spaceToBatchNDConfig: KernelConfig = {\n kernelName: SpaceToBatchND,\n
backendName: 'wasm',\n kernelFunc: spaceToBatchND as { } as KernelFunc\n};\n", "/**\n * @license\n *
Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed
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the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n
*\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is
distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n *
=====\\n
*/\\n\\nimport {KernelConfig, KernelFunc, SplitV, SplitVAttrs, SplitVInputs, util} from '@tensorflow/tfjs-
core';\\nimport {backend_util} from '@tensorflow/tfjs-core';\\n\\nimport {BackendWasm} from
'./backend_wasm';\\n\\nimport {slice} from './Slice';\\n\\nexport function splitV(\\n  args: {inputs: SplitVInputs, attrs:
SplitVAttrs, backend: BackendWasm}) {\\n  const {inputs,
attrs, backend} = args;\\n  const {x} = inputs;\\n  const {numOrSizeSplits, axis} = attrs;\\n\\n  const $axis =
util.parseAxisParam(axis, x.shape)[0];\\n\\n  const splitSizes = backend_util.prepareSplitSize(x, numOrSizeSplits,
$axis);\\n  const begin = new Array(x.shape.length).fill(0);\\n  const size = x.shape.slice();\\n  return splitSizes.map(s
=> {\\n    const xSliceSize = [...size];\\n    xSliceSize[$axis] = s;\\n    const xSlice =\\n      slice({inputs: {x}, attrs:
{begin, size: xSliceSize}, backend});\\n    begin[$axis] += s;\\n    return xSlice;\\n  });\\n}\\n\\nexport const
splitVConfig: KernelConfig = {\\n  kernelName: SplitV,\\n  backendName: 'wasm',\\n  kernelFunc: splitV as { } as
KernelFunc\\n};\\n", "/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n
*\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is
distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n *
=====\\n
*/\\n\\nimport {KernelConfig, Sqrt} from '@tensorflow/tfjs-core';\\n\\nimport {createUnaryKernelConfig} from
'./unary_kernel';\\n\\nexport const sqrtConfig: KernelConfig = createUnaryKernelConfig(Sqrt);\\n", "/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
\"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
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agreed to in writing, software\n
* distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR
CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing
permissions and\n * limitations under the License.\n *
=====\\n
*/\\n\\nimport {KernelConfig, Square} from '@tensorflow/tfjs-core';\\n\\nimport {createUnaryKernelConfig} from
'./unary_kernel';\\n\\nexport const squareConfig: KernelConfig = createUnaryKernelConfig(Square);\\n", "/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version
2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n
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law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n

```

* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *

```
=====\n\n*\n\nimport {KernelConfig, SquaredDifference} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from './binary_kernel';\nconst supportsFullBroadcast = true;\nexport const squaredDifferenceConfig: KernelConfig =\n  createBinaryKernelConfig(SquaredDifference, supportsFullBroadcast);\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on\n * an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or\n * implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */
```

```
=====\n\n*\n\nimport {KernelConfig, KernelFunc, Step, StepAttrs, StepInputs, TensorInfo} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nimport {CppType} from './types';\nlet wasmStep:\n  (xId: number, alpha: number, dtype: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n  wasmStep = backend.wasm.cwrap(Step, null /*void*/, [\n    'number', // x_id\n    'number', // alpha\n    'number', // dtype\n    'number', // out_id\n  ]);\n\n  function step(\n    args: {\n      backend: BackendWasm,\n      inputs: StepInputs,\n      attrs: StepAttrs\n    }): TensorInfo {\n    const {backend, inputs, attrs} = args;\n    const {alpha} = attrs;\n    const {x} = inputs;\n    const xId = backend.dataIdMap.get(x.dataId).id;\n    const out = backend.makeOutput(x.shape, x.dtype);\n    const outId = backend.dataIdMap.get(out.dataId).id;\n    wasmStep(xId, alpha, CCppType[x.dtype], outId);\n    return out;\n  }\n\n  export const stepConfig: KernelConfig = {\n    kernelName: Step,\n    backendName: 'wasm',\n    setupFunc: setup,\n    kernelFunc: step as {} as KernelFunc\n  };\n\n"/**\n * @license\n * Copyright 2021 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */
```

```
=====\n\n*\n\nimport {KernelConfig, KernelFunc, slice_util, StridedSlice, StridedSliceAttrs, StridedSliceInputs, TensorInfo, util} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nimport {reshape} from './Reshape';\nimport {slice} from './Slice';\nlet wasmStridedSlice: (\n  xId: number, xStridesBytes: Uint8Array, xRank: number,\n  beginBytes: Uint8Array, endBytes: Uint8Array, stridesBytes: Uint8Array,\n  outShapeBytes: Uint8Array, outStridesBytes: Uint8Array,\n  outShapeLength: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n  wasmStridedSlice = backend.wasm.cwrap(StridedSlice, null /*void*/, [\n    'number', // xId\n    'array', // xStrides\n    'number', // xRank\n    'array', // beginBytes\n    'array', // endBytes\n    'array', // stridesBytes\n    'array', // outShapeBytes\n    'array', // outStridesBytes\n    'number', // outShapeLength\n    'number', // outId\n  ]);\n\n  export function stridedSlice(\n    args: {\n      backend: BackendWasm,\n      inputs: StridedSliceInputs,\n      attrs: StridedSliceAttrs\n    }): TensorInfo {\n    const {backend, inputs, attrs} = args;\n    const {x} = inputs;\n    const {\n      begin,\n      end,\n      strides,\n      beginMask,\n      endMask,\n      ellipsisMask,\n      newAxisMask,\n      shrinkAxisMask\n    } = attrs;\n    const {\n      finalShapeSparse,\n      finalShape,\n      isIdentity,\n      sliceDim0,\n      isSimpleSlice,\n      begin: $begin,\n      end: $end,\n      strides: $strides\n    } =\n      slice_util.sliceInfo(\n        x.shape, begin, end, strides, beginMask, endMask, ellipsisMask,\n        newAxisMask, shrinkAxisMask);\n    let result;\n    if (isIdentity) {\n      // Optimization #1, slice is a no-op plus
```

```

reshape\n  result = reshape({inputs: {x}, backend, attrs: {shape: finalShape}});\n } else if (sliceDim0 ||
isSimpleSlice) {\n  // Optimization #2, slice is memory contiguous
  (only occurs in dim 0)\n  util.assert(\n    x.shape.length >= 1,\n    () => `Input must have rank at least 1, got:
${x.shape.length}`);\n\n  const size = slice_util.computeOutShape($begin, $end, $strides);\n  // To tolerate
begin[0] > end[0] (a 0-output slice), we min(begin, end).\n  const sliced = slice({inputs: {x}, backend, attrs:
{begin: $begin, size}});\n  result =\n    reshape({inputs: {x: sliced}, backend, attrs: {shape: finalShape}});\n  backend.disposeData(sliced.dataId);\n } else {\n  const out = backend.makeOutput(finalShapeSparse,
'float32');\n\n  const xId = backend.dataIdMap.get(x.dataId).id;\n  const xStridesBytes =\n    new
Uint8Array(new Int32Array(util.computeStrides(x.shape)).buffer);\n  const beginBytes = new Uint8Array(new
Int32Array($begin).buffer);\n  const endBytes = new Uint8Array(new Int32Array($end).buffer);\n  const
stridesBytes = new Uint8Array(new Int32Array($strides).buffer);\n\n  const outputShapeBytes =\n    new
Uint8Array(new Int32Array(finalShapeSparse).buffer);\n  const outStridesBytes = new Uint8Array(\n    new
Int32Array(util.computeStrides(finalShapeSparse)).buffer);\n  const outId =
backend.dataIdMap.get(out.dataId).id;\n\n  wasmStridedSlice(\n    xId, xStridesBytes, x.shape.length,
beginBytes, endBytes, stridesBytes,\n    outputShapeBytes, outStridesBytes, finalShapeSparse.length, outId);\n\n  result = reshape({inputs: {x: out}, backend, attrs: {shape: finalShape}});\n\n  backend.disposeData(out.dataId);\n
}\n\n  return result;\n}\n\nexport const stridedSliceConfig: KernelConfig = {\n  kernelName: StridedSlice,\n
backendName: 'wasm',\n  setupFunc: setup,\n  kernelFunc: stridedSlice as { } as KernelFunc\n};\n", "/*\n *
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at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in
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WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific
language governing permissions and\n * limitations under the License.\n *
=====\n
*/\nimport {KernelConfig, Sub} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from
'./binary_kernel';\nconst supportsFullBroadcast = true;\nexport const subConfig: KernelConfig =\n  createBinaryKernelConfig(Sub, supportsFullBroadcast);\n", "/*\n * \n * @license\n * Copyright 2019 Google LLC. All
Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this
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http://www.apache.org/licenses/LICENSE-2.0\n
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distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n *
=====\n
*/\n\nimport {backend_util, KernelConfig, KernelFunc, Sum, SumAttrs, SumInputs, TensorInfo, util} from
'@tensorflow/tfjs-core';\n\nimport {BackendWasm} from './backend_wasm';\n\nimport
{permuteAxesAndTranspose} from './kernel_utils';\nimport {CppType} from './types';\n\nlet wasmSum: (xId:
number, reduceSize: number, dtype: number, outId: number) =>\n  void;\n\nfunction setup(backend:
BackendWasm): void {\n  wasmSum = backend.wasm.cwrap(Sum, null /*void*/, [\n    'number', // input_id\n
'number', // reduce_size\n    'number', // dtype\n    'number', // out_id\n  ]);\n\n  function sum(args: {backend: BackendWasm, inputs: SumInputs, attrs:
SumAttrs}): TensorInfo {\n    const {backend, inputs, attrs} = args;\n    const {axis, keepDims} = attrs;\n    const
{x} = inputs;\n    const xId = backend.dataIdMap.get(x.dataId).id;\n    let inputId = xId;\n    let input = x;\n\n    const
{transposed, axes, originalAxes, inputWasTransposed} =\n      permuteAxesAndTranspose(x, axis, backend);\n\n    let reductionAxes = axes;\n    if (inputWasTransposed) {\n      const transposedId =

```



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backend.dataIdMap.get(transposed.dataId).id;\n  if (transposedId !== xId) {\n    // transpose was not a no-op. We
will need to dispose of this\n    // once we are done.\n    input = transposed;\n    inputId = transposedId;\n    reductionAxes = backend_util.getInnerMostAxes(\n      reductionAxes.length, input.shape.length);\n    }\n  }\n  backend_util.assertAxesAreInnerMostDims(\n    'sum', reductionAxes, input.shape.length);\n  const [outShape,
    reduceShape] =\n    backend_util.computeOutAndReduceShapes(input.shape, reductionAxes);\n  const reduceSize
= util.sizeFromShape(reduceShape);\n  const out = backend.makeOutput(outShape, input.dtype);\n  if
(util.sizeFromShape(input.shape) !== 0) {\n    const outId = backend.dataIdMap.get(out.dataId).id;\n    wasmSum(inputId, reduceSize, CppDType[out.dtype], outId);\n  }\n  if (inputWasTransposed) {\n    // dispose of
the transposed tensor.\n    backend.disposeData(transposed.dataId);\n  }\n  if (keepDims) {\n    // reshape\n    const
newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n    out.shape = newShape;\n  }\n  return out;\n}\n\nexport const sumConfig: KernelConfig = {\n  kernelName: Sum,\n  backendName: 'wasm',\n  setupFunc: setup,\n  kernelFunc: sum as {} as KernelFunc\n};\n\n", "/*\n * @license\n * Copyright 2021 Google
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except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *\n
=====
\n
*/\nimport {KernelConfig, Tan} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from
'./unary_kernel';\nexport const tanConfig: KernelConfig = createUnaryKernelConfig(Tan);\n\n", "/*\n * @license\n *
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\"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
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http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *\n
=====
\n
*/\nimport {KernelConfig, Tanh} from '@tensorflow/tfjs-core';\nimport {createUnaryKernelConfig} from
'./unary_kernel';\nexport const tanhConfig: KernelConfig = createUnaryKernelConfig(Tanh);\n\n", "/*\n * @license\n *
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\"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *\n
=====
\n
*/\n\nimport {KernelConfig, KernelFunc, Tile, TileAttrs, TileInputs} from '@tensorflow/tfjs-core';\nimport
{BackendWasm} from '../backend_wasm';\nimport {CppDType} from './types';\nlet wasmTile: (\n  xId:
number, xShape: Uint8Array, xShapeSize: number, newShape: Uint8Array,\n  newShapeSize: number, dtype:
number, outId: number) => void;\nfunction setup(backend: BackendWasm) {\n  wasmTile =
backend.wasm.cwrap(Tile, null /* void */, [\n    'number', // x_id\n    'array', // x_shape\n    'number', //
x_shape.length\n    'array', // new_shape\n    'number', // new_shape.length\n    'number' // out_id\n
  ]);\n}\n\nfunction tile(\n  args: {inputs: TileInputs, backend: BackendWasm, attrs: TileAttrs}) {\n  const {inputs,
backend, attrs} = args;\n  const {x} = inputs;\n  const xId = backend.dataIdMap.get(x.dataId).id;\n  const {reps} =
attrs;\n  const newShape: number[] = new Array(x.shape.length);\n  for (let i = 0; i < newShape.length; i++) {\n

```

```

newShape[i] = x.shape[i] * reps[i];\n } \n const xShapeBytes = new Uint8Array(new Int32Array(x.shape).buffer);\n
const newShapeBytes = new Uint8Array(new Int32Array(newShape).buffer);\n\n const out =
backend.makeOutput(newShape, x.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n wasmTile(\n
xId, xShapeBytes, x.shape.length, newShapeBytes, newShape.length,\n   CppDType[out.dtype], outId);\n return
out;\n}\n\nexport const tileConfig: KernelConfig = {\n  kernelName: Tile,\n  backendName: 'wasm',\n  setupFunc:
setup,\n  kernelFunc: tile as { } as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC.

```

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```

===== \n
*\n\nimport { KernelConfig, KernelFunc, TensorInfo, TopK, TopKAttrs, TopKInputs } from '@tensorflow/tfjs-
core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nimport { CppDType } from './types';\n\nlet wasmTopK:
(\n  xId: number, xShapeBytes: Uint8Array, xShapeLength: number,\n  xDType: CppDType, k: number, sorted:
boolean,
  outValuesId: number,\n  outIndicesId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n
wasmTopK = backend.wasm.cwrap(TopK, null /* void */, [\n  'number', // xId\n  'array', // x.shape\n  'number',
// x.shape.length\n  'number', // x.dtype\n  'number', // k\n  'bool', // sorted\n  'number', // outValuesId\n
'number', // outIndicesId\n  ]);\n}\n\nexport const topk:\n  (args: { inputs: TopKInputs, backend: BackendWasm,
attrs: TopKAttrs }) =>\n    TensorInfo[] | TensorInfo = ({ inputs, backend, attrs }) => {\n    const { x } = inputs;\n
const { k, sorted } = attrs;\n    const xId = backend.dataIdMap.get(x.dataId).id;\n    const xShapeBytes
= new Uint8Array(new Int32Array(x.shape).buffer);\n    const outputShape = x.shape.slice();\n
outputShape[outputShape.length - 1] = k;\n    const outValues = backend.makeOutput(outputShape, x.dtype);\n
const outValuesId = backend.dataIdMap.get(outValues.dataId).id;\n
const outIndices = backend.makeOutput(outputShape, 'int32');\n    const outIndicesId =
backend.dataIdMap.get(outIndices.dataId).id;\n\n    wasmTopK(\n      xId, xShapeBytes, x.shape.length,
CppDType[x.dtype], k, sorted,\n      outValuesId, outIndicesId);\n\n    return [outValues, outIndices];\n
};\n\nexport const topKConfig: KernelConfig = {\n  kernelName: TopK,\n  backendName: 'wasm',\n  setupFunc:
setup,\n  kernelFunc: topk as { } as KernelFunc,\n};\n", "/*\n * @license\n * Copyright 2021 Google LLC. All
Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR

```

CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *

```

===== \n
*\n\nimport { KernelConfig, KernelFunc, TensorInfo, Transform, TransformAttrs, TransformInputs, util } from
'@tensorflow/tfjs-core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nlet wasmTransform: (\n  imageId:
number, transformsId: number, isBatchTransform: boolean,\n  batch: number, outHeight: number, outWidth:
number, numChannels: number,\n  imageWidth: number, imageHeight: number, strides: Uint8Array,\n  stridesLength: number, interpolationModeId: number, fillModeId: number,\n  fillValue: number, outId: number)
=> void;\n\nfunction setup(backend: BackendWasm): void {\n  wasmTransform = backend.wasm.cwrap(Transform,
null /* void */, [\n    'number', // imageId\n    'number', // transformsId\n    'bool', // isBatchTransform\n
'number', // batch\n    'number', // outHeight\n    'number', // outWidth\n    'number', // numChannels\n
'number', // imageWidth\n    'number', // imageHeight\n    'array', // strides\n    'number', // stridesLength\n

```

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'number', // interpolationModeId\n    'number', // fillValue\n    'number' // outId\n);\n\nfunction transform(\n    args:\n        {backend: BackendWasm, inputs: TransformInputs, attrs: TransformAttrs})\n    TensorInfo {\n        const {backend, inputs, attrs} = args;\n        const {image, transforms} = inputs;\n        const {interpolation, fillMode, fillValue, outputShape} = attrs;\n        const [batch, imageHeight, imageWidth, numChannels] = image.shape;\n        const [outHeight, outWidth] =\n            outputShape != null ? outputShape : [imageHeight, imageWidth];\n        const outShape =\n            [batch, outHeight, outWidth, numChannels] as [number, number, number, number];\n        const strides =\n            new Uint8Array(new Int32Array(util.computeStrides(image.shape)).buffer);\n\n        const out = backend.makeOutput(outShape, image.dtype);\n        const outId = backend.dataIdMap.get(out.dataId).id;\n        const imageData = backend.dataIdMap.get(image.dataId);\n        const imageId = imageData.id;\n        const transformsData = backend.dataIdMap.get(transforms.dataId);\n        const transformsId = transformsData.id;\n        const interpolationModeId = interpolation === 'nearest' ? 1 : 2;\n        let fillModeId;\n        switch (fillMode) {\n            case 'constant':\n                fillModeId = 1; break;\n            case 'reflect':\n                fillModeId = 2; break;\n            case 'wrap':\n                fillModeId = 3; break;\n            case 'nearest':\n                fillModeId = 4; break;\n            default:\n                fillModeId = 1; break;\n        }\n        wasmTransform(\n            imageId, transformsId, (transforms.shape[0] > 1), batch, outHeight,\n            outWidth, numChannels, imageWidth, imageHeight, strides,\n            image.shape.length - 1, interpolationModeId, fillModeId, fillValue,\n            outId);\n\n        return out;\n    }\n\nexport const transformConfig: KernelConfig = {\n    kernelName: Transform,\n    backendName: 'wasm',\n    setupFunc: setup,\n    kernelFunc: transform as {} as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software distributed under the License is distributed on an "AS IS"\n * BASIS, WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n\nimport {KernelConfig, KernelFunc, ZerosLike, ZerosLikeInputs} from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nfunction zerosLike(args: {inputs: ZerosLikeInputs, backend: BackendWasm}) {\n    const {inputs: {x}, backend} = args;\n    const out = backend.makeOutput(x.shape, x.dtype);\n    const outVals = backend.typedArrayFromHeap(out);\n    outVals.fill(0);\n    return out;\n}\n\nexport const zerosLikeConfig: KernelConfig = {\n    kernelName: ZerosLike,\n    backendName: 'wasm',\n    kernelFunc: zerosLike as {} as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software distributed under the License is distributed on an "AS IS"\n * BASIS, WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n\nWe explicitly import the modular kernels so they get registered in the global registry when we compile the library. A modular build would replace the contents of this file and import only the kernels that are needed.\nimport {KernelConfig, registerKernel} from '@tensorflow/tfjs-core';\nimport {fusedMatMulConfig} from './kernels/_FusedMatMul';\nimport {absConfig} from './kernels/Abs';\nimport {addConfig} from './kernels/Add';\nimport {addNConfig} from './kernels/AddN';\nimport {allConfig} from './kernels/All';\nimport {anyConfig} from './kernels/Any';\nimport {argMaxConfig} from './kernels/ArgMax';\nimport {avgPoolConfig} from './kernels/AvgPool';\nimport {batchMatMulConfig} from './kernels/BatchMatMul';\nimport {batchToSpaceNDConfig} from './kernels/BatchToSpaceND';\nimport
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{castConfig} from './kernels/Cast';\nimport {ceilConfig} from './kernels/Ceil';\nimport {clipByValueConfig} from
 './kernels/ClipByValue';\nimport {concatConfig} from './kernels/Concat';\nimport {conv2DConfig} from
 './kernels/Conv2D';\nimport {conv2DBackpropInputConfig} from './kernels/Conv2DBackpropInput';\nimport
 {cosConfig} from './kernels/Cos';\nimport {coshConfig} from './kernels/Cosh';\nimport {cropAndResizeConfig}
 from './kernels/CropAndResize';\nimport {cumsumConfig} from './kernels/Cumsum';\nimport
 {depthToSpaceConfig} from './kernels/DepthToSpace';\nimport {depthwiseConv2dNativeConfig} from
 './kernels/DepthwiseConv2dNative';\nimport {eluConfig} from './kernels/Elu';\nimport {equalConfig} from
 './kernels/Equal';\nimport {expConfig} from './kernels/Exp';\nimport {expandDimsConfig} from
 './kernels/ExpandDims';\nimport {fillConfig} from './kernels/Fill';\nimport {flipLeftRightConfig} from
 './kernels/FlipLeftRight';\nimport {floorConfig} from './kernels/Floor';\nimport {floorDivConfig}
 from './kernels/FloorDiv';\nimport {fusedBatchNormConfig} from './kernels/FusedBatchNorm';\nimport
 {fusedConv2DConfig} from './kernels/FusedConv2D';\nimport {fusedDepthwiseConv2DConfig} from
 './kernels/FusedDepthwiseConv2D';\nimport {gatherNdConfig} from './kernels/GatherNd';\nimport
 {gatherV2Config} from './kernels/GatherV2';\nimport {greaterConfig} from './kernels/Greater';\nimport
 {greaterEqualConfig} from './kernels/GreaterEqual';\nimport {identityConfig} from './kernels/Identity';\nimport
 {leakyReluConfig} from './kernels/LeakyRelu';\nimport {lessConfig} from './kernels/Less';\nimport
 {lessEqualConfig} from './kernels/LessEqual';\nimport {logConfig} from './kernels/Log';\nimport
 {logicalAndConfig} from './kernels/LogicalAnd';\nimport {maxConfig} from './kernels/Max';\nimport
 {maximumConfig} from './kernels/Maximum';\nimport {maxPoolConfig} from './kernels/MaxPool';\nimport
 {meanConfig} from './kernels/Mean';\nimport {minConfig} from './kernels/Min';\nimport {minimumConfig} from
 './kernels/Minimum';\nimport {mirrorPadConfig} from './kernels/MirrorPad';\nimport {multiplyConfig} from
 './kernels/Multiply';\nimport {negConfig} from './kernels/Neg';\nimport {nonMaxSuppressionV3Config} from
 './kernels/NonMaxSuppressionV3';\nimport {nonMaxSuppressionV4Config} from
 './kernels/NonMaxSuppressionV4';\nimport {nonMaxSuppressionV5Config} from
 './kernels/NonMaxSuppressionV5';\nimport {notEqualConfig} from './kernels/NotEqual';\nimport {oneHotConfig}
 from './kernels/OneHot';\nimport {onesLikeConfig} from './kernels/OnesLike';\nimport {packConfig} from
 './kernels/Pack';\nimport {padV2Config} from './kernels/PadV2';\nimport {powConfig} from
 './kernels/Pow';\nimport {preluConfig} from './kernels/Prelu';\nimport {prodConfig} from './kernels/Prod';\nimport
 {rangeConfig} from './kernels/Range';\nimport {realDivConfig} from './kernels/RealDiv';\nimport {reluConfig}
 from './kernels/Relu';\nimport {relu6Config} from './kernels/Relu6';\nimport {reshapeConfig} from
 './kernels/Reshape';\nimport
 {resizeBilinearConfig} from './kernels/ResizeBilinear';\nimport {reverseConfig} from './kernels/Reverse';\nimport
 {rotateWithOffsetConfig} from './kernels/RotateWithOffset';\nimport {roundConfig} from
 './kernels/Round';\nimport {rsqrtConfig} from './kernels/Rsqrt';\nimport {scatterNdConfig} from
 './kernels/ScatterNd';\nimport {selectConfig} from './kernels/Select';\nimport {sigmoidConfig} from
 './kernels/Sigmoid';\nimport {sinConfig} from './kernels/Sin';\nimport {sliceConfig} from './kernels/Slice';\nimport
 {softmaxConfig} from './kernels/Softmax';\nimport {spaceToBatchNDConfig} from
 './kernels/SpaceToBatchND';\nimport {splitVConfig} from './kernels/SplitV';\nimport {sqrtConfig} from
 './kernels/Sqrt';\nimport {squareConfig} from './kernels/Square';\nimport {squaredDifferenceConfig} from
 './kernels/SquaredDifference';\nimport {stepConfig} from './kernels/Step';\nimport {stridedSliceConfig} from
 './kernels/StridedSlice';\nimport {subConfig} from './kernels/Sub';\nimport {sumConfig}
 from './kernels/Sum';\nimport {tanConfig} from './kernels/Tan';\nimport {tanhConfig} from
 './kernels/Tanh';\nimport {tileConfig} from './kernels/Tile';\nimport {topKConfig} from './kernels/TopK';\nimport
 {transformConfig} from './kernels/Transform';\nimport {transposeConfig} from './kernels/Transpose';\nimport
 {unpackConfig} from './kernels/Unpack';\nimport {zerosLikeConfig} from './kernels/ZerosLike';\n\n// List all kernel
 configs here\nconst kernelConfigs: KernelConfig[] = [\n  absConfig,\n  addConfig,\n  addNConfig,\n  allConfig,\n
  anyConfig,\n  argMaxConfig,\n  avgPoolConfig,\n  batchMatMulConfig,\n  batchToSpaceNDConfig,\n
  castConfig,\n  ceilConfig,\n  clipByValueConfig,\n  concatConfig,\n  conv2DConfig,\n

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conv2DBackpropInputConfig,\n cosConfig,\n coshConfig,\n cropAndResizeConfig,\n cumsumConfig,\n
depthToSpaceConfig,\n depthwiseConv2dNativeConfig,\n eluConfig,\n equalConfig,\n expConfig,\n
expandDimsConfig,\n fillConfig,\n flipLeftRightConfig,\n floorConfig,\n
  floorDivConfig,\n fusedMatMulConfig,\n fusedBatchNormConfig,\n fusedConv2DConfig,\n
fusedDepthwiseConv2DConfig,\n gatherNdConfig,\n gatherV2Config,\n greaterConfig,\n greaterEqualConfig,\n
identityConfig,\n leakyReluConfig,\n lessConfig,\n lessEqualConfig,\n logConfig,\n logicalAndConfig,\n
maxConfig,\n maximumConfig,\n maxPoolConfig,\n meanConfig,\n minConfig,\n minimumConfig,\n
mirrorPadConfig,\n multiplyConfig,\n negConfig,\n nonMaxSuppressionV3Config,\n
nonMaxSuppressionV4Config,\n nonMaxSuppressionV5Config,\n notEqualConfig,\n oneHotConfig,\n
onesLikeConfig,\n packConfig,\n padV2Config,\n powConfig,\n preluConfig,\n prodConfig,\n rangeConfig,\n
realDivConfig,\n reluConfig,\n relu6Config,\n reshapeConfig,\n resizeBilinearConfig,\n reverseConfig,\n
rotateWithOffsetConfig,\n rsqrtConfig,\n roundConfig,\n scatterNdConfig,\n selectConfig,\n sigmoidConfig,\n
sinConfig,\n sliceConfig,\n softmaxConfig,\n spaceToBatchNDConfig,\n splitVConfig,\n
  sqrtConfig,\n squareConfig,\n squaredDifferenceConfig,\n stepConfig,\n stridedSliceConfig,\n subConfig,\n
sumConfig,\n tanConfig,\n tanhConfig,\n tileConfig,\n topKConfig,\n transformConfig,\n transposeConfig,\n
unpackConfig,\n zerosLikeConfig\n];\n\nfor (const kernelConfig of kernelConfigs) {\n
  registerKernel(kernelConfig);\n}\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n *
Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in
compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n
* =====\n
*\n\nimport { KernelConfig, KernelFunc, TensorInfo, Unpack, UnpackAttrs, UnpackInputs } from
'@tensorflow/tfjs-core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nimport { slice } from
'./Slice';\n\nfunction unpack(\n  args: { inputs: UnpackInputs, backend: BackendWasm, attrs: UnpackAttrs }):\n  TensorInfo[] {\n    const { inputs, backend, attrs } = args;\n    const { value } = inputs;\n    let { axis } = attrs;\n    if (axis <
0) {\n      axis += value.shape.length;\n    }\n    const numOutputs = value.shape[axis];\n    const rank =
value.shape.length;\n    const outShape: number[] = new Array(rank - 1);\n    let outIndex = 0;\n    for (let i = 0; i < rank;\n    i++) {\n      if (i !== axis) {\n        outShape[outIndex++] = value.shape[i];\n      }\n    }\n    const outs: TensorInfo[] = new
Array(numOutputs);\n    const begin = new Array(rank).fill(0);\n    const size = value.shape.slice();\n    size[axis] = 1;\n    for (let i = 0; i < outs.length;\n    i++) {\n      begin[axis] = i;\n      outs[i] = slice({ inputs: { x: value }, attrs: { begin, size }, backend });\n    }\n    return
outs.map(({ dataId, dtype }) => ({ dataId, dtype, shape: outShape }));\n  }\n\nexport const unpackConfig: KernelConfig
= {\n  kernelName: Unpack,\n  backendName: 'wasm',\n  kernelFunc: unpack as {} as KernelFunc,\n};\n", "/*\n *
@license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version
2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n
* =====\n
*\n\nimport { env } from '@tensorflow/tfjs-core';\n\nconst ENV = env();\n\n/*\n * True if SIMD is supported.\n
*\n * From: https://github.com/GoogleChromeLabs/wasm-feature-detect\n\nENV.registerFlag(\n  // This typed array
passed in to WebAssembly.validate is WebAssembly binary\n  // code. In this case it is a small program that
contains SIMD\n  // instructions.\n  'WASM_HAS_SIMD_SUPPORT', async () => WebAssembly.validate(new
Uint8Array([\n    0, 97, 115, 109, 1, 0, 0, 0, 1, 4, 1, 96, 0, 0, 3,\n    2, 1, 0, 10, 9, 1, 7, 0, 65, 0, 253, 15, 26,

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11\n  ]));\n\n/**\n * True if threads are supported.\n */\n\n// From: https://github.com/GoogleChromeLabs/wasm-
feature-detect\nENV.registerFlag("WASM_HAS_MULTITHREAD_SUPPORT", async () => {\n //
TODO(annxingyuan): Enable node support once this is resolved:\n //
https://github.com/tensorflow/tfjs/issues/3830\n if (ENV.get('IS_NODE')) {\n  return false;\n }\n\n try
{\n  // Test for transferability of SABs (needed for Firefox)\n  //
https://groups.google.com/forum/#!msg/mozilla.dev.platform/IHkBZIHETpA/dwsMNchWEQAJ\n  new
MessageChannel().port1.postMessage(new SharedArrayBuffer(1));\n  // This typed array is a WebAssembly
program containing threaded\n  // instructions.\n  return WebAssembly.validate(new Uint8Array([\n    0, 97,
115, 109, 1, 0, 0, 0, 1, 4, 1, 96, 0, 0, 3, 2, 1, 0, 5,\n    4, 1, 3, 1, 1, 10, 11, 1, 9, 0, 65, 0, 254, 16, 2, 0, 26,
11\n  ]));\n } catch (e) {\n  return false;\n }\n});\n\n", "\nvar WasmBackendModuleThreadedSimd = (function() {\n
var _scriptDir = typeof document !== 'undefined' && document.currentScript ? document.currentScript.src :
undefined;\n if (typeof __filename !== 'undefined') _scriptDir = _scriptDir || __filename;\n return
(function(WasmBackendModuleThreadedSimd) {\n  WasmBackendModuleThreadedSimd =
WasmBackendModuleThreadedSimd || {};\n\nfunction
GROWABLE_HEAP_I8(){if(wasmMemory.buffer!=buffer){updateGlobalBufferAndViews(wasmMemory.buffer)}
return
HEAP8}function
GROWABLE_HEAP_U8(){if(wasmMemory.buffer!=buffer){updateGlobalBufferAndViews(wasmMemory.buffer)
}return HEAPU8}function
GROWABLE_HEAP_I32(){if(wasmMemory.buffer!=buffer){updateGlobalBufferAndViews(wasmMemory.buffer)
}return HEAP32}function
GROWABLE_HEAP_U32(){if(wasmMemory.buffer!=buffer){updateGlobalBufferAndViews(wasmMemory.buffer)
}}return HEAPU32}function
GROWABLE_HEAP_F64(){if(wasmMemory.buffer!=buffer){updateGlobalBufferAndViews(wasmMemory.buffer)
}}return HEAPF64}var Module=typeof
WasmBackendModuleThreadedSimd!="undefined"?WasmBackendModuleThreadedSimd:{};var
readyPromiseResolve,readyPromiseReject;Module["ready"]=new
Promise(function(resolve,reject){readyPromiseResolve=resolve;readyPromiseReject=reject});var
moduleOverrides={};var key;for(key in
Module){if(Module.hasOwnProperty(key)){moduleOverrides[key]=Module[key]}}var arguments_=[];var
thisProgram=\.this.program\`;var quit_=function(status,toThrow){throw
toThrow};var ENVIRONMENT_IS_WEB=false;var ENVIRONMENT_IS_WORKER=false;var
ENVIRONMENT_IS_NODE=false;var ENVIRONMENT_IS_SHELL=false;ENVIRONMENT_IS_WEB=typeof
window==="object";ENVIRONMENT_IS_WORKER=typeof
importScripts==="function";ENVIRONMENT_IS_NODE=typeof process==="object"&&typeof
process.versions==="object"&&typeof
process.versions.node==="string";ENVIRONMENT_IS_SHELL=!ENVIRONMENT_IS_WEB&&!ENVIRONM
ENT_IS_NODE&&!ENVIRONMENT_IS_WORKER;var
ENVIRONMENT_IS_PTHREAD=Module["ENVIRONMENT_IS_PTHREAD"]||false;if(ENVIRONMENT_IS_P
THREAD){buffer=Module["buffer"]}var scriptDirectory="";function
locateFile(path){if(Module["locateFile"]){return Module["locateFile"](path,scriptDirectory)}return
scriptDirectory+path}var read_,readAsync,readBinary,setWindowTitle;var nodeFS;var
nodePath;if(ENVIRONMENT_IS_NODE){if(ENVIRONMENT_IS_WORKER){scriptDirectory=require("path").
dirname(scriptDirectory)+"\\"}else{scriptDirectory=__dirname+"\\"}read_=function
shell_read(filename,binary){if(!nodeFS)nodeFS=require("fs");if(!nodePath)nodePath=require("path");filename=n
odePath["normalize"](filename);return
nodeFS["readFileSync"](filename,binary?null:"utf8")};readBinary=function readBinary(filename){var
ret=read_(filename,true);if(!ret.buffer){ret=new Uint8Array(ret)}assert(ret.buffer);return

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ret});if(process["argv"].length>1){thisProgram=process["argv"][1].replace(/\\/g,"\\")}arguments_=process["arg
v"].slice(2);process["on"]("\\uncaughtException",function(ex){if(!(ex instanceof ExitStatus)){throw
ex}});process["on"]("\\unhandledRejection",abort);quit_=function(status){process["exit"](status)};Module["insp
ect"]=function(){return"[Emscripten Module object]"};var
nodeWorkerThreads;try{nodeWorkerThreads=require("\\worker_threads")}catch(e){console.error("The
\\worker_threads\\ module is not supported in this node.js build - perhaps a newer version is needed?");throw
e}global.Worker=nodeWorkerThreads.Worker}else if(ENVIRONMENT_IS_SHELL){if(typeof
read!="undefined"){read_=function shell_read(f){return read(f)}readBinary=function readBinary(f){var
data;if(typeof readbuffer==="function"){return new
Uint8Array(readbuffer(f))}data=read(f,"binary");assert(typeof data==="object");return data};if(typeof
scriptArgs!="undefined"){arguments_=scriptArgs}else if(typeof
arguments!="undefined"){arguments_=arguments}if(typeof
quit==="function"){quit_=function(status){quit(status)}}if(typeof print!="undefined"){if(typeof
console==="undefined")console={};console.log=print;console.warn=console.error=typeof
printErr!="undefined"?printErr:print}}else
if(ENVIRONMENT_IS_WEB||ENVIRONMENT_IS_WORKER){if(ENVIRONMENT_IS_WORKER){scriptDire
ctory=self.location.href}else if(typeof
document!="undefined"&&document.currentScript){scriptDirectory=document.currentScript.src}if(typeof
_scriptDir != "undefined" &&
_scriptDir){scriptDirectory=_scriptDir}if(scriptDirectory.indexOf("\\blob:")!==0){scriptDirectory=scriptDirectory.s
ubstr(0,scriptDirectory.lastIndexOf("\\")+1)}else{scriptDirectory="\\"}if(ENVIRONMENT_IS_NODE){read_=fun
ction
shell_read(filename,binary){if(!nodeFS)nodeFS=require("\\fs");if(!nodePath)nodePath=require("\\path");filename=n
odePath["normalize\\"](filename);return
nodeFS["readFileSync\\"](filename,binary?null:"utf8");}readBinary=function readBinary(filename){var
ret=read_(filename,true);if(!ret.buffer){ret=new Uint8Array(ret)}assert(ret.buffer);return
ret}else{read_=function(url){var xhr=new XMLHttpRequest;xhr.open("\\GET",url,false);xhr.send(null);return
xhr.responseText};if(ENVIRONMENT_IS_WORKER){readBinary=function(url){var xhr=new
XMLHttpRequest;xhr.open("\\GET",url,false);xhr.responseType="arraybuffer";xhr.send(null);return new
Uint8Array(xhr.response)}}readAsync=function(url,onload,onerror){var xhr=new
XMLHttpRequest;xhr.open("\\GET",url,true);xhr.responseType="arraybuffer";xhr.onload=function(){if(xhr.status
==200||xhr.status==0&&xhr.response){onload(xhr.response);return}onerror();}xhr.onerror=onerror;xhr.send(null)}
}setWindowTitle=function(title){document.title=title}else{if(ENVIRONMENT_IS_NODE){if(typeof
performance==="undefined"){global.performance=require("\\perf_hooks").performance}}var
out=Module["print\\"]||console.log.bind(console);var err=Module["printErr\\"]||console.warn.bind(console);for(key
in
moduleOverrides){if(moduleOverrides.hasOwnProperty(key)){Module[key]=moduleOverrides[key]}}moduleOverr
ides=null;if(Module["arguments\\"]){arguments_=Module["arguments\\"]};if(Module["thisProgram\\"]){thisProgram=
Module["thisProgram\\"]};if(Module["quit\\"]){quit_=Module["quit\\"]};function
warnOnce(text){if(!warnOnce.shown)warnOnce.shown={};if(!warnOnce.shown[text]){warnOnce.shown[text]=1;er
r(text)}}var Atomics_load=Atomics.load;var Atomics_store=Atomics.store;var
Atomics_compareExchange=Atomics.compareExchange;var
wasmBinary;if(Module["wasmBinary\\"]){wasmBinary=Module["wasmBinary\\"]};var
noExitRuntime=Module["noExitRuntime\\"]||true;if(typeof WebAssembly!="object"){abort("\\no
native wasm support detected")}var wasmMemory;var wasmModule;var ABORT=false;var
EXITSTATUS;function assert(condition,text){if(!condition){abort("\\Assertion failed: \"+text)}}function
getCFunc(ident){var func=Module["_"+ident];assert(func,"Cannot call unknown function \"+ident+", make sure
it is exported");return func}function ccall(ident,returnType,argTypes,args,opts){var

```

```

toC={"string":function(str){ var ret=0;if(str!==null&&str!==undefined&&str!==0){ var
len=(str.length<<2)+1;ret=stackAlloc(len);stringToUTF8(str,ret,len)}return ret},"array":function(arr){ var
ret=stackAlloc(arr.length);writeArrayToMemory(arr,ret);return ret }};function
convertReturnValue(ret){if(returnType==="string")return UTF8ToString(ret);if(returnType==="boolean")return
Boolean(ret);return ret}var func=getCFunc(ident);var cArgs=[];var stack=0;if(args){for(var
i=0;i<args.length;i++){ var
converter=toC[argTypes[i]];if(converter){if(stack===0)stack=stackSave();cArgs[i]=converter(args[i])}else{cArgs[i]
=args[i]}}var
ret=func.apply(null,cArgs);ret=convertReturnValue(ret);if(stack!==0)stackRestore(stack);return ret}function
cwrap(ident,returnType,argTypes,opts){ argTypes=argTypes||[];var
numericArgs=argTypes.every(function(type){return type==="number"});var
numericRet=returnType!="string";if(numericRet&&numericArgs&&!opts){return getCFunc(ident)}return
function(){return ccall(ident,returnType,argTypes,arguments,opts)}}function
UTF8ArrayToString(heap,idx,maxBytesToRead){ var endIdx=idx+maxBytesToRead;var
str="";while(!(idx>=endIdx)){ var u0=heap[idx++];if(!u0)return
str;if(!(u0&128)){str+=String.fromCharCode(u0);continue}var
u1=heap[idx++]&63;if((u0&224)==192){str+=String.fromCharCode((u0&31)<<6|u1);continue}var
u2=heap[idx++]&63;if((u0&240)==224){u0=(u0&15)<<12|u1<<6|u2}else{u0=(u0&7)<<18|u1<<12|u2<<6|heap[id
x++]&63;if(u0<65536){str+=String.fromCharCode(u0)}else{ var ch=u0-
65536;str+=String.fromCharCode(55296|ch>>10,56320|ch&1023)}}return str}function
UTF8ToString(ptr,maxBytesToRead){return
ptr?UTF8ArrayToString(GROWABLE_HEAP_U8(),ptr,maxBytesToRead):""}function
stringToUTF8Array(str,heap,outIdx,maxBytesToWrite){if(!(maxBytesToWrite>0))return 0;var startIdx=outIdx;var
endIdx=outIdx+maxBytesToWrite-1;for(var i=0;i<str.length;++i){ var
u=str.charCodeAt(i);if(u>=55296&&u<=57343){ var
u1=str.charCodeAt(++i);u=65536+((u&1023)<<10)|u1&1023;if(u<=127){ if(outIdx>=endIdx)break;heap[outIdx++]
=u}else if(u<=2047){ if(outIdx+1>=endIdx)break;heap[outIdx++]=192|u>>6;heap[outIdx++]=128|u&63}else
if(u<=65535){ if(outIdx+2>=endIdx)break;heap[outIdx++]=224|u>>12;heap[outIdx++]=128|u>>6&63;heap[outIdx
++]=128|u&63}else{ if(outIdx+3>=endIdx)break;heap[outIdx++]=240|u>>18;heap[outIdx++]=128|u>>12&63;heap[
outIdx++]=128|u>>6&63;heap[outIdx++]=128|u&63}}heap[outIdx]=0;return outIdx-startIdx}function
stringToUTF8(str,outPtr,maxBytesToWrite){return
stringToUTF8Array(str,GROWABLE_HEAP_U8(),outPtr,maxBytesToWrite)}function lengthBytesUTF8(str){var
len=0;for(var i=0;i<str.length;++i){ var
u=str.charCodeAt(i);if(u>=55296&&u<=57343)u=65536+((u&1023)<<10)|str.charCodeAt(++i)&1023;if(u<=127)+
+len;else if(u<=2047)len+=2;else if(u<=65535)len+=3;else len+=4}return len}function
writeArrayToMemory(array,buffer){ GROWABLE_HEAP_I8().set(array,buffer)}function
alignUp(x,multiple){if(x%multiple>0){ x+=multiple-x%multiple}return x}var
buffer,HEAP8,HEAPU8,HEAP16,HEAPU16,HEAP32,HEAPU32,HEAPF32,HEAPF64;function
updateGlobalBufferAndViews(buf){ buffer=buf;Module["HEAP8"]=HEAP8=new
Int8Array(buf);Module["HEAP16"]=HEAP16=new Int16Array(buf);Module["HEAP32"]=HEAP32=new
Int32Array(buf);Module["HEAPU8"]=HEAPU8=new Uint8Array(buf);Module["HEAPU16"]=HEAPU16=new
Uint16Array(buf);Module["HEAPU32"]=HEAPU32=new
Uint32Array(buf);Module["HEAPF32"]=HEAPF32=new
Float32Array(buf);Module["HEAPF64"]=HEAPF64=new Float64Array(buf)}var
INITIAL_MEMORY=Module["INITIAL_MEMORY"]||16777216;if(ENVIRONMENT_IS_PTHREAD){wasmMem
ory=Module["wasmMemory"];buffer=Module["buffer"]}else{if(Module["wasmMemory"]){wasmMemory=
Module["wasmMemory"]}else{wasmMemory=new

```



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WebAssembly.Memory({"initial":INITIAL_MEMORY/65536,"maximum":2147483648/65536,"shared":true});
if(!(wasmMemory.buffer instanceof SharedArrayBuffer)){err("requested a shared WebAssembly.Memory but the
returned buffer is not a SharedArrayBuffer, indicating that while the browser has SharedArrayBuffer it does not
have WebAssembly threads support - you may need to set a
flag");if(ENVIRONMENT_IS_NODE){console.log("(on node you may need: --experimental-wasm-threads --
experimental-wasm-bulk-memory and also use a recent version)")}throw Error("bad
memory")}}if(wasmMemory){buffer=wasmMemory.buffer}INITIAL_MEMORY=buffer.byteLength;updateGlobalBufferAndViews(buffer);var wasmTable;var __ATPRERUN__=[];var __ATINIT__=[];var __ATMAIN__=[];var
__ATEXIT__=[];var __ATPOSTRUN__=[];var runtimeInitialized=false;var
runtimeExited=false;if(!ENVIRONMENT_IS_PTHREAD)__ATINIT__.push({func:function(){__wasm_call_ctors()}});function
preRun(){if(ENVIRONMENT_IS_PTHREAD)return;if(Module["preRun"]){if(typeof
Module["preRun"]!="function")Module["preRun"]=Module["preRun"];while(Module["preRun"].length){a
ddOnPreRun(Module["preRun"].shift())}callRuntimeCallbacks(__ATPRERUN__)}function
initRuntime(){runtimeInitialized=true;if(ENVIRONMENT_IS_PTHREAD)return;callRuntimeCallbacks(__ATINIT
__)function
preMain(){if(ENVIRONMENT_IS_PTHREAD)return;callRuntimeCallbacks(__ATMAIN__)}function
exitRuntime(){if(ENVIRONMENT_IS_PTHREAD)return;runtimeExited=true}function
postRun(){if(ENVIRONMENT_IS_PTHREAD)return;if(Module["postRun"]){if(typeof
Module["postRun"]!="function")Module["postRun"]=Module["postRun"];while(Module["postRun"].lengt
h){addOnPostRun(Module["postRun"].shift())}callRuntimeCallbacks(__ATPOSTRUN__)}function
addOnPreRun(cb){__ATPRERUN__.unshift(cb)}function addOnPostRun(cb){__ATPOSTRUN__.unshift(cb)}var
runDependencies=0;var runDependencyWatcher=null;var dependenciesFulfilled=null;function
addRunDependency(id){assert(!ENVIRONMENT_IS_PTHREAD,"addRunDependency cannot be used in a
pthread
worker");runDependencies++;if(Module["monitorRunDependencies"]){Module["monitorRunDependencies"](ru
nDependencies)}}function removeRunDependency(id){runDependencies--
;if(Module["monitorRunDependencies"]){Module["monitorRunDependencies"](runDependencies)}if(runDepend
encies==0){if(runDependencyWatcher!=null){clearInterval(runDependencyWatcher);runDependencyWatcher=null}if(dependenciesFulfilled){var
callback=dependenciesFulfilled;dependenciesFulfilled=null;callback()}}Module["preloadedImages"]={};Module
["preloadedAudios"]={};function
abort(what){if(Module["onAbort"]){Module["onAbort"](what)}if(ENVIRONMENT_IS_PTHREAD)console.err
or("Pthread aborting at "+(new
Error).stack);what+="\n";err(what);ABORT=true;EXITSTATUS=1;what+="abort("+what+"). Build with -s
ASSERTIONS=1 for more info.";var e=new WebAssembly.RuntimeError(what);readyPromiseReject(e);throw
e}function hasPrefix(str,prefix){return
String.prototype.startsWith?str.startsWith(prefix):str.indexOf(prefix)===0}var
dataURIPrefix="data:application/octet-stream;base64,";function isDataURI(filename){return
hasPrefix(filename,dataURIPrefix)}var fileURIPrefix="file://";function isFileURI(filename){return
hasPrefix(filename,fileURIPrefix)}var wasmBinaryFile="tfjs-backend-wasm-threaded-
simd.wasm";if(!isDataURI(wasmBinaryFile)){wasmBinaryFile=locateFile(wasmBinaryFile)}function
getBinary(file){try{if(file===wasmBinaryFile&&wasmBinary){return new
Uint8Array(wasmBinary)}if(readBinary){return readBinary(file)}else{throw"both async and sync fetching of the
wasm failed"}}catch(err){abort(err)}function
getBinaryPromise(){if(!wasmBinary&&(ENVIRONMENT_IS_WEB||ENVIRONMENT_IS_WORKER)){if(typeof
fetch=="function"&&!isFileURI(wasmBinaryFile)){return fetch(wasmBinaryFile,{credentials:"same-
origin"}).then(function(response){if(!response["ok"]){throw"failed to load wasm binary file at

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    "\"+wasmBinaryFile+"\""}return
    response["arrayBuffer"]()).catch(function(){return getBinary(wasmBinaryFile)}}else{if(readAsync){return new
    Promise(function(resolve,reject){readAsync(wasmBinaryFile,function(response){resolve(new
    Uint8Array(response))},reject)}})}return Promise.resolve().then(function(){return
    getBinary(wasmBinaryFile)}}function createWasm(){var info={"a":asmLibraryArg};function
    receiveInstance(instance,module){var
    exports=instance.exports;Module["asm"]=exports;wasmTable=Module["asm"]["T"];wasmModule=module;if(!E
    NVIRONMENT_IS_PTHREAD){var
    numWorkersToLoad=PThread.unusedWorkers.length;PThread.unusedWorkers.forEach(function(w){PThread.load
    WasmModuleToWorker(w,function(){if(!--numWorkersToLoad)removeRunDependency("\wasm-
    instantiate\")})))if(!ENVIRONMENT_IS_PTHREAD){addRunDependency("\wasm-instantiate\")}function
    receiveInstantiatedSource(output){receiveInstance(output["instance"],output["module"]);function
    instantiateArrayBuffer(receiver){return getBinaryPromise().then(function(binary){return
    WebAssembly.instantiate(binary,info)).then(receiver,function(reason){err("failed to asynchronously prepare
    wasm: "+reason);abort(reason)})}function instantiateAsync(){if(!wasmBinary&&typeof
    WebAssembly.instantiateStreaming===\function\&&!isDataURI(wasmBinaryFile)&&!isFileURI(wasmBinaryFil
    e)&&typeof fetch===\function\){return fetch(wasmBinaryFile,{credentials:"same-
    origin"}).then(function(response){var result=WebAssembly.instantiateStreaming(response,info);return
    result.then(receiveInstantiatedSource,function(reason){err("wasm streaming compile failed: "+reason);err("falling
    back to ArrayBuffer instantiation");return instantiateArrayBuffer(receiveInstantiatedSource)}))}else{return
    instantiateArrayBuffer(receiveInstantiatedSource)}if(Module["instantiateWasm"]){try{var
    exports=Module["instantiateWasm"](info,receiveInstance);return exports}catch(e){err("Module.instantiateWasm
    callback failed with error: "+e);return false}}instantiateAsync().catch(Promise.reject);return{}}var
    ASM_CONSTS={10520:function(){throw"Canceled!"},10538:function($0,$1){setTimeout(function(){__emscript
    en_do_dispatch_to_thread($0,$1),0})}};function initPthreadsJS(){PThread.initRuntime()}function
    callRuntimeCallbacks(callbacks){while(callbacks.length>0){var callback=callbacks.shift();if(typeof
    callback===\function\){callback(Module);continue}var func=callback.func;if(typeof
    func===\number\){if(callback.arg===undefined){wasmTable.get(func)}else{wasmTable.get(func)(callback.arg)
    }}else{func(callback.arg===undefined?null:callback.arg)}}}var
    ERRNO_CODES={EPERM:63,ENOENT:44,ESRCH:71,EINTR:27,EIO:29,ENXIO:60,E2BIG:1,ENOEXEC:45,E
    BADF:8,ECHILD:12,EAGAIN:6,EWOULDBLOCK:6,ENOMEM:48,EACCES:2,EFAULT:21,ENOTBLK:105,EB
    USY:10,EEXIST:20,EXDEV:75,ENODEV:43,ENOTDIR:54,EISDIR:31,EINVAL:28,ENFILE:41,EMFILE:33,EN
    OTTY:59,ETXTBSY:74,EFBIG:22,ENOSPC:51,ESPIPE:70,EROFS:69,EMLINK:34,EPIPE:64,EDOM:18,ERAN
    GE:68,ENOMSG:49,EIDRM:24,ECHRNG:106,EL2NSYNC:156,EL3HLT:107,EL3RST:108,ELNRNG:109,EUNA
    TCH:110,ENOSCSI:111,EL2HLT:112,EDEADLK:16,ENOLCK:46,EBADE:113,EBADR:114,EXFULL:115,ENOA
    NO:104,EBADRQC:103,EBADSLT:102,EDEADLOCK:16,EBFONT:101,ENOSTR:100,ENODATA:116,ETIME:
    117,ENOSR:118,ENONET:119,ENOPKG:120,EREMOTE:121,ENOLINK:47,EADV:122,ESRMNT:123,ECOMM
    :124,EPROTO:65,EMULTIHOP:36,EDOTDOT:125,EBADMSG:9,ENOTUNIQ:126,EBADFD:127,EREMCHG:1
    28,ELIBACC:129,ELIBBAD:130,ELIBSCN:131,ELIBMAX:132,ELIBEXEC:133,ENOSYS:52,ENOTEMPTY:55,
    ENAMETOOLONG:37,ELOOP:32,EOPNOTSUPP:138,EPFNOSUPPORT:139,ECONNRESET:15,ENOBUFS:42,
    EAFNOSUPPORT:5,EPROTOTYPE:67,ENOTSOCK:57,ENOPROTOOPT:50,ESHUTDOWN:140,ECONNREFU
    SED:14,EADDRINUSE:3,ECONNABORTED:13,ENETUNREACH:40,ENETDOWN:38,ETIMEDOUT:73,EHOS
    TDOWN:142,EHOSTUNREACH:23,EINPROGRESS:26,EALREADY:7,EDESTADDRREQ:17,EMSGSIZE:35,E
    PROTONOSUPPORT:66,ESOCKTNOSUPPORT:137,EADDRNOTAVAIL:4,ENETRESET:39,EISCONN:30,EN
    OTCONN:53,ETOOMANYREFS:141,EUSERS:136,EDQUOT:19,ESTALE:72,ENOTSUP:138,ENOMEDIUM:14
    8,EILSEQ:25,E_OVERFLOW:61,ECANCELED:11,ENOTRECOVERABLE:56,EOWNERDEAD:62,ESTRPIPE:13
    5};function

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_emsripten_futex_wake(addr,count){if(addr<=0||addr>GROWABLE_HEAP_I8().length||addr&3!=0||count<0)retu
rn-28;if(count==0)return 0;if(count>=2147483647)count=Infinity;var
mainThreadWaitAddress=Atomics.load(GROWABLE_HEAP_I32(),__emsripten_main_thread_futex>>2);var
mainThreadWoken=0;if(mainThreadWaitAddress==addr){var
loadedAddr=Atomics.compareExchange(GROWABLE_HEAP_I32(),__emsripten_main_thread_futex>>2,mainTh
readWaitAddress,0);if(loadedAddr==mainThreadWaitAddress){--count;mainThreadWoken=1;if(count<=0)return
1}}var ret=Atomics.notify(GROWABLE_HEAP_I32(),addr>>2,count);if(ret>=0)return
ret+mainThreadWoken;throw\"Atomics.notify returned an unexpected value
\"+ret}Module[\"_emsripten_futex_wake\"]=_emsripten_futex_wake;function
killThread(pthread_ptr){if(ENVIRONMENT_IS_PTHREAD)throw\"Internal Error! killThread() can only ever be
called from main application thread!\";if(!pthread_ptr)throw\"Internal Error! Null pthread_ptr in
killThread!\";GROWABLE_HEAP_I32()[pthread_ptr+12>>2]=0;var
pthread=PThread.pthreads[pthread_ptr];pthread.worker.terminate();PThread.freeThreadData(pthread);PThread.runni
ngWorkers.splice(PThread.runningWorkers.indexOf(pthread.worker),1);pthread.worker(pthread=undefined)}functio
n cancelThread(pthread_ptr){if(ENVIRONMENT_IS_PTHREAD)throw\"Internal Error! cancelThread() can only
ever be called from main application thread!\";if(!pthread_ptr)throw\"Internal Error! Null pthread_ptr in
cancelThread!\";var
pthread=PThread.pthreads[pthread_ptr];pthread.worker.postMessage({\"cmd\\\": \"cancel\\\"})}function
cleanupThread(pthread_ptr){if(ENVIRONMENT_IS_PTHREAD)throw\"Internal Error! cleanupThread() can only
ever be called from main application thread!\";if(!pthread_ptr)throw\"Internal Error! Null pthread_ptr in
cleanupThread!\";var
pthread=PThread.pthreads[pthread_ptr];if(pthread){GROWABLE_HEAP_I32()[pthread_ptr+12>>2]=0;var
worker=pthread.worker;PThread.returnWorkerToPool(worker)}}var
PThread={unusedWorkers:[],runningWorkers:[],initMainThreadBlock:function(){var
pthreadPoolSize=8;for(var
i=0;i<pthreadPoolSize;++i){PThread.allocateUnusedWorker()}};initRuntime:function(){var
tb=_malloc(228);for(var
i=0;i<228/4;++i)GROWABLE_HEAP_U32()[tb/4+i]=0;GROWABLE_HEAP_I32()[tb+12>>2]=tb;var
headPtr=tb+152;GROWABLE_HEAP_I32()[headPtr>>2]=headPtr;var tlsMemory=_malloc(512);for(var
i=0;i<128;++i)GROWABLE_HEAP_U32()[tlsMemory/4+i]=0;Atomics.store(GROWABLE_HEAP_U32(),tb+100
>>2,tlsMemory);Atomics.store(GROWABLE_HEAP_U32(),tb+40>>2,tb);__emsripten_thread_init(tb,!ENVIRON
MENT_IS_WORKER,1);__emsripten_register_main_browser_thread_id(tb);initWorker:function(){},pthreads:{},t
hreadExitHandlers:[],setThreadStatus:function(){},runExitHandlers:function(){while(PThread.threadExitHandlers.l
ength>0){PThread.threadExitHandlers.pop()};if(ENVIRONMENT_IS_PTHREAD&&_pthread_self())__pthread
_tsd_run_dtors(),runExitHandlersAndDeinitThread:function(tb,exitCode){Atomics.store(GROWABLE_HEAP_U
32(),tb+56>>2,1);Atomics.store(GROWABLE_HEAP_U32(),tb+60>>2,0);PThread.runExitHandlers();Atomics.stor
e(GROWABLE_HEAP_U32(),tb+4>>2,exitCode);Atomics.store(GROWABLE_HEAP_U32(),tb+0>>2,1);_emscri
pten_futex_wake(tb+0,2147483647);__emsripten_thread_init(0,0,0)},threadExit:function(exitCode){var
tb=_pthread_self();if(tb){PThread.runExitHandlersAndDeinitThread(tb,exitCode);if(ENVIRONMENT_IS_PTHRE
AD){postMessage({\"cmd\\\": \"exit\\\"})}}},threadCancel:function(){PThread.runExitHandlersAndDeinitThread(_pthr
ead_self(),-1);postMessage({\"cmd\\\": \"cancelDone\\\"})},terminateAllThreads:function(){for(var t in
PThread.pthreads){var
pthread=PThread.pthreads[t];if(pthread&&pthread.worker){PThread.returnWorkerToPool(pthread.worker)}}PThre
ad.pthreads={};for(var i=0;i<PThread.unusedWorkers.length;++i){var
worker=PThread.unusedWorkers[i];worker.terminate()}PThread.unusedWorkers=[];for(var
i=0;i<PThread.runningWorkers.length;++i){var worker=PThread.runningWorkers[i];var
pthread=worker(pthread);PThread.freeThreadData(pthread);worker.terminate()}PThread.runningWorkers=[]},freeTh
readData:function(pthread){if(!pthread)return;if(pthread.threadInfoStruct){var

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tlsMemory=GROWABLE_HEAP_I32()[pthread.threadInfoStruct+100>>2];GROWABLE_HEAP_I32()[pthread.threadInfoStruct+100>>2]=0;_free(tlsMemory);_free(pthread.threadInfoStruct)}pthread.threadInfoStruct=0;if(pthread.allocatedOwnStack&&pthread.stackBase)_free(pthread.stackBase);pthread.stackBase=0;if(pthread.worker)pthread.worker pthread=null},returnWorkerToPool:function(worker){PThread.runWithoutMainThreadQueuedCalls(function(){delete
PThread.threads[worker pthread.threadInfoStruct];PThread.unusedWorkers.push(worker);PThread.runningWorkers.splice(PThread.runningWorkers.indexOf(worker),1);PThread.freeThreadData(worker pthread);worker pthread=undefined}}),runWithoutMainThreadQueuedCalls:function(func){GROWABLE_HEAP_I32()[__emscripten_allow_main_runtime_queued_calls>>2]=0;try{func()}finally{GROWABLE_HEAP_I32()[__emscripten_allow_main_runtime_queued_calls>>2]=1}},receiveObjectTransfer:function(data){},loadWasmModuleToWorker:function(worker,onFinishedLoading){worker.onmessage=function(e){var
d=e["data"];var
cmd=d["cmd"];if(worker pthread)PThread.currentProxiedOperationCallerThread=worker pthread.threadInfoStruct;if(d["targetThread"]&&d["targetThread"]!="_pthread_self"){var
thread=PThread.threads[d.targetThread];if(thread){thread.worker.postMessage(e.data,d["transferList"])}else{console.error('Internal error! Worker sent a message \''+cmd+'\' to target pthread '+d["targetThread"]+', but that thread no longer exists!')}PThread.currentProxiedOperationCallerThread=undefined;return}if(cmd===\'processQueuedMainThreadWork\'){__emscripten_main_thread_process_queued_calls()}else
if(cmd===\'spawnThread\'){spawnThread(e.data)}else
if(cmd===\'cleanupThread\'){cleanupThread(d["thread"])}else
if(cmd===\'killThread\'){killThread(d["thread"])}else
if(cmd===\'cancelThread\'){cancelThread(d["thread"])}else
if(cmd===\'loaded\'){worker.loaded=true;if(onFinishedLoading)onFinishedLoading(worker);if(worker.runPthread){worker.runPthread();delete
worker.runPthread}}else if(cmd===\'print\'){out("Thread \''+d["threadId"]+\'': \''+d["text"]')}\}else
if(cmd===\'printErr\'){err("Thread \''+d["threadId"]+\'': \''+d["text"]')}\}else if(cmd===\'alert\'){alert("Thread \''+d["threadId"]+\'': \''+d["text"]')}\}else if(cmd===\'exit\'){var
detached=worker pthread&&Atomics.load(GROWABLE_HEAP_U32(),worker pthread.threadInfoStruct+64>>2);if(detached){PThread.returnWorkerToPool(worker)}\}else
if(cmd===\'exitProcess\'){try{exit(d["returnCode"])}catch(e){if(e instanceof ExitStatus)return;throw e}\}else
if(cmd===\'cancelDone\'){PThread.returnWorkerToPool(worker)}\}else
if(cmd===\'objectTransfer\'){PThread.receiveObjectTransfer(e.data)}\}else
if(e.data.target===\'setimmediate\'){worker.postMessage(e.data)}\}else{err(\'worker sent an unknown command \''+cmd')PThread.currentProxiedOperationCallerThread=undefined};worker.onerror=function(e){err(\'pthread sent an error! \''+e.filename+\'': \''+e.lineno+\'': \''+e.message')};if(ENVIRONMENT_IS_NODE){worker.on(\'message\',function(data){worker.onmessage({data:data}})});worker.on(\'error\',function(data){worker.onerror(data)});worker.on(\'exit\',function(data){})}worker.postMessage({\'cmd\':\'load\',\'urlOrBlob\':Module["mainScriptUrlOrBlob"]||_scriptDir,\'wasmMemory\':wasmMemory,\'wasmModule\':wasmModule}),allocateUnusedWorker:function(){var
pthreadMainJs=locateFile(\'tfjs-backend-wasm-threaded-simd.worker.js\');PThread.unusedWorkers.push(new Worker(pthreadMainJs)),getNewWorker:function(){if(PThread.unusedWorkers.length===0){PThread.allocateUnusedWorker();PThread.loadWasmModuleToWorker(PThread.unusedWorkers[0])}if(PThread.unusedWorkers.length>0)return PThread.unusedWorkers.pop();else return null},busySpinWait:function(msecs){var
t=performance.now()+msecs;while(performance.now()<t){}};function
establishStackSpace(stackTop,stackMax){__emscripten_stack_set_limits(stackTop,stackMax);stackRestore(stackTop)}}Module["establishStackSpace"]=establishStackSpace;function

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getNoExitRuntime(){return noExitRuntime}Module["getNoExitRuntime"]=getNoExitRuntime;function
invokeEntryPoint(ptr,arg){return
wasmTable.get(ptr)(arg)}Module["invokeEntryPoint"]=invokeEntryPoint;function
__assert_fail(condition,filename,line,func){abort("\nAssertion failed: '"+UTF8ToString(condition)+"', at:
 '"+[filename?UTF8ToString(filename):"unknown filename"],line,func?UTF8ToString(func):"unknown
function")})function __call_main(argc,argv){var returnCode=_main(argc,argv)}var
_emsripten_get_now;if(ENVIRONMENT_IS_NODE){_emsripten_get_now=function(){var
t=process["hrtime"]();return t[0]*1e3+t[1]/1e6}}else
if(ENVIRONMENT_IS_PTHREAD){_emsripten_get_now=function(){return performance.now()-
Module["__performance_now_clock_drift"]}}else if(typeof
dateNow!="undefined"){_emsripten_get_now=dateNow}else _emsripten_get_now=function(){return
performance.now()};function setErrNo(value){GROWABLE_HEAP_I32()[__errno_location()>>2]=value;return
value}function _atexit(func,arg){if(ENVIRONMENT_IS_PTHREAD)return
_emsripten_proxy_to_main_thread_js(1,1,func,arg)}function
_emsripten_notify_thread_queue(targetThreadId,mainThreadId){if(targetThreadId==mainThreadId){postMessag
e({"cmd\":"processQueuedMainThreadWork"})}else
if(ENVIRONMENT_IS_PTHREAD){postMessage({"targetThread\":targetThreadId,"cmd\":"processThreadQueu
e"})}else{var pthread=PThread.pthreads[targetThreadId];var
worker=pthread&&pthread.worker;if(!worker){return}worker.postMessage({"cmd\":"processThreadQueue"})}ret
urn 1}function _abort(){abort()}function _emsripten_asm_const_int(code,sigPtr,argbuf){var
args=readAsmConstArgs(sigPtr,argbuf);return ASM_CONSTS[code].apply(null,args)}function
_emsripten_conditional_set_current_thread_status(expectedStatus,newStatus){}function
_emsripten_futex_wait(addr,val,timeout){if(addr<=0||addr>GROWABLE_HEAP_I8().length||addr&3!=0)return-
28;if(!ENVIRONMENT_IS_WEB){var
ret=Atomics.wait(GROWABLE_HEAP_I32(),addr>>2,val,timeout);if(ret==="timed-out")return-
73;if(ret==="not-equal")return-6;if(ret==="ok")return
0;throw"Atomics.wait returned an unexpected value
 '"+ret}else{if(Atomics.load(GROWABLE_HEAP_I32(),addr>>2)!=val){return-6}var
tNow=performance.now();var tEnd=tNow+timeout;var
lastAddr=Atomics.exchange(GROWABLE_HEAP_I32(),__emsripten_main_thread_futex>>2,addr);while(1){tNo
w=performance.now();if(tNow>tEnd){lastAddr=Atomics.exchange(GROWABLE_HEAP_I32(),__emsripten_mai
n_thread_futex>>2,0);return-
73}lastAddr=Atomics.exchange(GROWABLE_HEAP_I32(),__emsripten_main_thread_futex>>2,0);if(lastAddr==
0){break}_emsripten_main_thread_process_queued_calls();if(Atomics.load(GROWABLE_HEAP_I32(),addr>>2)!
=val){return-
6}lastAddr=Atomics.exchange(GROWABLE_HEAP_I32(),__emsripten_main_thread_futex>>2,addr)}return
0}}function
_emsripten_memcpy_big(dest,src,num){GROWABLE_HEAP_U8().copyWithin(dest,src,src+num)}function
_emsripten_num_logical_cores(){if(ENVIRONMENT_IS_NODE)return require("os").cpus().length;return
navigator["hardwareConcurrency"]}function
_emsripten_proxy_to_main_thread_js(index,sync){var numCallArgs=arguments.length-2;var
stack=stackSave();var serializedNumCallArgs=numCallArgs;var args=stackAlloc(serializedNumCallArgs*8);var
b=args>>3;for(var i=0;i<numCallArgs;i++){var arg=arguments[2+i];GROWABLE_HEAP_F64()[b+i]=arg}var
ret=_emsripten_run_in_main_runtime_thread_js(index,serializedNumCallArgs,args,sync);stackRestore(stack);retur
n ret}var _emsripten_receive_on_main_thread_js_callArgs=[];var readAsmConstArgsArray=[];function
readAsmConstArgs(sigPtr,buf){readAsmConstArgsArray.length=0;var
ch;buf>>=2;while(ch=GROWABLE_HEAP_U8()[sigPtr++){var
double=ch<105;if(double&&buf&1)buf++;readAsmConstArgsArray.push(double?GROWABLE_HEAP_F64()[buf

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++>>1];GROWABLE_HEAP_I32()[buf]);++buf}return readAsmConstArgsArray}function
_emscripten_receive_on_main_thread_js(index,numCallArgs,args){_emscripten_receive_on_main_thread_js_callA
rgs.length=numCallArgs;var b=args>>3;for(var
i=0;i<numCallArgs;i++){_emscripten_receive_on_main_thread_js_callArgs[i]=GROWABLE_HEAP_F64()[b+i]}v
ar
isEmAsmConst=index<0;var func=!isEmAsmConst?proxiedFunctionTable[index]:ASM_CONSTS[-index-
1];return func.apply(null,_emscripten_receive_on_main_thread_js_callArgs)}function
_emscripten_get_heap_size(){return GROWABLE_HEAP_U8().length}function
emscripten_realloc_buffer(size){try{wasmmemory.grow(size-
buffer.byteLength+65535>>>16);updateGlobalBufferAndViews(wasmmemory.buffer);return
1}catch(e){}}function _emscripten_resize_heap(requestedSize){var
oldSize=_emscripten_get_heap_size();if(requestedSize<=oldSize){return false}var
maxHeapSize=2147483648;if(requestedSize>maxHeapSize){return false}for(var
cutDown=1;cutDown<=4;cutDown*=2){var
overGrownHeapSize=oldSize*(1+.2/cutDown);overGrownHeapSize=Math.min(overGrownHeapSize,requestedSize
+100663296);var
newSize=Math.min(maxHeapSize,alignUp(Math.max(requestedSize,overGrownHeapSize),65536));var
replacement=emscripten_realloc_buffer(newSize);if(replacement){return true}}return false}var
JSEvents={inEventHandler:0,removeAllEventListeners:function(){for(var
i=JSEvents.eventHandlers.length-1;i>=0;--
i){JSEvents._removeHandler(i)}JSEvents.eventHandlers=[];JSEvents.deferredCalls=[]},registerRemoveEventListen
ers:function(){if(!JSEvents.removeEventListenersRegistered){__ATEXIT__.push(JSEvents.removeAllEventListene
rs);JSEvents.removeEventListenersRegistered=true}},deferredCalls:[],deferCall:function(targetFunction,precedence
,argsList){function arraysHaveEqualContent(arrA,arrB){if(arrA.length!=arrB.length)return false;for(var i in
arrA){if(arrA[i]!=arrB[i])return false}return true}for(var i in JSEvents.deferredCalls){var
call=JSEvents.deferredCalls[i];if(call.targetFunction==targetFunction&&arraysHaveEqualContent(call.argsList,args
List))){return}}JSEvents.deferredCalls.push({targetFunction:targetFunction,precedence:precedence,argsList:argsList
});JSEvents.deferredCalls.sort(function(x,y){return
x.precedence<y.precedence}),removeDeferredCalls:function(targetFunction){for(var
i=0;i<JSEvents.deferredCalls.length;++i){if(JSEvents.deferredCalls[i].targetFunction==targetFunction){JSEvents.d
eferredCalls.splice(i,1);--i}},canPerformEventHandlerRequests:function(){return
JSEvents.inEventHandler&&JSEvents.currentEventHandler.allowsDeferredCalls},runDeferredCalls:function(){if(!J
SEvents.canPerformEventHandlerRequests()){return}for(var i=0;i<JSEvents.deferredCalls.length;++i){var
call=JSEvents.deferredCalls[i];JSEvents.deferredCalls.splice(i,1);--
i;call.targetFunction.apply(null,call.argsList)},eventHandlers:[],removeAllHandlersOnTarget:function(target,event
TypeString){for(var
i=0;i<JSEvents.eventHandlers.length;++i){if(JSEvents.eventHandlers[i].target==target&&(!eventTypeString||event
TypeString==JSEvents.eventHandlers[i].eventTypeString)){JSEvents._removeHandler(i--
)}}},_removeHandler:function(i){var
h=JSEvents.eventHandlers[i];h.target.removeEventListener(h.eventTypeString,h.eventListenerFunc,h.useCapture);J
SEvents.eventHandlers.splice(i,1)},registerOrRemoveHandler:function(eventHandler){var
jsEventHandler=function
jsEventHandler(event){++JSEvents.inEventHandler;JSEvents.currentEventHandler=eventHandler;JSEvents.runDef
erredCalls();eventHandler.handlerFunc(event);JSEvents.runDeferredCalls();--
JSEvents.inEventHandler};if(eventHandler.callbackfunc){eventHandler.eventListenerFunc=jsEventHandler;eventH
andler.target.addEventListener(eventHandler.eventTypeString,jsEventHandler,eventHandler.useCapture);JSEvents.e
ventHandlers.push(eventHandler);JSEvents.registerRemoveEventListeners()}else{for(var
i=0;i<JSEvents.eventHandlers.length;++i){if(JSEvents.eventHandlers[i].target==eventHandler.target&&JSEvents.e

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ventHandlers[i].eventTypeString==eventHandler.eventTypeString){JSEvents._removeHandler(i--
)}}}},queueEventHandlerOnThread_iiii:function(targetThread,eventHandlerFunc,eventTypeId,eventData,userData)
{ var stackTop=stackSave();var
varargs=stackAlloc(12);GROWABLE_HEAP_I32()[varargs>>2]=eventTypeId;GROWABLE_HEAP_I32()[varargs
+4>>2]=eventData;GROWABLE_HEAP_I32()[varargs+8>>2]=userData;__emscripten_call_on_thread(0,targetThr
ead,637534208,eventHandlerFunc,eventData,varargs);stackRestore(stackTop));getTargetThreadForEventCallback:f
unction(targetThread){ switch(targetThread){ case
1:return 0;case 2:return PThread.currentProxiedOperationCallerThread;default:return
targetThread } },getNodeNameForTarget:function(target){ if(!target)return\"\";if(target==window)return\"#window\";
if(target==screen)return\"#screen\";return
target&&target.nodeName?target.nodeName:\"\" },fullscreenEnabled:function(){ return
document.fullscreenEnabled||document.webkitFullscreenEnabled } };function stringToNewUTF8(jsString){ var
length=lengthBytesUTF8(jsString)+1;var cString=_malloc(length);stringToUTF8(jsString,cString,length);return
cString } function
_emscripten_set_offscreencanvas_size_on_target_thread_js(targetThread,targetCanvas,width,height){ var
stackTop=stackSave();var varargs=stackAlloc(12);var
targetCanvasPtr=0;if(targetCanvas){ targetCanvasPtr=stringToNewUTF8(targetCanvas)} GROWABLE_HEAP_I32(
)[varargs>>2]=targetCanvasPtr;GROWABLE_HEAP_I32()[varargs+4>>2]=width;GROWABLE_HEAP_I32()[var
args+8>>2]=height;__emscripten_call_on_thread(0,targetThread,657457152,0,targetCanvasPtr,varargs);stackRestor
e(stackTop)} function
_emscripten_set_offscreencanvas_size_on_target_thread(targetThread,targetCanvas,width,height){ targetCanvas=tar
getCanvas?UTF8ToString(targetCanvas):\"\";_emscripten_set_offscreencanvas_size_on_target_thread_js(targetThr
ead,targetCanvas,width,height)} function maybeCStringToJsString(cString){ return
cString>2?UTF8ToString(cString):cString } var specialHTMLTargets=[0,typeof
document!=\"undefined\"?document:0,typeof window!=\"undefined\"?window:0];function
findEventTarget(target){ target=maybeCStringToJsString(target);var
domElement=specialHTMLTargets[target]||(typeof
document!=\"undefined\"?document.querySelector(target):undefined);return domElement} function
findCanvasEventTarget(target){ return findEventTarget(target)} function
_emscripten_set_canvas_element_size_calling_thread(target,width,height){ var
canvas=findCanvasEventTarget(target);if(!canvas)return-
4;if(canvas.canvasSharedPtr){ GROWABLE_HEAP_I32()[canvas.canvasSharedPtr>>2]=width;GROWABLE_HEA
P_I32()[canvas.canvasSharedPtr+4>>2]=height}if(canvas.offscreenCanvas||!canvas.controlTransferredOffscreen){ if
(canvas.offscreenCanvas)canvas=canvas.offscreenCanvas;var
autoResizeViewport=false;if(canvas.GLctxObject&&canvas.GLctxObject.GLctx){ var
prevViewport=canvas.GLctxObject.GLctx.getParameter(2978);autoResizeViewport=prevViewport[0]==0&&prev
Viewport[1]==0&&prevViewport[2]==canvas.width&&prevViewport[3]==canvas.height} canvas.width=width;
canvas.height=height;if(autoResizeViewport){ canvas.GLctxObject.GLctx.viewport(0,0,width,height)} } else
if(canvas.canvasSharedPtr){ var
targetThread=GROWABLE_HEAP_I32()[canvas.canvasSharedPtr+8>>2];_emscripten_set_offscreencanvas_size_o
n_target_thread(targetThread,target,width,height);return 1 } else { return -4 } return 0 } function
_emscripten_set_canvas_element_size_main_thread(target,width,height){ if(ENVIRONMENT_IS_PTHREAD)retur
n
_emscripten_proxy_to_main_thread_js(2,1,target,width,height);return
_emscripten_set_canvas_element_size_calling_thread(target,width,height)} function
_emscripten_set_canvas_element_size(target,width,height){ var
canvas=findCanvasEventTarget(target);if(canvas){ return
_emscripten_set_canvas_element_size_calling_thread(target,width,height)} else { return

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_emsripten_set_canvas_element_size_main_thread(target,width,height)} }function
_emsripten_set_current_thread_status(newStatus){ }function
_emsripten_set_thread_name(threadId,name){ }function __webgl_enable_ANGLE_instanced_arrays(ctx){ var
ext=ctx.getExtension("ANGLE_instanced_arrays");if(ext){ ctx["vertexAttribDivisor"]=function(index,divisor){ ex
t["vertexAttribDivisorANGLE"](index,divisor)};ctx["drawArraysInstanced"]=function(mode,first,count,primcou
nt){ ext["drawArraysInstancedANGLE"](mode,first,count,primcount)};ctx["drawElementsInstanced"]=function(
mode,count,type,indices,primcount){ ext["drawElementsInstancedANGLE"](mode,count,type,indices,primcount)};
return
1 } }function __webgl_enable_OES_vertex_array_object(ctx){ var
ext=ctx.getExtension("OES_vertex_array_object");if(ext){ ctx["createVertexArray"]=function(){ return
ext["createVertexArrayOES"]();};ctx["deleteVertexArray"]=function(vao){ ext["deleteVertexArrayOES"](vao)};
ctx["bindVertexArray"]=function(vao){ ext["bindVertexArrayOES"](vao)};ctx["isVertexArray"]=function(vao)
{ return ext["isVertexArrayOES"](vao)};return 1 } }function __webgl_enable_WEBGL_draw_buffers(ctx){ var
ext=ctx.getExtension("WEBGL_draw_buffers");if(ext){ ctx["drawBuffers"]=function(n,bufs){ ext["drawBuffers
WEBGL"](n,bufs)};return 1 } }function
__webgl_enable_WEBGL_multi_draw(ctx){return!(ctx.multiDrawWebgl=ctx.getExtension("WEBGL_multi_dra
w"))} }var
GL={ counter:1,buffers:[],programs:[],framebuffers:[],renderbuffers:[],textures:[],uniforms:[],shaders:[],vaos:[],cont
exts:{ },offscreenCanvases:{ },timerQueriesEXT:[],programInfos:{ },stringCache:{ },unpackAlignment:4,recordError:
function
recordError(errorCode){ if(!GL.lastError){ GL.lastError=errorCode } },getNewId:function(table){ var
ret=GL.counter++;for(var i=table.length;i<ret;i++){ table[i]=null }return
ret },getSource:function(shader,count,string,length){ var source="";for(var i=0;i<count;++i){ var
len=length?GROWABLE_HEAP_I32()[length+i*4>>2]:-
1;source+=UTF8ToString(GROWABLE_HEAP_I32()[string+i*4>>2],len<0?undefined:len)}return
source },createContext:function(canvas,webGLContextAttributes){ var
ctx=canvas.getContext("webgl",webGLContextAttributes);if(!ctx)return 0;var
handle=GL.registerContext(ctx,webGLContextAttributes);return
handle },registerContext:function(ctx,webGLContextAttributes){ var
handle=_malloc(8);GROWABLE_HEAP_I32()[handle+4>>2]=_pthread_self();var
context={ handle:handle,attributes:webGLContextAttributes,version:webGLContextAttributes.majorVersion,GLctx:
ctx };if(ctx.canvas)ctx.canvas.GLctxObject=context;GL.contexts[handle]=context;if(typeof
webGLContextAttributes.enableExtensionsByDefault===undefined||webGLContextAttributes.enableExtensions
ByDefault){ GL.initExtensions(context)}return
handle },makeContextCurrent:function(contextHandle){ GL.currentContext=GL.contexts[contextHandle];Module.ctx
=GLctx=GL.currentContext&&GL.currentContext.GLctx;return!(contextHandle&&!GLctx)},getContext:function(c
ontextHandle){ return
GL.contexts[contextHandle] },deleteContext:function(contextHandle){ if(GL.currentContext===GL.contexts[context
Handle])GL.currentContext=null;if(typeof
JSEvents===undefined)JSEvents.removeHandlersOnTarget(GL.contexts[contextHandle].GLctx.canvas);if(GL.co
ntexts[contextHandle]&&GL.contexts[contextHandle].GLctx.canvas)GL.contexts[contextHandle].GLctx.canvas.GL
ctxObject=undefined;_free(GL.contexts[contextHandle].handle);GL.contexts[contextHandle]=null },initExtensions:f
unction(context){ if(!context)context=GL.currentContext;if(context.initExtensionsDone)return;context.initExtension
sDone=true;var
GLctx=context.GLctx;__webgl_enable_ANGLE_instanced_arrays(GLctx);__webgl_enable_OES_vertex_array_obj
ect(GLctx);__webgl_enable_WEBGL_draw_buffers(GLctx);GLctx.disjointTimerQueryExt=GLctx.getExtension("
EXT_disjoint_timer_query");__webgl_enable_WEBGL_multi_draw(GLctx);var

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exts=GLctx.getSupportedExtensions()||[];exts.forEach(function(ext){if(ext.indexOf("\lose_context")<0&&ext.inde
xOf("\debug")<0){GLctx.getExtension(ext)}}),populateUniformTable:function(program){var
p=GL.programs[program];var
ptable=GL.programInfos[program]={uniforms:{},maxUniformLength:0,maxAttributeLength:-
1,maxUniformBlockNameLength:-1};var utable=ptable.uniforms;var
numUniforms=GLctx.getProgramParameter(p,35718);for(var i=0;i<numUniforms;++i){var
u=GLctx.getActiveUniform(p,i);var
name=u.name;ptable.maxUniformLength=Math.max(ptable.maxUniformLength,name.length+1);if(name.slice(-
1)!="\"){name=name.slice(0,name.lastIndexOf("\["))}var loc=GLctx.getUniformLocation(p,name);if(loc){var
id=GL.getNewId(GL.uniforms);utable[name]=[u.size,id];GL.uniforms[id]=loc;for(var
j=1;j<u.size;++j){var
n=name+"\["+j+"]";loc=GLctx.getUniformLocation(p,n);id=GL.getNewId(GL.uniforms);GL.uniforms[id]=loc}}
}};var __emscripten_webgl_power_preferences=["default","\low-power","\high-performance"];function
__emscripten_webgl_do_create_context(target,attributes){var a=attributes>>2;var
powerPreference=GROWABLE_HEAP_I32()[a+(24>>2)];var
contextAttributes={"alpha":!!GROWABLE_HEAP_I32()[a+(0>>2)],"depth":!!GROWABLE_HEAP_I32()[a+(4
>>2)],"stencil":!!GROWABLE_HEAP_I32()[a+(8>>2)],"antialias":!!GROWABLE_HEAP_I32()[a+(12>>2)],"p
remultipliedAlpha":!!GROWABLE_HEAP_I32()[a+(16>>2)],"preserveDrawingBuffer":!!GROWABLE_HEAP_
I32()[a+(20>>2)],"powerPreference":__emscripten_webgl_power_preferences[powerPreference],"failIfMajorPerf
ormanceCaveat":!!GROWABLE_HEAP_I32()[a+(28>>2)],majorVersion:GROWABLE_HEAP_I32()[a+(32>>2)],
minorVersion:GROWABLE_HEAP_I32()[a+(36>>2)],enableExtensionsByDefault:GROWABLE_HEAP_I32()[a+(
40>>2)],explicitSwapControl:GROWABLE_HEAP_I32()[a+(44>>2)],proxyContextToMainThread:GROWABLE_
HEAP_I32()[a+(48>>2)],renderViaOffscreenBackBuffer:GROWABLE_HEAP_I32()[a+(52>>2)]};var
canvas=findCanvasEventTarget(target);if(!canvas){return 0}if(contextAttributes.explicitSwapControl){return
0}var contextHandle=GL.createContext(canvas,contextAttributes);return contextHandle}function
__emscripten_webgl_create_context(a0,a1){return __emscripten_webgl_do_create_context(a0,a1)}var
SYSCALLS={mappings:{},buffers:[null,[],[]],printChar:function(stream,curr){var
buffer=SYSCALLS.buffers[stream];if(curr===0||curr===10){(stream===1?out:err)(UTF8ArrayToString(buffer,0));
buffer.length=0}else{buffer.push(curr)}},varargs:undefined,get:function(){SYSCALLS.varargs+=4;var
ret=GROWABLE_HEAP_I32()[SYSCALLS.varargs-4>>2];return ret},getStr:function(ptr){var
ret=UTF8ToString(ptr);return ret},get64:function(low,high){return low}};function
_fd_close(fd){if(ENVIRONMENT_IS_PTHREAD)return __emscripten_proxy_to_main_thread_js(3,1,fd);return
0}function _fd_seek(fd,offset_low,offset_high,whence,newOffset){if(ENVIRONMENT_IS_PTHREAD)return
__emscripten_proxy_to_main_thread_js(4,1,fd,offset_low,offset_high,whence,newOffset)}function
_fd_write(fd,iov,iocnt,pnum){if(ENVIRONMENT_IS_PTHREAD)return
__emscripten_proxy_to_main_thread_js(5,1,fd,iov,iocnt,pnum);var num=0;for(var i=0;i<iocnt;i++){var
ptr=GROWABLE_HEAP_I32()[iov+i*8>>2];var len=GROWABLE_HEAP_I32()[iov+(i*8+4)>>2];for(var
j=0;j<len;j++){SYSCALLS.printChar(fd,GROWABLE_HEAP_U8)[ptr+j]}num+=len}GROWABLE_HEAP_I32
()[pnum>>2]=num;return 0}function _pthread_cleanup_pop(execute){var
routine=PThread.threadExitHandlers.pop();if(execute)routine()}function
_pthread_cleanup_push(routine,arg){PThread.threadExitHandlers.push(function(){wasmTable.get(routine)(arg))}}f
unction spawnThread(threadParams){if(ENVIRONMENT_IS_PTHREAD)throw"Internal Error! spawnThread()
can only ever be called from main application thread!";var
worker=PThread.getNewWorker();if(worker.pthread!==undefined)throw"Internal
error!";if(!threadParams.pthread_ptr)throw"Internal
error, no pthread ptr!";PThread.runningWorkers.push(worker);var tlsMemory=_malloc(128*4);for(var
i=0;i<128;++i){GROWABLE_HEAP_I32()[tlsMemory+i*4>>2]=0}var
stackHigh=threadParams.stackBase+threadParams.stackSize;var

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pthread=PThread.threads[threadParams.pthread_ptr]={ worker:worker,stackBase:threadParams.stackBase,stackSize
:threadParams.stackSize,allocatedOwnStack:threadParams.allocatedOwnStack,threadInfoStruct:threadParams.pthread
d_ptr};var
tis=pthread.threadInfoStruct>>2;Atomics.store(GROWABLE_HEAP_U32(),tis+(64>>2),threadParams.detached);A
tomics.store(GROWABLE_HEAP_U32(),tis+(100>>2),tlsMemory);Atomics.store(GROWABLE_HEAP_U32(),tis
+(40>>2),pthread.threadInfoStruct);Atomics.store(GROWABLE_HEAP_U32(),tis+(80>>2),threadParams.stackSiz
e);Atomics.store(GROWABLE_HEAP_U32(),tis+(76>>2),stackHigh);Atomics.store(GROWABLE_HEAP_U32(),t
is+(104>>2),threadParams.stackSize);Atomics.store(GROWABLE_HEAP_U32(),tis+(104+8>>2),stackHigh);Atom
ics.store(GROWABLE_HEAP_U32(),tis+(104+12>>2),threadParams.detached);var
global_libc=_emscripten_get_global_libc();var
global_locale=global_libc+40;Atomics.store(GROWABLE_HEAP_U32(),tis+(172>>2),global_locale);worker.pthr
ead=pthread;var
msg={"cmd\\":\\"run\\",\\"start_routine\\":threadParams.startRoutine,\\"arg\\":threadParams.arg,\\"threadInfoStruct\\":thre
adParams.pthread_ptr,\\"stackBase\\":threadParams.stackBase,\\"stackSize\\":threadParams.stackSize};worker.runPThread
ad=function(){msg.time=performance.now();worker.postMessage(msg,threadParams.transferList)};if(worker.loaded
){worker.runPThread();delete worker.runPThread}}function
_pthread_create(pthread_ptr,attr,start_routine,arg){if(typeof SharedArrayBuffer===\\"undefined\\"){err(\\"Current
environment does not support SharedArrayBuffer, pthreads are not available!\");return
6}if(!pthread_ptr){err(\\"pthread_create called with a null thread pointer!\");return 28}var transferList=[];var
error=0;if(ENVIRONMENT_IS_PTHREAD&&(transferList.length===0||error)){return
_emscripten_sync_run_in_main_thread_4(687865856,pthread_ptr,attr,start_routine,arg)}if(error)return
error;var stackSize=0;var stackBase=0;var detached=0;if(attr&&attr!=
1){stackSize=GROWABLE_HEAP_I32()[attr>>2];stackSize+=81920;stackBase=GROWABLE_HEAP_I32()[attr+
8>>2];detached=GROWABLE_HEAP_I32()[attr+12>>2]!==0}else{stackSize=2097152}var
allocatedOwnStack=stackBase===0;if(allocatedOwnStack){stackBase=_memalign(16,stackSize)}else{stackBase=
stackSize;assert(stackBase>0)}var threadInfoStruct=_malloc(228);for(var
i=0;i<228>>2;++i)GROWABLE_HEAP_U32()[threadInfoStruct>>2+i]=0;GROWABLE_HEAP_I32()[pthread_p
tr>>2]=threadInfoStruct;GROWABLE_HEAP_I32()[threadInfoStruct+12>>2]=threadInfoStruct;var
headPtr=threadInfoStruct+152;GROWABLE_HEAP_I32()[headPtr>>2]=headPtr;var
threadParams={stackBase:stackBase,stackSize:stackSize,allocatedOwnStack:allocatedOwnStack,detached:detached
,startRoutine:start_routine,pthread_ptr:threadInfoStruct,arg:arg,transferList:transferList};if(ENVIRONMENT_IS_P
THREAD){threadParams.cmd=\\"spawnThread\\";postMessage(threadParams,transferList)}else{spawnThread(thread
Params)}return
0}function __pthread_testcancel_js(){if(!ENVIRONMENT_IS_PTHREAD)return;var
tb=__pthread_self();if(!tb)return;var
cancelDisabled=Atomics.load(GROWABLE_HEAP_U32(),tb+56>>2);if(cancelDisabled)return;var
canceled=Atomics.load(GROWABLE_HEAP_U32(),tb+0>>2);if(canceled===2)throw\\"Canceled!\\"}function
_emscripten_check_blocking_allowed(){if(ENVIRONMENT_IS_NODE)return;if(ENVIRONMENT_IS_WORKE
R)return;warnOnce(\\"Blocking on the main thread is very dangerous, see
https://emscripten.org/docs/porting/pthreads.html#blocking-on-the-main-browser-thread\");}function
__emscripten_do_pthread_join(thread,status,block){if(!thread){err(\\"pthread_join attempted on a null thread
pointer!\");return
ERRNO_CODES.ESRCH}if(ENVIRONMENT_IS_PTHREAD&&__pthread_self()===thread){err(\\"PThread
\\"+thread+\\" is attempting to join to itself!\");return ERRNO_CODES.EDEADLK}else
if(!ENVIRONMENT_IS_PTHREAD&&_emscripten_main_browser_thread_id()===thread){err(\\"Main
thread \\"+thread+\\" is attempting to join to itself!\");return ERRNO_CODES.EDEADLK}var
self=GROWABLE_HEAP_I32()[thread+12>>2];if(self!==thread){err(\\"pthread_join attempted on thread
\\"+thread+\\", which does not point to a valid thread, or does not exist anymore!\");return

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ERRNO_CODES.ESRCH}var
detached=Atoms.load(GROWABLE_HEAP_U32(),thread+64>>2);if(detached){err("Attempted to join thread
\"+thread+\", which was already detached!");return
ERRNO_CODES.EINVAL}if(block){_emscripten_check_blocking_allowed()}for(;;){var
threadStatus=Atoms.load(GROWABLE_HEAP_U32(),thread+0>>2);if(threadStatus==1){var
threadExitCode=Atoms.load(GROWABLE_HEAP_U32(),thread+4>>2);if(status)GROWABLE_HEAP_I32()[sta
tus>>2]=threadExitCode;Atoms.store(GROWABLE_HEAP_U32(),thread+64>>2,1);if(!ENVIRONMENT_IS_PT
HREAD)cleanupThread(thread);else postMessage({"cmd":"cleanupThread","thread":thread});return
0}if(!block){return
ERRNO_CODES.EBUSY}__pthread_testcancel_js();if(!ENVIRONMENT_IS_PTHREAD)_emscripten_main_thre
ad_process_queued_calls();_emscripten_futex_wait(thread+0,threadStatus,ENVIRONMENT_IS_PTHREAD?100:1
)})}function
pthread_join(thread,status){return __emscripten_do_pthread_join(thread,status,true)}function
_sysconf(name){if(ENVIRONMENT_IS_PTHREAD)return
_emscripten_proxy_to_main_thread_js(6,1,name);switch(name){case 30:return 16384;case 85:var
maxHeapSize=2147483648;return maxHeapSize/16384;case 132:case 133:case 12:case 137:case 138:case 15:case
235:case 16:case 17:case 18:case 19:case 20:case 149:case 13:case 10:case 236:case 153:case 9:case 21:case 22:case
159:case 154:case 14:case 77:case 78:case 139:case 82:case 68:case 67:case 164:case 11:case 29:case 47:case
48:case 95:case 52:case 51:case 46:return 200809;case 27:case 246:case 127:case 128:case 23:case 24:case 160:case
161:case 181:case 182:case 242:case 183:case 184:case 243:case 244:case 245:case 165:case 178:case 179:case
49:case 50:case 168:case 169:case 175:case 170:case 171:case 172:case
97:case 76:case 32:case 173:case 35:case 80:case 81:case 79:return-1;case 176:case 177:case 7:case 155:case 8:case
157:case 125:case 126:case 92:case 93:case 129:case 130:case 131:case 94:case 91:return 1;case 74:case 60:case
69:case 70:case 4:return 1024;case 31:case 42:case 72:return 32;case 87:case 26:case 33:return 2147483647;case
34:case 1:return 47839;case 38:case 36:return 99;case 43:case 37:return 2048;case 0:return 2097152;case 3:return
65536;case 28:return 32768;case 44:return 32767;case 75:return 16384;case 39:return 1e3;case 89:return 700;case
71:return 256;case 40:return 255;case 2:return 100;case 180:return 64;case 25:return 20;case 5:return 16;case
6:return 6;case 73:return 4;case 84:{if(typeof navigator===\"object\")return
navigator[\"hardwareConcurrency\"]||1;return 1}}setErrNo(28);return-
1}if(!ENVIRONMENT_IS_PTHREAD)PThread.initMainThreadBlock();var GLctx;var
proxiedFunctionTable=[null,_atexit,_emscripten_set_canvas_element_size_main_thread,_fd_close,_fd_seek,_fd_wr
ite,_sysconf];var
asmLibraryArg={\"e\":__assert_fail,\"r\":__call_main,\"x\":__emscripten_notify_thread_queue,\"b\":_abort,\"y\":
_emscripten_asm_const_int,\"j\":_emscripten_conditional_set_current_thread_status,\"d\":_emscripten_futex_wait,\"c\":_emscripten_futex_wake,\"f\":_emscripten_get_now,\"p\":_emscripten_memcpy_big,\"A\":_emscripten_num_l
ogical_cores,\"u\":_emscripten_receive_on_main_thread_js,\"q\":_emscripten_resize_heap,\"v\":_emscripten_set_ca
nvas_element_size,\"i\":_emscripten_set_current_thread_status,\"s\":_emscripten_set_thread_name,\"w\":_emscript
en_webgl_create_context,\"l\":_fd_close,\"n\":_fd_seek,\"g\":_fd_write,\"o\":initPthreadsJS,\"a\":wasmMemory||Mo
dule[\"wasmMemory\"],\"z\":_pthread_cleanup_pop,\"k\":_pthread_cleanup_push,\"h\":_pthread_create,\"m\":_pthr
ead_join,\"t\":_sysconf};var asm=createWasm();var
__wasm_call_ctors=Module[\"__wasm_call_ctors\"]=function(){return(__wasm_call_ctors=Module[\"__wasm
_call_ctors\"]=Module[\"asm\"][\"B\"]).apply(null,arguments)};var
_init=Module[\"_init\"]=function(){return(_init=Module[\"_init\"]=Module[\"asm\"][\"C\"]).apply(null,arguments)};
var
_init_with_threads_count=Module[\"_init_with_threads_count\"]=function(){return(_init_with_threads_count=Mod
ule[\"_init_with_threads_count\"]=Module[\"asm\"][\"D\"]).apply(null,arguments)};var
_get_threads_count=Module[\"_get_threads_count\"]=function(){return(_get_threads_count=Module[\"_get_threads
_count\"]=Module[\"asm\"][\"E\"]).apply(null,arguments)};var

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_register_tensor=Module["_register_tensor"]=function(){return(_register_tensor=Module["_register_tensor"]=Module["_asm"][_"F"]).apply(null,arguments));var
_dispose_data=Module["_dispose_data"]=function(){return(_dispose_data=Module["_dispose_data"]=Module["_asm"][_"G"]).apply(null,arguments));var
_dispose=Module["_dispose"]=function(){return(_dispose=Module["_dispose"]=Module["_asm"][_"H"]).apply(null,arguments));var
_Abs=Module["_Abs"]=function(){return(_Abs=Module["_Abs"]=Module["_asm"][_"J"]).apply(null,arguments));var
_Add=Module["_Add"]=function(){return(_Add=Module["_Add"]=Module["_asm"][_"K"]).apply(null,arguments));var
_AddN=Module["_AddN"]=function(){return(_AddN=Module["_AddN"]=Module["_asm"][_"L"]).apply(null,arguments));var
_All=Module["_All"]=function(){return(_All=Module["_All"]=Module["_asm"][_"M"]).apply(null,arguments));var
_Any=Module["_Any"]=function(){return(_Any=Module["_Any"]=Module["_asm"][_"N"]).apply(null,arguments));var
_ArgMax=Module["_ArgMax"]=function(){return(_ArgMax=Module["_ArgMax"]=Module["_asm"][_"O"]).apply(null,arguments));var
_AvgPool=Module["_AvgPool"]=function(){return(_AvgPool=Module["_AvgPool"]=Module["_asm"][_"P"]).apply(null,arguments));var
_BatchMatMul=Module["_BatchMatMul"]=function(){return(_BatchMatMul=Module["_BatchMatMul"]=Module["_asm"][_"Q"]).apply(null,arguments));var
_Ceil=Module["_Ceil"]=function(){return(_Ceil=Module["_Ceil"]=Module["_asm"][_"R"]).apply(null,arguments));var
_ClipByValue=Module["_ClipByValue"]=function(){return(_ClipByValue=Module["_ClipByValue"]=Module["_asm"][_"S"]).apply(null,arguments));var
_Conv2D=Module["_Conv2D"]=function(){return(_Conv2D=Module["_Conv2D"]=Module["_asm"][_"T"]).apply(null,arguments));var
_Conv2DBackpropInput=Module["_Conv2DBackpropInput"]=function(){return(_Conv2DBackpropInput=Module["_Conv2DBackpropInput"]=Module["_asm"][_"U"]).apply(null,arguments));var
_Cos=Module["_Cos"]=function(){return(_Cos=Module["_Cos"]=Module["_asm"][_"V"]).apply(null,arguments));var
_Cosh=Module["_Cosh"]=function(){return(_Cosh=Module["_Cosh"]=Module["_asm"][_"W"]).apply(null,arguments));var
_CropAndResize=Module["_CropAndResize"]=function(){return(_CropAndResize=Module["_CropAndResize"]=Module["_asm"][_"X"]).apply(null,arguments));var
_Cumsum=Module["_Cumsum"]=function(){return(_Cumsum=Module["_Cumsum"]=Module["_asm"][_"Y"]).apply(null,arguments));var
_DepthToSpace=Module["_DepthToSpace"]=function(){return(_DepthToSpace=Module["_DepthToSpace"]=Module["_asm"][_"Z"]).apply(null,arguments));var
_DepthwiseConv2dNative=Module["_DepthwiseConv2dNative"]=function(){return(_DepthwiseConv2dNative=Module["_DepthwiseConv2dNative"]=Module["_asm"][_"a"]).apply(null,arguments));var
_Elu=Module["_Elu"]=function(){return(_Elu=Module["_Elu"]=Module["_asm"][_"a$"]).apply(null,arguments));var
_Equal=Module["_Equal"]=function(){return(_Equal=Module["_Equal"]=Module["_asm"][_"aa"]).apply(null,arguments));var
_Exp=Module["_Exp"]=function(){return(_Exp=Module["_Exp"]=Module["_asm"][_"ba"]).apply(null,arguments));var

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_FlipLeftRight=Module["_FlipLeftRight"]=function(){return(_FlipLeftRight=Module["_FlipLeftRight"]=Module["asm"][_"ca"]).apply(null,arguments)};var
_Floor=Module["_Floor"]=function(){return(_Floor=Module["_Floor"]=Module["asm"][_"da"]).apply(null,arguments)};var
_FloorDiv=Module["_FloorDiv"]=function(){return(_FloorDiv=Module["_FloorDiv"]=Module["asm"][_"ea"]).apply(null,arguments)};var
_FusedBatchNorm=Module["_FusedBatchNorm"]=function(){return(_FusedBatchNorm=Module["_FusedBatchNorm"]=Module["asm"][_"fa"]).apply(null,arguments)};var
_FusedConv2D=Module["_FusedConv2D"]=function(){return(_FusedConv2D=Module["_FusedConv2D"]=Module["asm"][_"ga"]).apply(null,arguments)};var
_FusedDepthwiseConv2D=Module["_FusedDepthwiseConv2D"]=function(){return(_FusedDepthwiseConv2D=Module["_FusedDepthwiseConv2D"]=Module["asm"][_"ha"]).apply(null,arguments)};var
_Gather=Module["_Gather"]=function(){return(_Gather=Module["_Gather"]=Module["asm"][_"ia"]).apply(null,arguments)};var
_GatherNd=Module["_GatherNd"]=function(){return(_GatherNd=Module["_GatherNd"]=Module["asm"][_"ja"]).apply(null,arguments)};var
_Greater=Module["_Greater"]=function(){return(_Greater=Module["_Greater"]=Module["asm"][_"ka"]).apply(null,arguments)};var
_GreaterEqual=Module["_GreaterEqual"]=function(){return(_GreaterEqual=Module["_GreaterEqual"]=Module["asm"][_"la"]).apply(null,arguments)};var
_LeakyRelu=Module["_LeakyRelu"]=function(){return(_LeakyRelu=Module["_LeakyRelu"]=Module["asm"][_"ma"]).apply(null,arguments)};var
_Less=Module["_Less"]=function(){return(_Less=Module["_Less"]=Module["asm"][_"na"]).apply(null,arguments)};var
_LessEqual=Module["_LessEqual"]=function(){return(_LessEqual=Module["_LessEqual"]=Module["asm"][_"oa"]).apply(null,arguments)};var
_Log=Module["_Log"]=function(){return(_Log=Module["_Log"]=Module["asm"][_"pa"]).apply(null,arguments)};var
_LogicalAnd=Module["_LogicalAnd"]=function(){return(_LogicalAnd=Module["_LogicalAnd"]=Module["asm"][_"qa"]).apply(null,arguments)};var
_Max=Module["_Max"]=function(){return(_Max=Module["_Max"]=Module["asm"][_"ra"]).apply(null,arguments)};var
_MaxPool=Module["_MaxPool"]=function(){return(_MaxPool=Module["_MaxPool"]=Module["asm"][_"sa"]).apply(null,arguments)};var
_Maximum=Module["_Maximum"]=function(){return(_Maximum=Module["_Maximum"]=Module["asm"][_"ta"]).apply(null,arguments)};var
_Mean=Module["_Mean"]=function(){return(_Mean=Module["_Mean"]=Module["asm"][_"ua"]).apply(null,arguments)};var
_Min=Module["_Min"]=function(){return(_Min=Module["_Min"]=Module["asm"][_"va"]).apply(null,arguments)};var
_Minimum=Module["_Minimum"]=function(){return(_Minimum=Module["_Minimum"]=Module["asm"][_"wa"]).apply(null,arguments)};var
_MirrorPad=Module["_MirrorPad"]=function(){return(_MirrorPad=Module["_MirrorPad"]=Module["asm"][_"xa"]).apply(null,arguments)};var
_Multiply=Module["_Multiply"]=function(){return(_Multiply=Module["_Multiply"]=Module["asm"][_"ya"]).apply(null,arguments)};var
_Neg=Module["_Neg"]=function(){return(_Neg=Module["_Neg"]=Module["asm"][_"za"]).apply(null,arguments)};var

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_NonMaxSuppressionV3=Module["_NonMaxSuppressionV3"]=function(){return(_NonMaxSuppressionV3=Module["_NonMaxSuppressionV3"]=Module["asm"]()["Aa"]).apply(null,arguments)};var
_NonMaxSuppressionV4=Module["_NonMaxSuppressionV4"]=function(){return(_NonMaxSuppressionV4=Module["_NonMaxSuppressionV4"]=Module["asm"]()["Ba"]).apply(null,arguments)};var
_NonMaxSuppressionV5=Module["_NonMaxSuppressionV5"]=function(){return(_NonMaxSuppressionV5=Module["_NonMaxSuppressionV5"]=Module["asm"]()["Ca"]).apply(null,arguments)};var
_NotEqual=Module["_NotEqual"]=function(){return(_NotEqual=Module["_NotEqual"]=Module["asm"]()["Da"]).apply(null,arguments)};var
_OneHot=Module["_OneHot"]=function(){return(_OneHot=Module["_OneHot"]=Module["asm"]()["Ea"]).apply(null,arguments)};var
_PadV2=Module["_PadV2"]=function(){return(_PadV2=Module["_PadV2"]=Module["asm"]()["Fa"]).apply(null,arguments)};var
_Pow=Module["_Pow"]=function(){return(_Pow=Module["_Pow"]=Module["asm"]()["Ga"]).apply(null,arguments)};var
_Prelu=Module["_Prelu"]=function(){return(_Prelu=Module["_Prelu"]=Module["asm"]()["Ha"]).apply(null,arguments)};var
_Prod=Module["_Prod"]=function(){return(_Prod=Module["_Prod"]=Module["asm"]()["Ia"]).apply(null,arguments)};var
_RealDiv=Module["_RealDiv"]=function(){return(_RealDiv=Module["_RealDiv"]=Module["asm"]()["Ja"]).apply(null,arguments)};var
_Relu=Module["_Relu"]=function(){return(_Relu=Module["_Relu"]=Module["asm"]()["Ka"]).apply(null,arguments)};var
_Relu6=Module["_Relu6"]=function(){return(_Relu6=Module["_Relu6"]=Module["asm"]()["La"]).apply(null,arguments)};var
_ResizeBilinear=Module["_ResizeBilinear"]=function(){return(_ResizeBilinear=Module["_ResizeBilinear"]=Module["asm"]()["Ma"]).apply(null,arguments)};var
_Reverse=Module["_Reverse"]=function(){return(_Reverse=Module["_Reverse"]=Module["asm"]()["Na"]).apply(null,arguments)};var
_RotateWithOffset=Module["_RotateWithOffset"]=function(){return(_RotateWithOffset=Module["_RotateWithOffset"]=Module["asm"]()["Oa"]).apply(null,arguments)};var
_Round=Module["_Round"]=function(){return(_Round=Module["_Round"]=Module["asm"]()["Pa"]).apply(null,arguments)};var
_Rsqrt=Module["_Rsqrt"]=function(){return(_Rsqrt=Module["_Rsqrt"]=Module["asm"]()["Qa"]).apply(null,arguments)};var
_ScatterNd=Module["_ScatterNd"]=function(){return(_ScatterNd=Module["_ScatterNd"]=Module["asm"]()["Ra"]).apply(null,arguments)};var
_SelectV2=Module["_SelectV2"]=function(){return(_SelectV2=Module["_SelectV2"]=Module["asm"]()["Sa"]).apply(null,arguments)};var
_Sigmoid=Module["_Sigmoid"]=function(){return(_Sigmoid=Module["_Sigmoid"]=Module["asm"]()["Ta"]).apply(null,arguments)};var
_Sin=Module["_Sin"]=function(){return(_Sin=Module["_Sin"]=Module["asm"]()["Ua"]).apply(null,arguments)};var
_Softmax=Module["_Softmax"]=function(){return(_Softmax=Module["_Softmax"]=Module["asm"]()["Va"]).apply(null,arguments)};var
_Sqrt=Module["_Sqrt"]=function(){return(_Sqrt=Module["_Sqrt"]=Module["asm"]()["Wa"]).apply(null,arguments)};var
_Square=Module["_Square"]=function(){return(_Square=Module["_Square"]=Module["asm"]()["Xa"]).apply(null,arguments)};var

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_SquaredDifference=Module["_SquaredDifference"]=function(){return(_SquaredDifference=Module["_SquaredDifference"]=Module["_asm"][_"Ya"]).apply(null,arguments)};var
_Step=Module["_Step"]=function(){return(_Step=Module["_Step"]=Module["_asm"][_"Za"]).apply(null,arguments)};var
_StridedSlice=Module["_StridedSlice"]=function(){return(_StridedSlice=Module["_StridedSlice"]=Module["_asm"][_"a"]).apply(null,arguments)};var
_Sub=Module["_Sub"]=function(){return(_Sub=Module["_Sub"]=Module["_asm"][_"$a"]).apply(null,arguments)};var
_Sum=Module["_Sum"]=function(){return(_Sum=Module["_Sum"]=Module["_asm"][_"ab"]).apply(null,arguments)};var
_Tan=Module["_Tan"]=function(){return(_Tan=Module["_Tan"]=Module["_asm"][_"bb"]).apply(null,arguments)};var
_Tanh=Module["_Tanh"]=function(){return(_Tanh=Module["_Tanh"]=Module["_asm"][_"cb"]).apply(null,arguments)};var
_Tile=Module["_Tile"]=function(){return(_Tile=Module["_Tile"]=Module["_asm"][_"db"]).apply(null,arguments)};var
_TopK=Module["_TopK"]=function(){return(_TopK=Module["_TopK"]=Module["_asm"][_"eb"]).apply(null,arguments)};var
_Transform=Module["_Transform"]=function(){return(_Transform=Module["_Transform"]=Module["_asm"][_"fb"]).apply(null,arguments)};var
_Transpose=Module["_Transpose"]=function(){return(_Transpose=Module["_Transpose"]=Module["_asm"][_"gb"]).apply(null,arguments)};var
__FusedMatMul=Module["__FusedMatMul"]=function(){return(__FusedMatMul=Module["__FusedMatMul"]=Module["_asm"][_"hb"]).apply(null,arguments)};var
_malloc=Module["_malloc"]=function(){return(_malloc=Module["_malloc"]=Module["_asm"][_"ib"]).apply(null,arguments)};var
_free=Module["_free"]=function(){return(_free=Module["_free"]=Module["_asm"][_"jb"]).apply(null,arguments)};var
__errno_location=Module["__errno_location"]=function(){return(__errno_location=Module["__errno_location"]=Module["_asm"][_"kb"]).apply(null,arguments)};var
_emscripten_get_global_libc=Module["_emscripten_get_global_libc"]=function(){return(_emscripten_get_global_libc=Module["_emscripten_get_global_libc"]=Module["_asm"][_"lb"]).apply(null,arguments)};var
_pthread_self=Module["_pthread_self"]=function(){return(_pthread_self=Module["_pthread_self"]=Module["_asm"][_"mb"]).apply(null,arguments)};var
__pthread_tsd_run_dtors=Module["__pthread_tsd_run_dtors"]=function(){return(__pthread_tsd_run_dtors=Module["__pthread_tsd_run_dtors"]=Module["_asm"][_"nb"]).apply(null,arguments)};var
_emscripten_main_thread_process_queued_calls=Module["_emscripten_main_thread_process_queued_calls"]=function(){return(_emscripten_main_thread_process_queued_calls=Module["_emscripten_main_thread_process_queued_calls"]=Module["_asm"][_"ob"]).apply(null,arguments)};var
_emscripten_current_thread_process_queued_calls=Module["_emscripten_current_thread_process_queued_calls"]=function(){return(_emscripten_current_thread_process_queued_calls=Module["_emscripten_current_thread_process_queued_calls"]=Module["_asm"][_"pb"]).apply(null,arguments)};var
_emscripten_register_main_browser_thread_id=Module["_emscripten_register_main_browser_thread_id"]=function(){return(_emscripten_register_main_browser_thread_id=Module["_emscripten_register_main_browser_thread_id"]=Module["_asm"][_"qb"]).apply(null,arguments)};var
_emscripten_main_browser_thread_id=Module["_emscripten_main_browser_thread_id"]=function(){return(_emscripten_main_browser_thread_id=Module["_emscripten_main_browser_thread_id"]=Module["_asm"][_"rb"]).apply(null,arguments)};var

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__emscripten_do_dispatch_to_thread=Module["__emscripten_do_dispatch_to_thread"]=function(){return(__emsc
ripten_do_dispatch_to_thread=Module["__emscripten_do_dispatch_to_thread"]=Module["asm"]["sb"]).apply(n
ull,arguments)};var
__emscripten_sync_run_in_main_thread_4=Module["__emscripten_sync_run_in_main_thread_4"]=function(){retur
n(__emscripten_sync_run_in_main_thread_4=Module["__emscripten_sync_run_in_main_thread_4"]=Module["asm\
"]["tb"]).apply(null,arguments)};var
__emscripten_run_in_main_runtime_thread_js=Module["__emscripten_run_in_main_runtime_thread_js"]=function(
){return(__emscripten_run_in_main_runtime_thread_js=Module["__emscripten_run_in_main_runtime_thread_js"]=
Module["asm"]["ub"]).apply(null,arguments)};var
__emscripten_call_on_thread=Module["__emscripten_call_on_thread"]=function(){return(__emscripten_call_on_t
hread=Module["__emscripten_call_on_thread"]=Module["asm"]["vb"]).apply(null,arguments)};var
__emscripten_tls_init=Module["__emscripten_tls_init"]=function(){return(__emscripten_tls_init=Module["__emsc
ripten_tls_init"]=Module["asm"]["wb"]).apply(null,arguments)};var
__emscripten_thread_init=Module["__emscripten_thread_init"]=function(){return(__emscripten_thread_init=Mod
ule["__emscripten_thread_init"]=Module["asm"]["xb"]).apply(null,arguments)};var
stackSave=Module["stackSave"]=function(){return(stackSave=Module["stackSave"]=Module["asm"]["yb"]).a
pply(null,arguments)};var
stackRestore=Module["stackRestore"]=function(){return(stackRestore=Module["stackRestore"]=Module["asm\
"]["zb"]).apply(null,arguments)};var
stackAlloc=Module["stackAlloc"]=function(){return(stackAlloc=Module["stackAlloc"]=Module["asm"]["Ab\
"]).apply(null,arguments)};var
__emscripten_stack_set_limits=Module["__emscripten_stack_set_limits"]=function(){return(__emscripten_stack_set_
limits=Module["__emscripten_stack_set_limits"]=Module["asm"]["Bb"]).apply(null,arguments)};var
__memalign=Module["__memalign"]=function(){return(__memalign=Module["__memalign"]=Module["asm"]["Cb
"]).apply(null,arguments)};var
__emscripten_allow_main_runtime_queued_calls=Module["__emscripten_allow_main_runtime_queued_calls"]=1
0512;var
__emscripten_main_thread_futex=Module["__emscripten_main_thread_futex"]=12148;Module["cwrap"]=cwrap
;Module["PThread"]=PThread;Module["PThread"]=PThread;Module["wasmMemory"]=wasmMemory;Module
["ExitStatus"]=ExitStatus;var
calledRun;function ExitStatus(status){this.name="ExitStatus";this.message="Program terminated with
exit(\"+status+\")";this.status=status}dependenciesFulfilled=function
runCaller(){if(!calledRun)run();if(!calledRun)dependenciesFulfilled=runCaller};function
run(args){args=args||arguments;if(runDependencies>0){return}if(ENVIRONMENT_IS_PTHREAD){readyPromis
eResolve(Module);initRuntime();postMessage({"cmd":"loaded"});return}preRun();if(runDependencies>0){retur
n}function
doRun(){if(calledRun)return;calledRun=true;Module["calledRun"]=true;if(ABORT)return;initRuntime();preMain(
);readyPromiseResolve(Module);if(Module["onRuntimeInitialized"]){Module["onRuntimeInitialized"]();}postRun(
)}if(Module["setStatus"]){Module["setStatus"]("Running...");setTimeout(function(){setTimeout(function(){Mo
dule["setStatus"](""),1);doRun(),1})else{doRun()}}Module["run"]=run;function
exit(status,implicit){if(implicit&&noExitRuntime&&status===0){return}if(!implicit){if(ENVIRONMENT_IS_PT
HREAD){postMessage({"cmd":"exitProcess","returnCode":status});}throw
new
ExitStatus(status)}else{}}if(noExitRuntime){}}else{PThread.terminateAllThreads();EXITSTATUS=status;exitRun
time();if(Module["onExit"]){Module["onExit"](status);ABORT=true}quit_(status,new
ExitStatus(status))}if(Module["preInit"]){if(typeof
Module["preInit"]==function)Module["preInit"]=[Module["preInit"]];while(Module["preInit"].length>0){
Module["preInit"].pop()}if(ENVIRONMENT_IS_PTHREAD){noExitRuntime=false;PThread.initWorker()}run

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());\n\n\n return WasmBackendModuleThreadedSimd.ready\n}\n\n\n);\n\nif (typeof exports === 'object' && typeof
module === 'object')\n module.exports = WasmBackendModuleThreadedSimd;\n\nelse if (typeof define ===
'function' && define['amd'])\n define([], function() { return WasmBackendModuleThreadedSimd; });\n\nelse if
(typeof exports === 'object')\n exports["WasmBackendModuleThreadedSimd"]
= WasmBackendModuleThreadedSimd;\n\n\n\nvar WasmBackendModule = (function() {\n var _scriptDir = typeof
document !== 'undefined' && document.currentScript ? document.currentScript.src : undefined;\n if (typeof
__filename !== 'undefined') _scriptDir = _scriptDir || __filename;\n return (\nfunction(WasmBackendModule) {\n
WasmBackendModule = WasmBackendModule || {};\n\nvar Module=typeof
WasmBackendModule!=="undefined"?WasmBackendModule:{};var
readyPromiseResolve,readyPromiseReject;Module["ready"]=new
Promise(function(resolve,reject){ readyPromiseResolve=resolve;readyPromiseReject=reject});var
moduleOverrides={};var key;for(key in
Module){if(Module.hasOwnProperty(key)){ moduleOverrides[key]=Module[key] }}var arguments_=[];var
thisProgram=\.\/this.program";var quit_=function(status,toThrow){throw toThrow};var
ENVIRONMENT_IS_WEB=false;var ENVIRONMENT_IS_WORKER=false;var
ENVIRONMENT_IS_NODE=false;var ENVIRONMENT_IS_SHELL=false;ENVIRONMENT_IS_WEB=typeof
window==="object";ENVIRONMENT_IS_WORKER=typeof
importScripts==="function";ENVIRONMENT_IS_NODE=typeof process==="object"&&typeof
process.versions==="object"&&typeof
process.versions.node==="string";ENVIRONMENT_IS_SHELL=!ENVIRONMENT_IS_WEB&&!ENVIRONM
ENT_IS_NODE&&!ENVIRONMENT_IS_WORKER;var scriptDirectory=\.\/";function
locateFile(path){if(Module["locateFile"]){return Module["locateFile"](path,scriptDirectory)}return
scriptDirectory+path}var read_,readAsync,readBinary,setWindowTitle;var nodeFS;var
nodePath;if(ENVIRONMENT_IS_NODE){if(ENVIRONMENT_IS_WORKER){scriptDirectory=require(\`path\`).
dirname(scriptDirectory)+\`\/\`}else{scriptDirectory=__dirname+\`\/\`}read_=function
shell_read(filename,binary){if(!nodeFS)nodeFS=require("fs");if(!nodePath)nodePath=require(\`path\`);filename=n
odePath["normalize"](filename);return
nodeFS["readFileSync"](filename,binary?null:"utf8");};readBinary=function readBinary(filename){var
ret=read_(filename,true);if(!ret.buffer){ret=new Uint8Array(ret)}assert(ret.buffer);return
ret};if(process["argv"].length>1){thisProgram=process["argv"][1].replace(/\\/g,`\`\/\`")}arguments_=process["arg
v"].slice(2);process["on"]("\`uncaughtException\`",function(ex){if(!(ex instanceof ExitStatus)){throw
ex}});process["on"]("\`unhandledRejection\`",abort);quit_=function(status){process["exit"](status)};Module["insp
ect"]=function(){return"[Emscripten Module object]"};else if(ENVIRONMENT_IS_SHELL){if(typeof
read!=="undefined"){read_=function shell_read(f){return read(f)}}readBinary=function readBinary(f){var
data;if(typeof readbuffer==="function"){return new
Uint8Array(readbuffer(f))}data=read(f,"binary");assert(typeof data==="object");return data};if(typeof
scriptArgs!="undefined"){arguments_=scriptArgs}else if(typeof
arguments!="undefined"){arguments_=arguments}if(typeof
quit==="function"){quit_=function(status){quit(status)}}if(typeof print!=="undefined"){if(typeof
console==="undefined")console={};console.log=print;console.warn=console.error=typeof
printErr!=="undefined"?printErr:print}}else
if(ENVIRONMENT_IS_WEB||ENVIRONMENT_IS_WORKER){if(ENVIRONMENT_IS_WORKER){scriptDire
ctory=self.location.href}else if(typeof
document!=="undefined"&&document.currentScript){scriptDirectory=document.currentScript.src}if(_scriptDir){s
criptDirectory=_scriptDir}if(scriptDirectory.indexOf("\`blob:\`")!=="0"){scriptDirectory=scriptDirectory.substr(0,script
Directory.lastIndexOf("\`\/\`")+1)}else{scriptDirectory=\.\/"}{read_=function(url){var xhr=new
XMLHttpRequest;xhr.open("\`GET\`",url,false);xhr.send(null);return
xhr.responseText};if(ENVIRONMENT_IS_WORKER){readBinary=function(url){var xhr=new

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XMLHttpRequest;xhr.open(\"GET\",url,false);xhr.responseType=\"arraybuffer\";xhr.send(null);return new
Uint8Array(xhr.response)}}readAsync=function(url,onload,onerror){var xhr=new
XMLHttpRequest;xhr.open(\"GET\",url,true);xhr.responseType=\"arraybuffer\";xhr.onload=function(){if(xhr.status
==200||xhr.status==0&&xhr.response){onload(xhr.response);return}onerror();}xhr.onerror=onerror;xhr.send(null)}
}setWindowTitle=function(title){document.title=title} }else{ }var
out=Module[\"print\"]||console.log.bind(console);var err=Module[\"printErr\"]||console.warn.bind(console);for(key
in
moduleOverrides){if(moduleOverrides.hasOwnProperty(key)){Module[key]=moduleOverrides[key]} }moduleOverr
ides=null;if(Module[\"arguments\"]){arguments_=Module[\"arguments\"]};if(Module[\"thisProgram\"]){thisProgram=
Module[\"thisProgram\"]};if(Module[\"quit\"]){quit_=Module[\"quit\"]};var
wasmBinary;if(Module[\"wasmBinary\"]){wasmBinary=Module[\"wasmBinary\"]};var
noExitRuntime=Module[\"noExitRuntime\"]||true;if(typeof WebAssembly!=\"object"){abort(\"no native wasm
support detected\")}var wasmMemory;var ABORT=false;var EXITSTATUS;function
assert(condition,text){if(!condition){abort(\"Assertion failed: \" +text)}}function getCFunc(ident){var
func=Module[\"_\"+ident];assert(func,\"Cannot call unknown function \" +ident+\", make sure it is exported\");return
func}function
ccall(ident,returnType,argTypes,args,opts){var toC={\"string\":function(str){var
ret=0;if(str!==null&&str!==undefined&&str!==0){var
len=(str.length<2)+1;ret=stackAlloc(len);stringToUTF8(str,ret,len)}return ret},\"array\":function(arr){var
ret=stackAlloc(arr.length);writeArrayToMemory(arr,ret);return ret}};function
convertReturnValue(ret){if(returnType===\"string\")return UTF8ToString(ret);if(returnType===\"boolean\")return
Boolean(ret);return ret}var func=getCFunc(ident);var cArgs=[];var stack=0;if(args){for(var
i=0;i<args.length;i++){var
converter=toC[argTypes[i]];if(converter){if(stack===0)stack=stackSave();cArgs[i]=converter(args[i])}else{cArgs[i
]=args[i]}}var ret=func.apply(null,cArgs);ret=convertReturnValue(ret);if(stack!==0)stackRestore(stack);return
ret}function cwrap(ident,returnType,argTypes,opts){argTypes=argTypes||[];var
numericArgs=argTypes.every(function(type){return type===\"number\"});var
numericRet=returnType!=\"string\";if(numericRet&&numericArgs&&!opts){return getCFunc(ident)}return
function(){return ccall(ident,returnType,argTypes,arguments,opts)}}var UTF8Decoder=typeof
TextDecoder!=\"undefined\"?new TextDecoder(\"utf8\"):undefined;function
UTF8ArrayToString(heap,idx,maxBytesToRead){var endIdx=idx+maxBytesToRead;var
endPtr=idx;while(heap[endPtr]&&!(endPtr>=endIdx))++endPtr;if(endPtr-
idx>16&&heap.subarray&&UTF8Decoder){return UTF8Decoder.decode(heap.subarray(idx,endPtr))}else{var
str=\"\";while(idx<endPtr){var u0=heap[idx++];if(!(u0&128)){str+=String.fromCharCode(u0);continue}var
u1=heap[idx++]&63;if((u0&224)==192){str+=String.fromCharCode((u0&31)<<6|u1);continue}var
u2=heap[idx++]&63;if((u0&240)==224){u0=(u0&15)<<12|u1<<6|u2}else{u0=(u0&7)<<18|u1<<12|u2<<6|heap[i
d
x++]&63}if(u0<65536){str+=String.fromCharCode(u0)}else{var ch=u0-
65536;str+=String.fromCharCode(55296|ch>>10,56320|ch&1023)}}return str}function
UTF8ToString(ptr,maxBytesToRead){return
ptr?UTF8ArrayToString(HEAPU8,ptr,maxBytesToRead):\"\"}function
stringToUTF8Array(str,heap,outIdx,maxBytesToWrite){if(!(maxBytesToWrite>0))return
0;var startIdx=outIdx;var endIdx=outIdx+maxBytesToWrite-1;for(var i=0;i<str.length;++i){var
u=str.charCodeAt(i);if(u>=55296&&u<=57343){var
u1=str.charCodeAt(++i);u=65536+((u&1023)<<10|u1&1023)}if(u<=127){if(outIdx>=endIdx)break;heap[outIdx++]
=u}else if(u<=2047){if(outIdx+1>=endIdx)break;heap[outIdx++]=192|u>>6;heap[outIdx++]=128|u&63}else
if(u<=65535){if(outIdx+2>=endIdx)break;heap[outIdx++]=224|u>>12;heap[outIdx++]=128|u>>6&63;heap[outIdx
++] =128|u&63}else{if(outIdx+3>=endIdx)break;heap[outIdx++]=240|u>>18;heap[outIdx++]=128|u>>12&63;heap[
outIdx++] =128|u>>6&63;heap[outIdx++] =128|u&63}}heap[outIdx]=0;return outIdx-startIdx}function

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stringToUTF8(str,outPtr,maxBytesToWrite){return
stringToUTF8Array(str,HEAPU8,outPtr,maxBytesToWrite)}function
writeArrayToMemory(array,buffer){HEAP8.set(array,buffer)}function
alignUp(x,multiple){if(x%multiple>0){x+=multiple-x%multiple}return x}var
buffer,HEAP8,HEAPU8,HEAP16,HEAPU16,HEAP32,HEAPU32,HEAPF32,HEAPF64;function
updateGlobalBufferAndViews(buf){buffer=buf;Module[\"HEAP8\"]=HEAP8=new
Int8Array(buf);Module[\"HEAP16\"]=HEAP16=new Int16Array(buf);Module[\"HEAP32\"]=HEAP32=new
Int32Array(buf);Module[\"HEAPU8\"]=HEAPU8=new Uint8Array(buf);Module[\"HEAPU16\"]=HEAPU16=new
Uint16Array(buf);Module[\"HEAPU32\"]=HEAPU32=new
Uint32Array(buf);Module[\"HEAPF32\"]=HEAPF32=new
Float32Array(buf);Module[\"HEAPF64\"]=HEAPF64=new Float64Array(buf)}var
INITIAL_MEMORY=Module[\"INITIAL_MEMORY\"]||16777216;var wasmTable;var __ATPRERUN__=[];var
__ATINIT__=[];var __ATMAIN__=[];var __ATPOSTRUN__=[];var
runtimeInitialized=false;__ATINIT__.push({func:function(){__wasm_call_ctors()}});function
preRun(){if(Module[\"preRun\"]){if(typeof
Module[\"preRun\"]!=\"function\")Module[\"preRun\"]=[Module[\"preRun\"]];while(Module[\"preRun\"].length){a
ddOnPreRun(Module[\"preRun\"].shift())}callRuntimeCallbacks(__ATPRERUN__)}function
initRuntime(){runtimeInitialized=true;callRuntimeCallbacks(__ATINIT__)}function
preMain(){callRuntimeCallbacks(__ATMAIN__)}function
postRun(){if(Module[\"postRun\"]){if(typeof
Module[\"postRun\"]!=\"function\")Module[\"postRun\"]=[Module[\"postRun\"]];while(Module[\"postRun\"].lengt
h){addOnPostRun(Module[\"postRun\"].shift())}callRuntimeCallbacks(__ATPOSTRUN__)}function
addOnPreRun(cb){__ATPRERUN__.unshift(cb)}function addOnPostRun(cb){__ATPOSTRUN__.unshift(cb)}var
runDependencies=0;var runDependencyWatcher=null;var dependenciesFulfilled=null;function
addRunDependency(id){runDependencies++;if(Module[\"monitorRunDependencies\"]){Module[\"monitorRunDep
endencies\"](runDependencies)}}function removeRunDependency(id){runDependencies--
;if(Module[\"monitorRunDependencies\"]){Module[\"monitorRunDependencies\"](runDependencies)}if(runDepend
encies==0){if(runDependencyWatcher!=null){clearInterval(runDependencyWatcher);runDependencyWatcher=null
}if(dependenciesFulfilled){var
callback=dependenciesFulfilled;dependenciesFulfilled=null;callback()}}Module[\"preloadedImages\"]={};Module
[\"preloadedAudios\"]={};function
abort(what){if(Module[\"onAbort\"]){Module[\"onAbort\"](what)}what+=\"\\n\";err(what);ABORT=true;EXITSTAT
US=1;what=\"abort(\\n+what+\\n). Build with -s ASSERTIONS=1 for more info.\";var e=new
WebAssembly.RuntimeError(what);readyPromiseReject(e);throw e}function hasPrefix(str,prefix){return
String.prototype.startsWith?str.startsWith(prefix):str.indexOf(prefix)===0}var
dataURIPrefix=\"data:application/octet-stream;base64,\";function isDataURI(filename){return
hasPrefix(filename,dataURIPrefix)}var fileURIPrefix=\"file://\";function isFileURI(filename){return
hasPrefix(filename,fileURIPrefix)}var wasmBinaryFile=\"tfjs-backend-
wasm.wasm\";if(!isDataURI(wasmBinaryFile)){wasmBinaryFile=locateFile(wasmBinaryFile)}function
getBinary(file){try{if(file===wasmBinaryFile&&wasmBinary){return new
Uint8Array(wasmBinary)}if(readBinary){return readBinary(file)}else{throw\"both async and sync fetching of the
wasm failed\"}}catch(err){abort(err)}}function
getBinaryPromise(){if(!wasmBinary&&(ENVIRONMENT_IS_WEB||ENVIRONMENT_IS_WORKER)){if(typeof
fetch===\"function\"&&!isFileURI(wasmBinaryFile)){return fetch(wasmBinaryFile,{credentials:\"same-
origin\"}).then(function(response){if(!response[\"ok\"]){throw\"failed to load wasm binary file at
\\n+wasmbinaryfile+\"\\n\"}return response[\"arrayBuffer\"]()}).catch(function(){return
getBinary(wasmBinaryFile)})}else{if(readAsync){return new
Promise(function(resolve,reject){readAsync(wasmBinaryFile,function(response){resolve(new

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Uint8Array(response))),reject))}}}}return Promise.resolve().then(function(){return
getBinary(wasmBinaryFile)}))function createWasm(){var info={"a":asmLibraryArg};function
receiveInstance(instance,module){var
exports=instance.exports;Module["asm"]=exports;wasmMemory=Module["asm"]()["j"];updateGlobalBufferAnd
Views(wasmMemory.buffer);wasmTable=Module["asm"]()["r"];removeRunDependency("wasm-
instantiate");addRunDependency("wasm-instantiate");function
receiveInstantiatedSource(output){receiveInstance(output["instance"]);function
instantiateArrayBuffer(receiver){return getBinaryPromise().then(function(binary){return
WebAssembly.instantiate(binary,info)}).then(receiver,function(reason){err("failed to asynchronously prepare
wasm: "+reason);abort(reason)}))}function instantiateAsync(){if(!wasmBinary&&typeof
WebAssembly.instantiateStreaming===\function"&&!isDataURI(wasmBinaryFile)&&!isFileURI(wasmBinaryFil
e)&&typeof fetch===\function"){return fetch(wasmBinaryFile,{credentials:"same-
origin"}).then(function(response){var result=WebAssembly.instantiateStreaming(response,info);return
result.then(receiveInstantiatedSource,function(reason){err("wasm streaming compile failed: "+reason);err("falling
back to ArrayBuffer instantiation");return instantiateArrayBuffer(receiveInstantiatedSource)}))}}else{return
instantiateArrayBuffer(receiveInstantiatedSource)}if(Module["instantiateWasm"]){try{var
exports=Module["instantiateWasm"](info,receiveInstance);return exports}catch(e){err("Module.instantiateWasm
callback failed with error: "+e);return false}}instantiateAsync().catch(readyPromiseReject);return {}}function
callRuntimeCallbacks(callbacks){while(callbacks.length>0){var callback=callbacks.shift();if(typeof
callback===\function"){callback(Module);continue}var func=callback.func;if(typeof
func===\number"){if(callback.arg===undefined){wasmTable.get(func)}else{wasmTable.get(func)(callback.arg)
}}else{func(callback.arg===undefined?null:callback.arg)}}function _abort(){abort()}function
_emscripten_memcpy_big(dest,src,num){HEAPU8.copyWithin(dest,src,src+num)}function
_emscripten_get_heap_size(){return HEAPU8.length}function
emscripten_realloc_buffer(size){try{wasmMemory.grow(size-
buffer.byteLength+65535>>>16);updateGlobalBufferAndViews(wasmMemory.buffer);return
1}catch(e){}}function _emscripten_resize_heap(requestedSize){var oldSize=_emscripten_get_heap_size();var
maxHeapSize=2147483648;if(requestedSize>maxHeapSize){return false}for(var
cutDown=1;cutDown<=4;cutDown*=2){var
overGrownHeapSize=oldSize*(1+.2/cutDown);overGrownHeapSize=Math.min(overGrownHeapSize,requestedSize
+100663296);var
newSize=Math.min(maxHeapSize,alignUp(Math.max(requestedSize,overGrownHeapSize),65536));var
replacement=emscripten_realloc_buffer(newSize);if(replacement){return true}}return false}var
SYSCALLS={mappings:{},buffers:[null,[],[]],printChar:function(stream,curr){var
buffer=SYSCALLS.buffers[stream];if(curr===0||curr===10){(stream===1?out:err)(UTF8ArrayToString(buffer,0));
buffer.length=0}else{buffer.push(curr)}},varargs:undefined,get:function(){SYSCALLS.varargs+=4;var
ret=HEAP32[SYSCALLS.varargs-4>>2];return ret},getStr:function(ptr){var ret=UTF8ToString(ptr);return
ret},get64:function(low,high){return low}};function _fd_close(fd){return 0}function
_fd_seek(fd,offset_low,offset_high,whence,newOffset){}function _fd_write(fd,iiov,iocvnt,pnum){var num=0;for(var
i=0;i<iocvnt;i++){var ptr=HEAP32[iov+i*8>>2];var len=HEAP32[iov+(i*8+4)>>2];for(var
j=0;j<len;j++){SYSCALLS.printChar(fd,HEAPU8[ptr+j])}num+=len}HEAP32[pnum>>2]=num;return
0}function _pthread_create(){return 6}function _pthread_join(){return 28}function
setErrNo(value){HEAP32[___errno_location()>>2]=value;return value}function
_sysconf(name){switch(name){case 30:return 16384;case 85:var maxHeapSize=2147483648;return
maxHeapSize/16384;case 132:case 133:case 12:case 137:case 138:case 15:case 235:case 16:case 17:case 18:case
19:case 20:case 149:case 13:case 10:case 236:case 153:case 9:case 21:case 22:case 159:case 154:case 14:case
77:case 78:case 139:case 82:case 68:case 67:case 164:case 11:case 29:case 47:case 48:case 95:case 52:case 51:case
46:return 200809;case 27:case 246:case 127:case 128:case 23:case 24:case 160:case 161:case 181:case 182:case

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242:case 183:case 184:case 243:case 244:case 245:case 165:case 178:case 179:case 49:case 50:case 168:case
169:case 175:case 170:case 171:case 172:case 97:case 76:case 32:case 173:case 35:case 80:case 81:case 79:return-
1;case 176:case 177:case 7:case
155:case 8:case 157:case 125:case 126:case 92:case 93:case 129:case 130:case 131:case 94:case 91:return 1;case
74:case 60:case 69:case 70:case 4:return 1024;case 31:case 42:case 72:return 32;case 87:case 26:case 33:return
2147483647;case 34:case 1:return 47839;case 38:case 36:return 99;case 43:case 37:return 2048;case 0:return
2097152;case 3:return 65536;case 28:return 32768;case 44:return 32767;case 75:return 16384;case 39:return
1e3;case 89:return 700;case 71:return 256;case 40:return 255;case 2:return 100;case 180:return 64;case 25:return
20;case 5:return 16;case 6:return 6;case 73:return 4;case 84:{if(typeof navigator===\"object\")return
navigator[\"hardwareConcurrency\"]||1;return 1 } }setErrNo(28);return-1 }var
asmLibraryArg={\"a\":_abort,\"d\":_emscripten_memcpy_big,\"e\":_emscripten_resize_heap,\"f\":_fd_close,\"c\":_f
d_seek,\"b\":_fd_write,\"h\":_pthread_create,\"g\":_pthread_join,\"i\":_sysconf};var asm=createWasm();var
__wasm_call_ctors=Module[\"__wasm_call_ctors\"]=function(){return(__wasm_call_ctors=Module[\"__wasm
_call_ctors\"]=Module[\"asm\"][\"k\"]).apply(null,arguments)};var
_init=Module[\"_init\"]=function(){return(_init=Module[\"_init\"]=Module[\"asm\"][\"l\"]).apply(null,arguments)};
var
_init_with_threads_count=Module[\"_init_with_threads_count\"]=function(){return(_init_with_threads_count=Mod
ule[\"_init_with_threads_count\"]=Module[\"asm\"][\"m\"]).apply(null,arguments)};var
_get_threads_count=Module[\"_get_threads_count\"]=function(){return(_get_threads_count=Module[\"_get_threads
_count\"]=Module[\"asm\"][\"n\"]).apply(null,arguments)};var
_register_tensor=Module[\"_register_tensor\"]=function(){return(_register_tensor=Module[\"_register_tensor\"]=M
odule[\"asm\"][\"o\"]).apply(null,arguments)};var
_dispose_data=Module[\"_dispose_data\"]=function(){return(_dispose_data=Module[\"_dispose_data\"]=Module[\"
asm\"][\"p\"]).apply(null,arguments)};var
_dispose=Module[\"_dispose\"]=function(){return(_dispose=Module[\"_dispose\"]=Module[\"asm\"][\"q\"]).apply(n
ull,arguments)};var
_Abs=Module[\"_Abs\"]=function(){return(_Abs=Module[\"_Abs\"]=Module[\"asm\"][\"s\"]).apply(null,arguments
)};var
_Add=Module[\"_Add\"]=function(){return(_Add=Module[\"_Add\"]=Module[\"asm\"][\"t\"]).apply(null,argument
s)};var
_AddN=Module[\"_AddN\"]=function(){return(_AddN=Module[\"_AddN\"]=Module[\"asm\"][\"u\"]).apply(null,ar
guments)};var
_All=Module[\"_All\"]=function(){return(_All=Module[\"_All\"]=Module[\"asm\"][\"v\"]).apply(null,arguments)};
var
_Any=Module[\"_Any\"]=function(){return(_Any=Module[\"_Any\"]=Module[\"asm\"][\"w\"]).apply(null,argumen
ts)};var
_ArgMax=Module[\"_ArgMax\"]=function(){return(_ArgMax=Module[\"_ArgMax\"]=Module[\"asm\"][\"x\"]).app
ly(null,arguments)};var
_AvgPool=Module[\"_AvgPool\"]=function(){return(_AvgPool=Module[\"_AvgPool\"]=Module[\"asm\"][\"y\"]).a
pply(null,arguments)};var
_BatchMatMul=Module[\"_BatchMatMul\"]=function(){return(_BatchMatMul=Module[\"_BatchMatMul\"]=Modu
le[\"asm\"][\"z\"]).apply(null,arguments)};var
_Ceil=Module[\"_Ceil\"]=function(){return(_Ceil=Module[\"_Ceil\"]=Module[\"asm\"][\"A\"]).apply(null,argument
s)};var
_ClipByValue=Module[\"_ClipByValue\"]=function(){return(_ClipByValue=Module[\"_ClipByValue\"]=Module[\"
asm\"][\"B\"]).apply(null,arguments)};var
_Conv2D=Module[\"_Conv2D\"]=function(){return(_Conv2D=Module[\"_Conv2D\"]=Module[\"asm\"][\"C\"]).ap
ply(null,arguments)};var

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_Conv2DBackpropInput=Module["_Conv2DBackpropInput"]=function(){return(_Conv2DBackpropInput=Module["_Conv2DBackpropInput"]=Module["_asm"][_"D"]).apply(null,arguments)};var
_Cos=Module["_Cos"]=function(){return(_Cos=Module["_Cos"]=Module["_asm"][_"E"]).apply(null,arguments)};var
_Cosh=Module["_Cosh"]=function(){return(_Cosh=Module["_Cosh"]=Module["_asm"][_"F"]).apply(null,arguments)};var
_CropAndResize=Module["_CropAndResize"]=function(){return(_CropAndResize=Module["_CropAndResize"]=Module["_asm"][_"G"]).apply(null,arguments)};var
_Cumsum=Module["_Cumsum"]=function(){return(_Cumsum=Module["_Cumsum"]=Module["_asm"][_"H"]).apply(null,arguments)};var
_DepthToSpace=Module["_DepthToSpace"]=function(){return(_DepthToSpace=Module["_DepthToSpace"]=Module["_asm"][_"I"]).apply(null,arguments)};var
_DepthwiseConv2dNative=Module["_DepthwiseConv2dNative"]=function(){return(_DepthwiseConv2dNative=Module["_DepthwiseConv2dNative"]=Module["_asm"][_"J"]).apply(null,arguments)};var
_Elu=Module["_Elu"]=function(){return(_Elu=Module["_Elu"]=Module["_asm"][_"K"]).apply(null,arguments)};var
_Equal=Module["_Equal"]=function(){return(_Equal=Module["_Equal"]=Module["_asm"][_"L"]).apply(null,arguments)};var
_Exp=Module["_Exp"]=function(){return(_Exp=Module["_Exp"]=Module["_asm"][_"M"]).apply(null,arguments)};var
_FlipLeftRight=Module["_FlipLeftRight"]=function(){return(_FlipLeftRight=Module["_FlipLeftRight"]=Module["_asm"][_"N"]).apply(null,arguments)};var
_Floor=Module["_Floor"]=function(){return(_Floor=Module["_Floor"]=Module["_asm"][_"O"]).apply(null,arguments)};var
_FloorDiv=Module["_FloorDiv"]=function(){return(_FloorDiv=Module["_FloorDiv"]=Module["_asm"][_"P"]).apply(null,arguments)};var
_FusedBatchNorm=Module["_FusedBatchNorm"]=function(){return(_FusedBatchNorm=Module["_FusedBatchNorm"]=Module["_asm"][_"Q"]).apply(null,arguments)};var
_FusedConv2D=Module["_FusedConv2D"]=function(){return(_FusedConv2D=Module["_FusedConv2D"]=Module["_asm"][_"R"]).apply(null,arguments)};var
_FusedDepthwiseConv2D=Module["_FusedDepthwiseConv2D"]=function(){return(_FusedDepthwiseConv2D=Module["_FusedDepthwiseConv2D"]=Module["_asm"][_"S"]).apply(null,arguments)};var
_Gather=Module["_Gather"]=function(){return(_Gather=Module["_Gather"]=Module["_asm"][_"T"]).apply(null,arguments)};var
_GatherNd=Module["_GatherNd"]=function(){return(_GatherNd=Module["_GatherNd"]=Module["_asm"][_"U"]).apply(null,arguments)};var
_Greater=Module["_Greater"]=function(){return(_Greater=Module["_Greater"]=Module["_asm"][_"V"]).apply(null,arguments)};var
_GreaterEqual=Module["_GreaterEqual"]=function(){return(_GreaterEqual=Module["_GreaterEqual"]=Module["_asm"][_"W"]).apply(null,arguments)};var
_LeakyRelu=Module["_LeakyRelu"]=function(){return(_LeakyRelu=Module["_LeakyRelu"]=Module["_asm"][_"X"]).apply(null,arguments)};var
_Less=Module["_Less"]=function(){return(_Less=Module["_Less"]=Module["_asm"][_"Y"]).apply(null,arguments)};var
_LessEqual=Module["_LessEqual"]=function(){return(_LessEqual=Module["_LessEqual"]=Module["_asm"][_"Z"]).apply(null,arguments)};var
_Log=Module["_Log"]=function(){return(_Log=Module["_Log"]=Module["_asm"][_" _"]).apply(null,arguments)};var

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_LogicalAnd=Module["_LogicalAnd"]=function(){return(_LogicalAnd=Module["_LogicalAnd"]=Module["asm"][_("$")]).apply(null,arguments)};var
_Max=Module["_Max"]=function(){return(_Max=Module["_Max"]=Module["asm"][_("aa")]).apply(null,arguments)};var
_MaxPool=Module["_MaxPool"]=function(){return(_MaxPool=Module["_MaxPool"]=Module["asm"][_("ba")]).apply(null,arguments)};var
_Maximum=Module["_Maximum"]=function(){return(_Maximum=Module["_Maximum"]=Module["asm"][_("ca")]).apply(null,arguments)};var
_Mean=Module["_Mean"]=function(){return(_Mean=Module["_Mean"]=Module["asm"][_("da")]).apply(null,arguments)};var
_Min=Module["_Min"]=function(){return(_Min=Module["_Min"]=Module["asm"][_("ea")]).apply(null,arguments)};var
_Minimum=Module["_Minimum"]=function(){return(_Minimum=Module["_Minimum"]=Module["asm"][_("fa")]).apply(null,arguments)};var
_MirrorPad=Module["_MirrorPad"]=function(){return(_MirrorPad=Module["_MirrorPad"]=Module["asm"][_("ga")]).apply(null,arguments)};var
_Multiply=Module["_Multiply"]=function(){return(_Multiply=Module["_Multiply"]=Module["asm"][_("ha")]).apply(null,arguments)};var
_Neg=Module["_Neg"]=function(){return(_Neg=Module["_Neg"]=Module["asm"][_("ia")]).apply(null,arguments)};var
_NonMaxSuppressionV3=Module["_NonMaxSuppressionV3"]=function(){return(_NonMaxSuppressionV3=Module["_NonMaxSuppressionV3"]=Module["asm"][_("ja")]).apply(null,arguments)};var
_NonMaxSuppressionV4=Module["_NonMaxSuppressionV4"]=function(){return(_NonMaxSuppressionV4=Module["_NonMaxSuppressionV4"]=Module["asm"][_("ka")]).apply(null,arguments)};var
_NonMaxSuppressionV5=Module["_NonMaxSuppressionV5"]=function(){return(_NonMaxSuppressionV5=Module["_NonMaxSuppressionV5"]=Module["asm"][_("la")]).apply(null,arguments)};var
_NotEqual=Module["_NotEqual"]=function(){return(_NotEqual=Module["_NotEqual"]=Module["asm"][_("ma")]).apply(null,arguments)};var
_OneHot=Module["_OneHot"]=function(){return(_OneHot=Module["_OneHot"]=Module["asm"][_("na")]).apply(null,arguments)};var
_PadV2=Module["_PadV2"]=function(){return(_PadV2=Module["_PadV2"]=Module["asm"][_("oa")]).apply(null,arguments)};var
_Pow=Module["_Pow"]=function(){return(_Pow=Module["_Pow"]=Module["asm"][_("pa")]).apply(null,arguments)};var
_Prelu=Module["_Prelu"]=function(){return(_Prelu=Module["_Prelu"]=Module["asm"][_("qa")]).apply(null,arguments)};var
_Prod=Module["_Prod"]=function(){return(_Prod=Module["_Prod"]=Module["asm"][_("ra")]).apply(null,arguments)};var
_RealDiv=Module["_RealDiv"]=function(){return(_RealDiv=Module["_RealDiv"]=Module["asm"][_("sa")]).apply(null,arguments)};var
_Relu=Module["_Relu"]=function(){return(_Relu=Module["_Relu"]=Module["asm"][_("ta")]).apply(null,arguments)};var
_Relu6=Module["_Relu6"]=function(){return(_Relu6=Module["_Relu6"]=Module["asm"][_("ua")]).apply(null,arguments)};var
_ResizeBilinear=Module["_ResizeBilinear"]=function(){return(_ResizeBilinear=Module["_ResizeBilinear"]=Module["asm"][_("va")]).apply(null,arguments)};var
_Reverse=Module["_Reverse"]=function(){return(_Reverse=Module["_Reverse"]=Module["asm"][_("wa")]).apply(null,arguments)};var

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_RotateWithOffset=Module["_RotateWithOffset"]=function(){return(_RotateWithOffset=Module["_RotateWithOffset"]=Module["asm"][_"xa"]).apply(null,arguments)};var
_Round=Module["_Round"]=function(){return(_Round=Module["_Round"]=Module["asm"][_"ya"]).apply(null,arguments)};var
_Rsqrt=Module["_Rsqrt"]=function(){return(_Rsqrt=Module["_Rsqrt"]=Module["asm"][_"za"]).apply(null,arguments)};var
_ScatterNd=Module["_ScatterNd"]=function(){return(_ScatterNd=Module["_ScatterNd"]=Module["asm"][_"Aa"]).apply(null,arguments)};var
_SelectV2=Module["_SelectV2"]=function(){return(_SelectV2=Module["_SelectV2"]=Module["asm"][_"Ba"]).apply(null,arguments)};var
_Sigmoid=Module["_Sigmoid"]=function(){return(_Sigmoid=Module["_Sigmoid"]=Module["asm"][_"Ca"]).apply(null,arguments)};var
_Sin=Module["_Sin"]=function(){return(_Sin=Module["_Sin"]=Module["asm"][_"Da"]).apply(null,arguments)};var
_Softmax=Module["_Softmax"]=function(){return(_Softmax=Module["_Softmax"]=Module["asm"][_"Ea"]).apply(null,arguments)};var
_Sqrt=Module["_Sqrt"]=function(){return(_Sqrt=Module["_Sqrt"]=Module["asm"][_"Fa"]).apply(null,arguments)};var
_Square=Module["_Square"]=function(){return(_Square=Module["_Square"]=Module["asm"][_"Ga"]).apply(null,arguments)};var
_SquaredDifference=Module["_SquaredDifference"]=function(){return(_SquaredDifference=Module["_SquaredDifference"]=Module["asm"][_"Ha"]).apply(null,arguments)};var
_Step=Module["_Step"]=function(){return(_Step=Module["_Step"]=Module["asm"][_"Ia"]).apply(null,arguments)};var
_StridedSlice=Module["_StridedSlice"]=function(){return(_StridedSlice=Module["_StridedSlice"]=Module["asm"][_"Ja"]).apply(null,arguments)};var
_Sub=Module["_Sub"]=function(){return(_Sub=Module["_Sub"]=Module["asm"][_"Ka"]).apply(null,arguments)};var
_Sum=Module["_Sum"]=function(){return(_Sum=Module["_Sum"]=Module["asm"][_"La"]).apply(null,arguments)};var
_Tan=Module["_Tan"]=function(){return(_Tan=Module["_Tan"]=Module["asm"][_"Ma"]).apply(null,arguments)};var
_Tanh=Module["_Tanh"]=function(){return(_Tanh=Module["_Tanh"]=Module["asm"][_"Na"]).apply(null,arguments)};var
_Tile=Module["_Tile"]=function(){return(_Tile=Module["_Tile"]=Module["asm"][_"Oa"]).apply(null,arguments)};var
_TopK=Module["_TopK"]=function(){return(_TopK=Module["_TopK"]=Module["asm"][_"Pa"]).apply(null,arguments)};var
_Transform=Module["_Transform"]=function(){return(_Transform=Module["_Transform"]=Module["asm"][_"Qa"]).apply(null,arguments)};var
_Transpose=Module["_Transpose"]=function(){return(_Transpose=Module["_Transpose"]=Module["asm"][_"Ra"]).apply(null,arguments)};var
__FusedMatMul=Module["__FusedMatMul"]=function(){return(__FusedMatMul=Module["__FusedMatMul"]=Module["asm"][_"Sa"]).apply(null,arguments)};var
_malloc=Module["_malloc"]=function(){return(_malloc=Module["_malloc"]=Module["asm"][_"Ta"]).apply(null,arguments)};var
_free=Module["_free"]=function(){return(_free=Module["_free"]=Module["asm"][_"Ua"]).apply(null,arguments)};var

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__errno_location=Module["__errno_location"]=function(){return(__errno_location=Module["__errno_location"])=Module["asm"]()["Va"])};var
stackSave=Module["stackSave"]=function(){return(stackSave=Module["stackSave"]=Module["asm"]()["Wa"])};var
stackRestore=Module["stackRestore"]=function(){return(stackRestore=Module["stackRestore"]=Module["asm"]()["Xa"])};var
stackAlloc=Module["stackAlloc"]=function(){return(stackAlloc=Module["stackAlloc"]=Module["asm"]()["Ya"])};var
Module["cwrap"]=cwrap;var calledRun;function
ExitStatus(status){this.name="ExitStatus";this.message="Program terminated with
exit("+status+")";this.status=status}dependenciesFulfilled=function
runCaller(){if(!calledRun)run();if(!calledRun)dependenciesFulfilled=runCaller};function
run(args){args=args||arguments_;if(runDependencies>0){return}preRun();if(runDependencies>0){return}function
doRun(){if(calledRun)return;calledRun=true;Module["calledRun"]=true;if(ABORT)return;initRuntime();preMain(
);readyPromiseResolve(Module);if(Module["onRuntimeInitialized"]){Module["onRuntimeInitialized"]();postRun(
)}if(Module["setStatus"]){Module["setStatus"]("Running...");setTimeout(function(){setTimeout(function(){Module["setStatus"]("")},1);doRun(),1)}else{doRun()}}Module["run"]=run;if(Module["preInit"]){if(typeof
Module["preInit"]=="function")Module["preInit"]=[Module["preInit"]];while(Module["preInit"].length>0){
Module["preInit"].pop()})();return WasmBackendModule.ready})();nif (typeof exports ===
'object' && typeof module === 'object')\n module.exports = WasmBackendModule;\nelse if (typeof define ===
'function' && define['amd'])\n define([], function() { return WasmBackendModule; });\nelse if (typeof exports ===
'object')\n exports["WasmBackendModule"] = WasmBackendModule;\n"/**\n * @license\n * Copyright 2019
Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
=====
*/\nimport './flags_wasm';\nimport {backend_util, BackendTimingInfo, DataStorage, DataType, deprecationWarn,
engine, env, KernelBackend, TensorInfo, util} from '@tensorflow/tfjs-core';\nimport {BackendWasmModule,
WasmFactoryConfig} from './wasm-out/tfjs-backend-wasm';\nimport {BackendWasmThreadedSimdModule} from
'./wasm-out/tfjs-backend-wasm-threaded-simd';\nimport
wasmFactoryThreadedSimd from './wasm-out/tfjs-backend-wasm-threaded-simd.js';\n// @ts-ignore\nimport
{wasmWorkerContents} from './wasm-out/tfjs-backend-wasm-threaded-simd.worker.js';\nimport wasmFactory
from './wasm-out/tfjs-backend-wasm.js';\n\ninterface TensorData {\n id: number;\n memoryOffset: number;\n
shape: number[];\n dtype: DataType;\n refCount: number;\n /** Only used for string tensors, storing encoded
bytes. */\n stringBytes?: Uint8Array[];\n}\n\nexport type DataId = object; // object instead of {} to force non-
primitive.\n\nexport class BackendWasm extends KernelBackend {\n // 0 is reserved for null data ids.\n private
dataIdNextNumber = 1;\n dataIdMap: DataStorage<TensorData>;\n\n constructor(public wasm:
BackendWasmModule|BackendWasmThreadedSimdModule) {\n super();\n
this.wasm.tfjs.initWithThreadsCount(threadsCount);\n actualThreadsCount = this.wasm.tfjs.getThreadsCount();\n
this.dataIdMap = new DataStorage(this, engine());\n }\n\n write(values:
backend_util.BackendValues, shape: number[], dtype: DataType):\n DataId {\n const dataId = {id:
this.dataIdNextNumber++};\n this.move(dataId, values, shape, dtype, 1);\n return dataId;\n }\n\n
numDataIds(): number {\n return this.dataIdMap.numDataIds();\n }\n\n async time(f: () => void):
Promise<BackendTimingInfo> {\n const start = util.now();\n f();\n const kernelMs = util.now() - start;\n
return {kernelMs};\n }\n\n move(\n dataId: DataId, values: backend_util.BackendValues, shape: number[],\n

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dtype: DataType, refCount: number): void {\n  const id = this.dataIdNextNumber++;\n  if (dtype === 'string') {\n    const stringBytes = values as Uint8Array[];\n    this.dataIdMap.set(\n      dataId,\n      {id, stringBytes,\n        shape, dtype, memoryOffset: null, refCount});\n    return;\n  }\n  const size = util.sizeFromShape(shape);\n  const numBytes = size * util.bytesPerElement(dtype);\n  const memoryOffset = this.wasm._malloc(numBytes);\n  this.dataIdMap.set(dataId, {id, memoryOffset, shape, dtype, refCount});\n  this.wasm.tfjs.registerTensor(id,\n    size, memoryOffset);\n  if (values != null) {\n    this.wasm.HEAPU8.set(\n      new Uint8Array(\n        (values as backend_util.TypedArray).buffer,\n        (values as backend_util.TypedArray).byteOffset,\n        numBytes),\n      memoryOffset);\n  }\n}\n\nasync read(dataId: DataId):  
Promise<backend_util.BackendValues> {\n  return this.readSync(dataId);\n}\n\nreadSync(dataId: DataId):  
backend_util.BackendValues {\n  const {memoryOffset, dtype, shape, stringBytes} =\n    this.dataIdMap.get(dataId);\n  if (dtype === 'string') {\n    return stringBytes;\n  }\n  const bytes =\n    this.wasm.HEAPU8.slice(\n      memoryOffset,\n      memoryOffset + util.sizeFromShape(shape) *\n        util.bytesPerElement(dtype));\n  return typedArrayFromBuffer(bytes.buffer, dtype);\n}\n\n/**\n * Dispose the  
memory if the dataId  
has 0 refCount. Return true if the memory\n * is released, false otherwise.\n * @param dataId\n * @oaram force  
Optional, remove the data regardless of refCount\n */\ndisposeData(dataId: DataId, force = false): boolean {\n  if  
(this.dataIdMap.has(dataId)) {\n    const data = this.dataIdMap.get(dataId);\n    data.refCount--;\n    if (!force  
&& data.refCount > 0) {\n      return false;\n    }\n    this.wasm._free(data.memoryOffset);\n    this.wasm.tfjs.disposeData(data.id);\n    this.dataIdMap.delete(dataId);\n  }\n  return true;\n}\n\n/** Return  
refCount of a `TensorData`.\n */\nrefCount(dataId: DataId): number {\n  if (this.dataIdMap.has(dataId)) {\n    const tensorData = this.dataIdMap.get(dataId);\n    return tensorData.refCount;\n  }\n  return 0;\n}\n\nincRef(dataId: DataId) {\n  const data = this.dataIdMap.get(dataId);\n  if (data != null) {\n    data.refCount++;\n  }\n}\n\nfloatPrecision(): 32 {\n  return 32;\n}\n\n// Returns the memory offset of a tensor. Useful for debugging and unit\n// testing.\ngetMemoryOffset(dataId:  
DataId): number {\n  return this.dataIdMap.get(dataId).memoryOffset;\n}\n\ndispose() {\n  this.wasm.tfjs.dispose();\n  if ('PThread' in this.wasm) {\n    this.wasm.PThread.terminateAllThreads();\n  }\n  this.wasm = null;\n}\n\nmemory() {\n  return {unreliable: false};\n}\n\n/**\n * Make a tensor info for the  
output of an op. If `memoryOffset` is not\n * present, this method allocates memory on the WASM heap. If  
`memoryOffset`\n * is present, the memory was allocated elsewhere (in c++) and we just record\n * the pointer  
where that memory lives.\n */\nmakeOutput(shape: number[], dtype: DataType, memoryOffset?: number):  
TensorInfo {\n  let dataId: {};\n  if (memoryOffset == null) {\n    dataId = this.write(null /* values */, shape,\n      dtype);\n  } else {\n    const id = this.dataIdNextNumber++;\n    dataId = {id};\n    this.dataIdMap.set(dataId, {id, memoryOffset, shape, dtype, refCount: 1});\n    const size =\n      util.sizeFromShape(shape);\n    this.wasm.tfjs.registerTensor(id, size, memoryOffset);\n  }\n  return {dataId,\n    shape, dtype};\n}\n\ntypedArrayFromHeap({shape, dtype, dataId}: TensorInfo):  
backend_util.TypedArray {\n  const buffer = this.wasm.HEAPU8.buffer;\n  const {memoryOffset} = this.dataIdMap.get(dataId);\n  const\n    size = util.sizeFromShape(shape);\n  switch (dtype) {\n    case 'float32':\n      return new Float32Array(buffer,\n        memoryOffset, size);\n    case 'int32':\n      return new Int32Array(buffer, memoryOffset, size);\n    case 'bool':\n      return new Uint8Array(buffer, memoryOffset, size);\n    default:\n      throw new Error(`Unknown dtype\n        ${dtype}`);\n  }\n}\n\nfunction createInstantiateWasmFunc(path: string) {\n  // this will be replace by rollout  
plugin patchWechatWebAssembly in\n  // minprogram's output.\n  // tslint:disable-next-line:no-any\n  return (imports: any, callback: any) => {\n    util.fetch(path, {credentials: 'same-origin'}).then((response) => {\n      if (!response['ok']) {\n        imports.env.a`failed to load wasm binary file at '${path}'`;\n      }\n      response.arrayBuffer().then(binary => {\n        WebAssembly.instantiate(binary, imports).then(output => {\n          callback(output.instance, output.module);\n        });\n      });\n    });\n    return {};\n  };\n}\n\n/**\n * Returns the  
path of the WASM binary.\n * @param simdSupported whether SIMD is supported\n * @param threadsSupported whether multithreading is supported\n * @param wasmModuleFolder the directory containing the WASM  
binaries.\n */\nfunction getPathToWasmBinary(\n  simdSupported: boolean, threadsSupported: boolean,\n
```

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wasmModuleFolder: string) {\n if (wasmPath != null) {\n // If wasmPath is defined, the user has supplied a full
path to\n // the vanilla .wasm binary.\n return wasmPath;\n }\n\n let path:
WasmBinaryName = 'tfjs-backend-wasm.wasm';\n if (simdSupported && threadsSupported) {\n path = 'tfjs-
backend-wasm-threaded-simd.wasm';\n } else if (simdSupported) {\n path = 'tfjs-backend-wasm-simd.wasm';\n
}\n\n if (wasmFileMap != null) {\n if (wasmFileMap[path] != null) {\n return wasmFileMap[path];\n }\n
}\n\n return wasmModuleFolder + path;\n}\n\n/**\n * Initializes the wasm module and creates the js <--> wasm
bridge.\n *\n * NOTE: We wrap the wasm module in a object with property 'wasm' instead of\n * returning
Promise<BackendWasmModule> to avoid freezing Chrome (last tested\n * in Chrome 76).\n */\n\nexport async
function init(): Promise<{wasm: BackendWasmModule}> {\n const [simdSupported, threadsSupported] = await
Promise.all([\n env().getAsync('WASM_HAS_SIMD_SUPPORT'),\n
env().getAsync('WASM_HAS_MULTITHREAD_SUPPORT')\n ]);\n\n return new Promise((resolve, reject) =>
{\n const factoryConfig: WasmFactoryConfig = {};\n\n /**\n * This function
overrides the Emscripten module locateFile utility.\n * @param path The relative path to the file that needs to be
loaded.\n * @param prefix The path to the main JavaScript file's directory.\n */\n factoryConfig.locateFile =
(path, prefix) => {\n if (path.endsWith('.worker.js')) {\n const response = wasmWorkerContents;\n const
blob = new Blob([response], {type: 'application/javascript'});\n return URL.createObjectURL(blob);\n }\n\n
if (path.endsWith('.wasm')) {\n return getPathToWasmBinary(\n simdSupported as boolean,\n
threadsSupported as boolean,\n wasmPathPrefix != null ? wasmPathPrefix : prefix);\n }\n return prefix
+ path;\n };\n\n // Use the instantiateWasm override when system fetch is not available.\n // Reference:\n //
https://github.com/emscripten-
core/emscripten/blob/2bca083cbbd5a4133db61fbd74d04f7feecfa907/tests/manual_wasm_instantiate.html#L170\n
if (customFetch) {\n
factoryConfig.instantiateWasm =\n createInstantiateWasmFunc(getPathToWasmBinary(\n
simdSupported as boolean, threadsSupported as boolean,\n wasmPathPrefix != null ? wasmPathPrefix :
''));\n }\n\n let initialized = false;\n factoryConfig.onAbort = () => {\n if (initialized) {\n // Emscripten
already called console.warn so no need to double log.\n return;\n }\n if (initAborted) {\n //
Emscripten calls `onAbort` twice, resulting in double error\n // messages.\n return;\n }\n initAborted
= true;\n const rejectMsg =\n 'Make sure the server can serve the `.wasm` file relative to the ' +\n
'bundled js file. For more details see https://github.com/tensorflow/tfjs/blob/master/tfjs-backend-
wasm/README.md#using-bundlers';\n reject({message: rejectMsg});\n };\n\n let wasm:
Promise<BackendWasmModule>;\n // If `wasmPath` has been defined we must initialize
the vanilla module.\n if (threadsSupported && simdSupported && wasmPath == null) {\n
factoryConfig.mainScriptUrlOrBlob = new Blob(\n [var WasmBackendModuleThreadedSimd = ` +\n
wasmFactoryThreadedSimd.toString(),\n {type: 'text/javascript'});\n wasm =
wasmFactoryThreadedSimd(factoryConfig);\n } else {\n // The wasmFactory works for both vanilla and SIMD
binaries.\n wasm = wasmFactory(factoryConfig);\n }\n\n // The WASM module has been successfully
created by the factory.\n // Any error will be caught by the onAbort callback defined above.\n
wasm.then((module) => {\n initialized = true;\n initAborted = false;\n\n const voidReturnType: string =
null;\n // Using the tfjs namespace to avoid conflict with emscripten's API.\n module.tfjs = {\n init:
module.cwrap('init', null, []),\n initWithThreadCount:\n module.cwrap('init_with_threads_count', null,
['number']),\n getThreadCount:
module.cwrap('get_threads_count', 'number', []),\n registerTensor: module.cwrap(\n 'register_tensor',
null,\n [\n 'number', // id\n 'number', // size\n 'number', // memoryOffset\n
]),\n disposeData: module.cwrap('dispose_data', voidReturnType, ['number']),\n dispose:
module.cwrap('dispose', voidReturnType, []),\n };;\n\n resolve({wasm: module});\n });;\n }\n\n\nfunction
typedArrayFromBuffer(\n buffer: ArrayBuffer, dtype: DataType): backend_util.TypedArray {\n switch (dtype)
{\n case 'float32':\n return new Float32Array(buffer);\n case 'int32':\n return new Int32Array(buffer);\n
case 'bool':\n return new Uint8Array(buffer);\n default:\n throw new Error(`Unknown dtype ${dtype}`);\n
}

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}\n\nconst wasmBinaryNames = [\n  'tfjs-backend-wasm.wasm', 'tfjs-backend-wasm-simd.wasm',\n  'tfjs-backend-wasm-threaded-simd.wasm'] as const
;\n\ntype WasmBinaryName = typeof wasmBinaryNames[number];\n\nlet wasmPath: string = null;\nlet
wasmPathPrefix: string = null;\nlet wasmFileMap: {[key in WasmBinaryName]?: string} = {};\nlet initAborted =
false;\nlet customFetch = false;\n\n/**\n * @deprecated Use `setWasmPaths` instead.\n * Sets the path to the
`.wasm` file which will be fetched when the wasm\n * backend is initialized. See\n *
https://github.com/tensorflow/tfjs/blob/master/tfjs-backend-wasm/README.md#using-bundlers\n * for more
details.\n * @param path wasm file path or url\n * @param usePlatformFetch optional boolean to use platform fetch
to download\n * the wasm file, default to false.\n *\n * @doc {heading: 'Environment', namespace: 'wasm'}\n
*/\nexport function setWasmPath(path: string, usePlatformFetch = false): void {\n  deprecationWarn(\n
'setWasmPath has been deprecated in favor of setWasmPaths and' +\n    ' will be removed in a future release.);\n  if
(initAborted) {\n    throw new Error(\n
'The WASM backend was already initialized. Make sure you call ' +\n      ' `setWasmPath()` before you call
`tf.setBackend()` or `tf.ready()`');\n  }\n  wasmPath = path;\n  customFetch = usePlatformFetch;\n}\n\n/**\n *
Configures the locations of the WASM binaries.\n *\n * ```js\n * setWasmPaths({\n *   'tfjs-backend-wasm.wasm':
'renamed.wasm',\n *   'tfjs-backend-wasm-simd.wasm': 'renamed-simd.wasm',\n *   'tfjs-backend-wasm-threaded-
simd.wasm': 'renamed-threaded-simd.wasm'\n * });\n * tf.setBackend('wasm');\n * ```\n *\n * @param
prefixOrFileMap This can be either a string or object:\n * - (string) The path to the directory where the WASM
binaries are located.\n * Note that this prefix will be used to load each binary (vanilla,\n * SIMD-enabled,
threading-enabled, etc.). \n * - (object) Mapping from names of WASM binaries to custom\n * full paths
specifying the locations of those binaries. This is useful if\n * your WASM binaries are not all located in the same
directory,\n
or if your\n * WASM binaries have been renamed.\n * @param usePlatformFetch optional boolean to use
platform fetch to download\n * the wasm file, default to false.\n *\n * @doc {heading: 'Environment', namespace:
'wasm'}\n */\nexport function setWasmPaths(\n  prefixOrFileMap: string|{[key in WasmBinaryName]?: string},\n
usePlatformFetch = false): void {\n  if (initAborted) {\n    throw new Error(\n
'The WASM backend was already initialized. Make sure you call ' +\n      ' `setWasmPaths()` before you call `tf.setBackend()` or ' +\n
`tf.ready()`');\n  }\n  if (typeof prefixOrFileMap === 'string') {\n    wasmPathPrefix = prefixOrFileMap;\n  } else
{\n    wasmFileMap = prefixOrFileMap;\n    const missingPaths =\n      wasmBinaryNames.filter(name =>
wasmFileMap[name] == null);\n    if (missingPaths.length > 0) {\n      throw new Error(\n
'There were no entries found for the following binaries: ` ` +\n        `${missingPaths.join(',')}`. Please either
call setWasmPaths with a ` ` +\n        `map providing a path for each binary, or with a string indicating ` ` +\n
`the directory where all the binaries can be found.`);\n    }\n  }\n  customFetch = usePlatformFetch;\n}\n\n/**\n *
Used in unit tests.\n */\nexport function resetWasmPath(): void {\n  wasmPath = null;\n  wasmPathPrefix = null;\n
wasmFileMap = {};\n  customFetch = false;\n  initAborted = false;\n}\n\nlet threadsCount = -1;\nlet
actualThreadsCount = -1;\n\n/**\n * Sets the number of threads that will be used by XNNPACK to create\n *
threadpool (default to the number of logical CPU cores).\n *\n * This must be called before calling
`tf.setBackend('wasm')`.\n */\nexport function setThreadsCount(numThreads: number) {\n  threadsCount =
numThreads;\n}\n\n/**\n * Gets the actual threads count that is used by XNNPACK.\n *\n * It is set after the
backend is initialized.\n */\nexport function getThreadsCount(): number {\n  if (actualThreadsCount === -1) {\n
throw new Error('WASM backend not initialized.);\n  }\n  return actualThreadsCount;\n}\n\n", "export const wasmWorkerContents = 'var
Module={};function threadPrintErr(){var text=Array.prototype.slice.call(arguments).join("\n");console.error(text)}function threadAlert(){var text=Array.prototype.slice.call(arguments).join("\n");postMessage({cmd:"alert",text:text,threadId:Module["_pthread_self"]()})}var
err=threadPrintErr;this.alert=threadAlert;Module["instantiateWasm"]=function(info,receiveInstance){var
instance=new
WebAssembly.Instance(Module["wasmModule"],info);Module["wasmModule"]=null;receiveInstance(instance);r

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return instance.exports};function
moduleLoaded(){ }this.onmessage=function(e){try{if(e.data.cmd===\"load\"){Module[\"wasmModule\"]=e.data.wasmModule;Module[\"wasmMemory\"]=e.data.wasmMemory;Module[\"buffer\"]=Module[\"wasmMemory\"].buffer;Module[\"ENVIRONMENT_IS_PTHREAD\"] =true;if(typeof
e.data.urlOrBlob===\"string\"){importScripts(e.data.urlOrBlob)}else{var
objectUrl=URL.createObjectURL(e.data.urlOrBlob);importScripts(objectUrl);URL.revokeObjectURL(objectUrl)}
WasmBackendModuleThreadedSimd(Module).then(function(instance){Module=instance;moduleLoaded()})}else
if(e.data.cmd===\"objectTransfer\"){Module[\"PThread\"].receiveObjectTransfer(e.data)}else
if(e.data.cmd===\"run\"){Module[\"__performance_now_clock_drift\"] =performance.now()-
e.data.time;Module[\"__emscripten_thread_init\"](e.data.threadInfoStruct,0,0);var max=e.data.stackBase;var
top=e.data.stackBase+e.data.stackSize;Module[\"establishStackSpace\"](top,max);Module[\"_emscripten_tls_init\"](
);Module[\"PThread\"].receiveObjectTransfer(e.data);Module[\"PThread\"].setThreadStatus(Module[\"_pthread_self
\")(0,1);try{var
result=Module[\"invokeEntryPoint\"](e.data.start_routine,e.data.arg);if(!Module[\"getNoExitRuntime\"]())Module[\"
PThread\"].threadExit(result)}catch(ex){if(ex===\"Canceled!\"){Module[\"PThread\"].threadCancel()}else
if(ex!==\"unwind\")if(ex instanceof
Module[\"ExitStatus\"]){if(Module[\"getNoExitRuntime\"]()){ }else{Module[\"PThread\"].threadExit(ex.status)} }el
se{Module[\"PThread\"].threadExit(-2);throw
ex}} } }else
if(e.data.cmd===\"cancel\")if(Module[\"_pthread_self\"]()){Module[\"PThread\"].threadCancel()}else
if(e.data.target===\"setimmediate\"){}else
if(e.data.cmd===\"processThreadQueue\")if(Module[\"_pthread_self\"]()){Module[\"_emscripten_current_thread_
process_queued_calls\"]()}else{err(\"worker.js received unknown command
\"+e.data.cmd);err(e.data)} }catch(ex){err(\"worker.js onmessage() captured an uncaught exception:
\"+ex);if(ex&&ex.stack)err(ex.stack);throw ex}};if(typeof process===\"object\"&&typeof
process.versions===\"object\"&&typeof process.versions.node===\"string\"){self={location:{href: __filename}};var
onmessage=this.onmessage;var
nodeWorkerThreads=require(\"worker_threads\");global.Worker=nodeWorkerThreads.Worker;var
parentPort=nodeWorkerThreads.parentPort;parentPort.on(\"message\",function(data){onmessage({data:data})});var
nodeFS=require(\"fs\");var nodeRead=function(filename){return
nodeFS.readFileSync(filename,\"utf8\")};function
globalEval(x){global.require=require;global.Module=Module;eval.call(null,x)}importScripts=function(f){globalEva
l(nodeRead(f));postMessage=function(msg){parentPort.postMessage(msg)};if(typeof
performance===\"undefined\"){performance={now:function(){return Date.now()}}};\"/** @license See the
LICENSE file. */\n\n// This code is auto-generated, do not modify this file!\nconst version = '3.11.0';\nexport
{version};\n\n\", \"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * \n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND,\n *
either express or implied.\n * See the License for the specific language governing permissions and\n * limitations
under the License.\n *
=====
\n
*/\n\nimport './flags_wasm';\n\nimport {registerBackend} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm,
init} from './backend_wasm';\n\nexport {BackendWasm, getThreadsCount, setThreadsCount, setWasmPath,
setWasmPaths} from './backend_wasm';\n\nexport {version as version_wasm} from './version';\n\nconst
WASM_PRIORITY = 2;\nregisterBackend('wasm', async () => {\n  const {wasm} = await init();\n  return new
BackendWasm(wasm);\n},

```

WASM_PRIORITY);\n"],["names":["CppType","FusableActivation","wasmFusedMatMul","fusedMatMulConfig","kernelName","_FusedMatMul","backendName","setupFunc","backend","wasm","cwrap","kernelFunc","args","inputs","attrs","a","b","bias","preluActivationWeights","dtype","Error","transposeA","transposeB","activation","leakyreluAlpha","aId","dataIdMap","get","dataId","id","bId","biasId","biasData","shape","length","preluActivationWeightsId","fusedActivation","leftDim","rightDim","batchDim","out","makeOutput","outId","aShapeBytes","UInt8Array","Int32Array","buffer","bShapeBytes","createUnaryKernelConfig","outType","wasmFunc","x","xId","util","sizeFromShape","absConfig","Abs","createBinaryKernelConfig","supportsFullBroadcast","outputType","newShape","backend_util","assertAndGetBroadcastShape","aBroadcastDims","getBroadcastDims","bBroadcastDims","loopsOverAllOfA","every","v","i","loopsOverAllOfB","addConfig","Add","addNConfig","AddN","inputIds","map","inputIdsBytes","identity","inVals","typedArrayFromHeap","set","identityConfig","Identity","wasmTranspose","transpose","reducedShape","perm","newPerm","push","minValIdx","j","removeOneSizeDims","permIsNoOp","outShape","inShape","Array","computeOutShape","cloned","permBytes","xShapeBytes","transposeConfig","Transpose","permuteAxesAndTranspose","axis","xShape","xRank","originalAxes","parseAxisParam","axes","permutedAxes","getAxesPermutation","xTransposed","inputWasTransposed","getInnerMostAxes","transposed","wasmAll","allConfig","All","keepDims","inputId","input","inputRank","assertAxesAreInnerMostDims","reduceShape","computeOutAndReduceShapes","reduceSize","disposeData","expandShapeToKeepDim","wasmAny","anyConfig","Any","argMaxConfig","ArgMax","transposedId","slice","outerSize","innerSize","wasmAvgPool","avgPoolConfig","AvgPool","filterSize","strides","pad","dimRoundingMode","convInfo","computePool2DInfo","filterHeight","filterWidth","padTop","padInfo","top","padRight","right","padBottom","bottom","padLeft","left","strideHeight","strideWidth","channels","inChannels","dataFormat","dilationWidth","dilationHeight","reshape","xSize","\$shape","inferFromImplicitShape","assert","incRef","reshapeConfig","Reshape","wasmBatchMatMul","batchMatMulConfig","BatchMatMul","aRank","bRank","innerShapeA","innerShapeB","outerShapeA","outerShapeB","outerDimsA","outerDimsB","batchDimA","batchDimB","batchDimsCompatible","concat","b3dShape","a3d","b3d","a3dId","b3dId","Math","max","sliceImpl","vals","begin","size","isContinous","slice_util","isSliceContinous","xStrides","computeStrides","flatOffset","computeFlatOffset","subarray","decodedData","fromUInt8ToStringArray","inBuf","outBuf","outLoc","indexToLoc","inLoc","idx","fromStringArrayToUInt8","values","begin_","size_","parseSliceParams","xVals","readSync","outData","stringBytes","res","sliceImplCPU","outVals","rank","xStride","outOffset","beginI","beginJ","endI","xOffset","slice2d","xStride1","xStride2","beginK","endJ","slice3d","xStride3","endK","beginL","k","slice4d","sliceConfig","Slice","batchToSpaceNDConfig","BatchToSpaceND","blockShape","crops","prod","reduce","reshaped","getReshaped","permuted","getPermuted","reshapedPermuted","getReshapedPermuted","sliceBeginCoords","getSliceBeginCoords","sliceSize","getSliceSize","xReshaped","result","cast","castConfig","Cast","ceilConfig","Ceil","wasmClip","clipByValueConfig","ClipByValue","clipValueMin","clipValueMax","t","\$inputs","filter","shapes","assertParamsConsistent","inputs2D","inputsValShapes","simplyConcat","getArrayFromDType","offset","forEach","colOffset","tIdx","row","resIdx","col","concatImplCPU","finalOutShape","sumInnerDims","innerDims","innerDim","inOffset","concatConfig","Concat","wasmConv2d","conv2DConfig","Conv2D","filterId","dilations","\$dataFormat","convertConv2DDataFormat","computeConv2DInfo","inputChannels","outputChannels","outChannels","isSamePad","type","wasmConv2DBackpropInput","conv2DBackpropInputConfig","Conv2DBackpropInput","dy","inputShape","batchSize","inHeight","inWidth","outHeight","outWidth","topPad","leftPad","isChannelsLast","dxStrides","dyStrides","fltS0","fltS1","fltS2","xBatchStride","xRowStride","xColStride","xChannelStride","yBatchStride","yRowStride","yColStride","yChannelStride","dyId","cosConfig","Cos","coshConfig","Cosh","InterpolationMethod","wasmCropAndResize","cropAndResizeConfig","CropAndResize","method","extrapolationValue","cropSize","image","boxes","boxInd","numBoxes","cropHeight","cropWidth","castedData","imagesData","imagesId","boxesId","boxIndId","imagesShapeBytes","wasmCumsum","cumsumConfig","Cumsum","exclusive","reverse","permutation","permutedX","permutedAxis","permutedOut","finalDim","permutedXId","permutedOutId","getUndoAxesPermutation","wasmDepthToSpace","depthToSpaceConfig","DepthToSpace","blockSize","outputHeight","outputWidth","outputDepth","outputShape","xStridesBytes","outputShapeBytes","outStridesBytes","wasmDepthwiseConv2d","depthwiseConv2dNativeConfig","DepthwiseConv2dNative","\$dilations","eluConfig","Elu","equalConfig","Equal","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in path(s):

* /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/tf-backend-wasm.fesm.min.js.map

No license file was found, but licenses were detected in source scan.

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compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n */" ] }
```

```
* =====\n
*\nimport {KernelConfig, Square} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from
'./unary_kernel';\n\nexport const squareConfig: KernelConfig = createUnaryKernelConfig(Square);\n\n"]}
```

Found in path(s):

* /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Square.js.map

No license file was found, but licenses were detected in source scan.

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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing
permissions and\n * limitations under the License.\n *
=====\\n
```

```
*\n\nimport {FloorDiv, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createBinaryKernelConfig} from
'./binary_kernel';\n\nconst supportsFullBroadcast = false;\n\nexport const floorDivConfig: KernelConfig =\ncreateBinaryKernelConfig(FloorDiv, supportsFullBroadcast);\n\n"]}
```

Found in path(s):

* /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/FloorDiv.js.map

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```
=====\n*\n\nimport { Any, AnyAttrs, AnyInputs, backend_util, KernelConfig, KernelFunc, TensorInfo, util } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nimport { permuteAxesAndTranspose } from './kernel_utils';\n\nlet\n  wasmAny: (xId: number, reduceSize: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n  wasmAny = backend.wasm.cwrap(Any, null /*void*/, ['number, number, number']);\n\n  function any(args: { backend: BackendWasm, inputs: AnyInputs, attrs: AnyAttrs }): TensorInfo {\n    const { backend, inputs, attrs } = args;\n    const { axis, keepDims } = attrs;\n    const { x } = inputs;\n    const xId = backend.dataIdMap.get(x.dataId).id;\n    let inputId = xId;\n    let input = x;\n\n    const { transposed, axes, originalAxes, inputWasTransposed } =\n      permuteAxesAndTranspose(x, axis, backend);\n\n    if (inputWasTransposed) {\n      const transposedId = backend.dataIdMap.get(transposed.dataId).id;\n      input = transposed;\n      inputId = transposedId;\n    }\n\n    const inputRank = input.shape.length;\n    backend_util.assertAxesAreInnerMostDims('any', axes, inputRank);\n\n    const [outShape, reduceShape] =\n      backend_util.computeOutAndReduceShapes(input.shape, axes);\n\n    const reduceSize = util.sizeFromShape(reduceShape);\n\n    const out = backend.makeOutput(outShape, x.dtype);\n\n    if (util.sizeFromShape(input.shape) !== 0) {\n      const outId = backend.dataIdMap.get(out.dataId).id;\n      wasmAny(inputId, reduceSize, outId);\n    }\n\n    if (inputWasTransposed) {\n      // dispose of the transposed tensor.\n      backend.disposeData(transposed.dataId);\n    }\n\n    if (keepDims) {\n      // reshape\n      const newShape = backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n      out.shape = newShape;\n    }\n\n    return out;\n  }\n\n  export const anyConfig: KernelConfig = {\n    kernelName: Any,\n    backendName: 'wasm',\n    setupFunc: setup,\n    kernelFunc: any as {} as KernelFunc\n  };\n}
```

Found in path(s):

* /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Any.js.map

No license file was found, but licenses were detected in source scan.

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```

```
* =====\n
*\nimport {KernelConfig, Neg} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from
'./unary_kernel';\nexport const negConfig: KernelConfig = createUnaryKernelConfig(Neg);\n"]}
```

Found in path(s):

* /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Neg.js.map

No license file was found, but licenses were detected in source scan.

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*
=====\\n
```

```
*\n\nimport {DataType, KernelConfig, TensorInfo, UnaryInputs, util} from
'@tensorflow/tfjs-core';\n\nimport {BackendWasm} from './backend_wasm';\n\nimport {CppType} from
'./types';\n\nexport function createUnaryKernelConfig(\n  kernelName: string, outType?: DataType): KernelConfig
{\n  let wasmFunc: (xId: number, dtype: number, outId: number) => void;\n\n  function setupFunc(backend:
BackendWasm): void {\n    wasmFunc = backend.wasm.cwrap(kernelName, null /* void */, [\n      'number', //
x_id\n      'number', // dtype\n      'number', // out_id\n    ]);\n  }\n\n  function kernelFunc(args: {backend:
BackendWasm, inputs: UnaryInputs}): TensorInfo {\n    const {backend, inputs: {x}} = args;\n    const xId =
backend.dataIdMap.get(x.dataId).id;\n    const out = backend.makeOutput(x.shape, outType || x.dtype);\n    const
outId = backend.dataIdMap.get(out.dataId).id;\n\n    // Short-circuit zero-sized tensors.\n    if
(util.sizeFromShape(out.shape) === 0) {\n      return out;\n    }\n\n    wasmFunc(xId, CCppType[x.dtype], outId);\n
return out;\n  }\n\n  return {kernelName, backendName: 'wasm', setupFunc, kernelFunc};\n}\n"]}
```

Found in path(s):

* /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/unary_kernel.js.map

No license file was found, but licenses were detected in source scan.

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=====\n\n*\n\nimport { KernelConfig, KernelFunc, Prelu, PreluInputs } from '@tensorflow/tfjs-core';\n\nimport
{ BackendWasm } from '../backend_wasm';\n\nimport { cast } from './Cast';\n\nlet wasmPrelu: (xId: number,
weightsId: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmPrelu =
backend.wasm.cwrap(Prelu, null /* void */, [\n 'number', // x_id\n 'number', // weights_id\n 'number' //
out_id\n]);\n\n function prelu(args: { inputs: PreluInputs, backend: BackendWasm }) {\n const { inputs, backend }
= args;\n const { x, alpha } = inputs;\n const xId = backend.dataIdMap.get(x.dataId).id;\n const weightsId =
backend.dataIdMap.get(alpha.dataId).id;\n\n let inputId = xId;\n const input = x;\n let castedInput = input;\n if (input.dtype !== 'float32') {\n castedInput =
cast({ backend, inputs: { x }, attrs: { dtype: 'float32' } });\n inputId = backend.dataIdMap.get(castedInput.dataId).id;\n }\n\n const out = backend.makeOutput(x.shape, 'float32');\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n wasmPrelu(inputId, weightsId, outId);\n\n if (input.dtype !== 'float32') {\n backend.disposeData(castedInput.dataId);\n }\n\n return out;\n }\n\n export const preluConfig: KernelConfig = {\n kernelName: Prelu,\n backendName: 'wasm',\n setupFunc: setup,\n kernelFunc: prelu as {} as KernelFunc\n };
}\n\n}

Found in path(s):

* /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Prelu.js.map

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 * =====*/

Found in path(s):

* /tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/kernels/Floor.cc
 * /tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/unary.cc
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 * /tfjs-backend-wasm-zip/tfjs-backend-wasm/src/cc/batch_mat_mul_impl.cc
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```

=====\\n
*\\n\\nimport { KernelConfig, KernelFunc, Select, SelectInputs, util } from '@tensorflow/tfjs-core';\\n\\nimport
{ BackendWasm } from '../backend_wasm';\\n\\nlet wasmSelect: (\\n  conditionId: number, tId: number, eId: number,
offset: number,\\n  outId: number) => void;\\n\\nfunction setup(backend: BackendWasm) {\\n  wasmSelect =
backend.wasm.cwrap('SelectV2', null, [\\n  'number', // conditionId\\n  'number', // tId\\n  'number', // eId\\n
'number', // offset\\n  'number', // outId\\n  ]);\\n}\\n\\nfunction select(args: { inputs: SelectInputs, backend:
BackendWasm }) {\\n  const { inputs, backend } = args;\\n  const { condition, t, e } = inputs;\\n\\n  const conditionId =
backend.dataIdMap.get(condition.dataId).id;\\n  const tId =
backend.dataIdMap.get(t.dataId).id;\\n  const eId = backend.dataIdMap.get(e.dataId).id;\\n  const out =
backend.makeOutput(t.shape, t.dtype);\\n  const outId = backend.dataIdMap.get(out.dataId).id;\\n\\n  const cRank =
condition.shape.length;\\n  const tRank = t.shape.length;\\n\\n  const offset = cRank === 0 || cRank > 1 || tRank === 1
?\\n    1 :\\n    util.sizeFromShape(t.shape.slice(1));\\n\\n  wasmSelect(conditionId, tId, eId, offset, outId);\\n  return
out;\\n}\\n\\n\\nexport const selectConfig: KernelConfig = {\\n  kernelName: Select,\\n  backendName: 'wasm',\\n
kernelFunc: select as { } as KernelFunc,\\n  setupFunc: setup\\n};\\n"}

```

Found in path(s):

* /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Select.js.map

No license file was found, but licenses were detected in source scan.

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ntent":["/*\n

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```
=====\n\n*/\n\nimport {KernelConfig, KernelFunc, ResizeBilinear, ResizeBilinearAttrs, ResizeBilinearInputs, TensorInfo,  
util} from '@tensorflow/tfjs-core';\n\nimport {BackendWasm} from '../backend_wasm';\n\nimport  
{cast} from './Cast';\n\nlet wasmResizeBilinear: (\n  xId: number, batch: number, oldHeight: number, oldWidth:  
number,\n  numChannels: number, newHeight: number, newWidth: number,\n  alignCorners: number,  
halfPixelCenters: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm): void {\n  wasmResizeBilinear = backend.wasm.cwrap(ResizeBilinear, null /*void*/, [\n    'number', // xId\n    'number', //  
batch\n    'number', // oldHeight\n    'number', // oldWidth\n    'number', // numChannels\n    'number', //  
newHeight\n    'number', // newWidth\n    'number', // alignCorners\n    'number', // halfPixelCenters\n    'number'  
// outId\n  ]);\n\n  function resizeBilinear(args: {\n    backend: BackendWasm,\n    inputs: ResizeBilinearInputs,\n    attrs: ResizeBilinearAttrs\n  }): TensorInfo {\n    const {backend, inputs, attrs} = args;\n    const {images} = inputs;\n    const {alignCorners, halfPixelCenters, size} = attrs;\n    const [newHeight, newWidth] = size;\n    const  
[batch, oldHeight, oldWidth, numChannels] = images.shape;\n    const outShape = [batch, newHeight, newWidth,  
numChannels];\n    let xData = backend.dataIdMap.get(images.dataId);\n    let castedData;\n    if (xData.dtype !==  
'float32') {\n      castedData =\n        cast({backend, inputs: {x: images}, attrs: {dtype: 'float32'}});\n      xData =  
backend.dataIdMap.get(castedData.dataId);\n    }\n    const xId = xData.id;\n    const out =  
backend.makeOutput(outShape, 'float32');\n    if (util.sizeFromShape(images.shape) === 0) {\n      return out;\n    }\n    const outId = backend.dataIdMap.get(out.dataId).id;\n    wasmResizeBilinear(\n      xId, batch, oldHeight,  
oldWidth, numChannels, newHeight, newWidth,\n      alignCorners ? 1 : 0, halfPixelCenters ? 1 : 0, outId);\n    if  
(castedData !== null) {\n      backend.disposeData(castedData.dataId);\n    }\n    return out;\n  }\n\n  export const  
resizeBilinearConfig: KernelConfig = {\n    kernelName: ResizeBilinear,\n    backendName: 'wasm',\n    setupFunc:  
setup,\n    kernelFunc:  
resizeBilinear as {} as KernelFunc\n  };\n}
```

Found in path(s):

* /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/ResizeBilinear.js.map

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No license file was found, but licenses were detected in source scan.

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=====\\n
*\n\nimport { KernelConfig, RealDiv } from '@tensorflow/tfjs-core';\n\nimport { createBinaryKernelConfig } from
'/binary_kernel';\n\nconst supportsFullBroadcast = true;\n\nexport const realDivConfig: KernelConfig =\ncreateBinaryKernelConfig(RealDiv, supportsFullBroadcast);\n\n"]}
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Found in path(s):

* /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/RealDiv.js.map

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```
* =====\n*\nimport { KernelConfig, KernelFunc, TensorInfo, Transform, TransformAttrs, TransformInputs, util } from  
'@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nlet wasmTransform: (\n  imageId:  
number, transformsId: number, isBatchTransform: boolean,\n  batch: number, outHeight: number, outWidth:  
number, numChannels: number,\n  imageWidth: number, imageHeight: number, strides: Uint8Array,\n  stridesLength: number, interpolationModeId: number, fillModeId: number,\n  fillValue: number, outId: number)  
=> void;\nfunction setup(backend: BackendWasm): void {\n  wasmTransform = backend.wasm.cwrap(Transform,  
null /*void*/, [\n    'number', // imageId\n    'number', // transformsId\n    'bool', // isBatchTransform\n    'number', // batch\n    'number', // outHeight\n    'number', // outWidth\n    'number', // numChannels\n    'number', //  
imageWidth\n    'number',  
    // imageHeight\n    'array', // strides\n    'number', // stridesLength\n    'number', // interpolationModeId\n    'number', // fillModeId\n    'number', // fillValue\n    'number', // outId\n  ]);\n  function transform(\n    args: {\n      backend: BackendWasm, inputs: TransformInputs, attrs: TransformAttrs\n    }): TensorInfo {\n    const { backend,  
inputs, attrs } = args;\n    const { image, transforms } = inputs;\n    const { interpolation, fillMode, fillValue,  
outputShape } = attrs;\n    const [batch, imageHeight, imageWidth, numChannels] = image.shape;\n    const  
[outHeight, outWidth] =\n      outputShape != null ? outputShape : [imageHeight, imageWidth];\n    const outShape  
=\n      [batch, outHeight, outWidth,\n        numChannels] as [number, number, number, number];\n    const strides =\n      new Uint8Array(new Int32Array(util.computeStrides(image.shape)).buffer);\n    const out =  
backend.makeOutput(outShape, image.dtype);\n    const outId = backend.dataIdMap.get(out.dataId).id;\n    const imageData = backend.dataIdMap.get(image.dataId);\n    const imageId = imageData.id;\n    const  
transformsData = backend.dataIdMap.get(transforms.dataId);\n    const transformsId = transformsData.id;\n    const  
interpolationModeId = interpolation === 'nearest' ? 1 : 2;\n    let fillModeId;\n    switch (fillMode) {\n      case  
'constant':\n        fillModeId = 1;\n        break;\n      case 'reflect':\n        fillModeId = 2;\n        break;\n      case 'wrap':\n        fillModeId = 3;\n        break;\n      case 'nearest':\n        fillModeId = 4;\n        break;\n      default:\n        fillModeId = 1;\n        break;\n    }\n    wasmTransform(\n      imageId, transformsId, (transforms.shape[0] > 1), batch, outHeight,\n      outWidth, numChannels, imageWidth, imageHeight, strides,\n      image.shape.length - 1, interpolationModeId,  
fillModeId, fillValue,\n      outId);\n    return out;\n  }\n  export const transformConfig: KernelConfig = {\n    kernelName: Transform,\n    backendName: 'wasm',\n    setupFunc: setup,\n    kernelFunc:  
transform as {} as KernelFunc\n  };\n}
```

Found in path(s):

* /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Transform.js.map

No license file was found, but licenses were detected in source scan.

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=====\n
*\n\n// Register the wasm backend.\n\nimport './index';\n\n// tslint:disable-next-line: no-imports-from-dist\nimport {setTestEnvs} from '@tensorflow/tfjs-core/dist/jasmine_util';\nimport jasmine from 'jasmine';\n\nError.stackTraceLimit = Infinity;\n\nprocess.on('unhandledRejection', e => {\n throw e;\n});\n\nsetTestEnvs([\n {\n name: 'wasm-node',\n backendName: 'wasm',\n isDataSync: true\n }\n]);\n\nconst runner = new jasmine({});\nrunner.loadConfig({\n spec_files: [\n 'src/**/*.test.ts'\n],\n random: false\n});\n\nif (process.env.JASMINE_SEED) {\n runner.seed(process.env.JASMINE_SEED);\n}\n\nrunner.execute();\n\n"]}

Found in path(s):

* /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/test_node.js.map

No license file was found, but licenses were detected in source scan.

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=====\n
*\n\nimport {KernelConfig, Multiply} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from './binary_kernel';\n\nconst supportsFullBroadcast = true;\n\nexport const multiplyConfig: KernelConfig =\n createBinaryKernelConfig(Multiply, supportsFullBroadcast);\n\n"]}

Found in path(s):

* /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Multiply.js.map

No license file was found, but licenses were detected in source scan.

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```
=====\n\n* \n\nimport { backend_util, KernelConfig, KernelFunc, Cumsum, CumsumAttrs, CumsumInputs, TensorInfo, util } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from './backend_wasm';\nimport { CppDType } from './types';\nimport { transpose } from './Transpose';\n\nlet wasmCumsum: (xId: number, exclusive: number, reverse: number, finalDim: number, outId: number, dtype: CppDType) => void;\n\nfunction setup(backend: BackendWasm) {\n  wasmCumsum = backend.wasm.cwrap(Cumsum, null /* void */, [\n    'number', // x_id\n    'number', // exclusive\n    'number', // reverse\n    'number', // final_dim\n    'number', // out_id\n    'number' // dtype\n  ]);\n\n  export function cumsum(\n    args: { inputs: CumsumInputs, backend: BackendWasm, attrs: CumsumAttrs }\n  ): TensorInfo {\n    const { inputs, backend, attrs } = args;\n\n    const { x } = inputs;\n    const { axis, exclusive, reverse } = attrs;\n    const xRank = x.shape.length;\n\n    util.assert(x.dtype === 'float32' || x.dtype === 'int32',\n      () => `cumsum does not support ${x.dtype} tensors in the WASM backend`);\n    // permute required axis to inner most axis\n    const permutation = backend_util.getAxesPermutation([axis], xRank);\n    let permutedX = x;\n    if (permutation !== null) {\n      permutedX = transpose({ inputs: { x }, attrs: { perm: permutation }, backend });\n    }\n    const permutedAxis = backend_util.getInnerMostAxes(1, xRank)[0];\n    backend_util.assertAxesAreInnerMostDims('cumsum', [permutedAxis], xRank);\n\n    const permutedOut = backend.makeOutput(permutedX.shape, permutedX.dtype);\n    const finalDim = permutedX.shape[permutedAxis];\n    const permutedXId = backend.dataIdMap.get(permutedX.dataId).id;\n    const permutedOutId = backend.dataIdMap.get(permutedOut.dataId).id;\n    wasmCumsum(permutedXId, exclusive ? 1 : 0, reverse ? 1 : 0, finalDim,\n      permutedOutId, CppDType[x.dtype]);\n\n    // transpose data back if permuted\n    let out = permutedOut;\n    if (permutation !== null) {\n      const undoPermutation = backend_util.getUndoAxesPermutation(permutation);\n      out = transpose(\n        { inputs: { x: permutedOut }, attrs: { perm: undoPermutation }, backend }\n      );\n    }\n    backend.disposeData(permutedX.dataId);\n    backend.disposeData(permutedOut.dataId);\n\n    return out;\n  }\n\n  export const cumsumConfig: KernelConfig = {\n    kernelName: Cumsum,\n    backendName: 'wasm',\n    setupFunc: setup,\n    kernelFunc: cumsum as { } as KernelFunc\n  };
}
```

Found in path(s):

* /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Cumsum.js.map

No license file was found, but licenses were detected in source scan.

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AC","sourcesContent":["/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed
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* =====\n
*\nimport { Abs, KernelConfig } from '@tensorflow/tfjs-core';\nimport { createUnaryKernelConfig } from
'./unary_kernel';\nexport const absConfig: KernelConfig = createUnaryKernelConfig(Abs);\n"]}
```

Found in path(s):

* /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Abs.js.map

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 * =====
 */
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the specific language governing permissions and\n * limitations under the License.\n *

```
=====\n\n*/\n\nimport { backend_util, KernelConfig, KernelFunc, ReshapeAttrs, ReshapeInputs, SpaceToBatchND,  
SpaceToBatchNDAttrs, SpaceToBatchNDInputs, TensorInfo, TransposeAttrs, TransposeInputs, util } from  
'@tensorflow/tfjs-core';\n\nimport { BackendWasm } from './backend_wasm';\n\nimport { padV2Config } from  
'./PadV2';\n\nimport { reshape } from './Reshape';\n\nimport { transpose } from './Transpose';\n\nfunction  
spaceToBatchND(args: {\n  inputs: SpaceToBatchNDInputs,\n  backend: BackendWasm,\n  attrs:  
SpaceToBatchNDAttrs\n}) {\n  const { inputs, backend, attrs } = args;\n  const { x } = inputs;\n  const { blockSize,  
padding } = attrs;\n  const prod = util.sizeFromShape(blockSize);\n  const completePadding: Array<[number,  
number]> = [[0, 0]];\n  completePadding.push(...(padding as Array<[number, number]>));\n  for (let i = 1 +  
blockSize.length; i < x.shape.length; ++i) {\n    completePadding.push([0, 0]);\n  }\n  const paddedX =  
padV2Config.kernelFunc({\n    inputs: { x },\n    backend,\n    attrs: { padding: completePadding, constantValue: 0 }\n  }) as TensorInfo;\n  const reshapedPaddedShape =\n    backend_util.getReshaped(paddedX.shape, blockSize, prod, false);\n  const permutedReshapedPaddedPermutation = backend_util.getPermuted(\n    reshapedPaddedShape.length,  
blockSize.length, false);\n  const flattenShape =\n    backend_util.getReshapedPermuted(paddedX.shape,  
blockSize, prod, false);\n  const reshapeInputs: ReshapeInputs = { x: paddedX };\n  const reshapeAttrs:  
ReshapeAttrs = { shape: reshapedPaddedShape };\n  const paddedXReshaped =\n    reshape({ inputs: reshapeInputs,  
backend, attrs: reshapeAttrs });\n  const transposeInputs: TransposeInputs = { x: paddedXReshaped };\n  const  
transposeAttrs: TransposeAttrs = { perm: permutedReshapedPaddedPermutation };\n  const paddedXT =\n    transpose({ inputs: transposeInputs, backend, attrs: transposeAttrs });\n  const resultReshapeInputs: ReshapeInputs  
= { x: paddedXT };\n  const resultReshapeAttrs: ReshapeAttrs = { shape: flattenShape };\n  const result = reshape(\n    { inputs:  
resultReshapeInputs, backend, attrs: resultReshapeAttrs });\n  backend.disposeData(paddedX.dataId);\n  backend.disposeData(paddedXReshaped.dataId);\n  backend.disposeData(paddedXT.dataId);\n  return  
result;\n}\n\nexport const spaceToBatchNDConfig: KernelConfig = {\n  kernelName: SpaceToBatchND,\n  backendName: 'wasm',\n  kernelFunc: spaceToBatchND as KernelFunc\n};\n\n"]}
```

* /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/SpaceToBatchND.js.map
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    WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
    the specific language governing
    permissions and\n * limitations under the License.\n *
    =====\n
    */\nimport { KernelConfig, Maximum } from '@tensorflow/tfjs-core';\n\nimport { createBinaryKernelConfig } from
```

```
.'/binary_kernel';\nconst supportsFullBroadcast = false;\n\nexport const maximumConfig: KernelConfig =\n  createBinaryKernelConfig(Maximum, supportsFullBroadcast);\n\n}}}
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* /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Maximum.js.map

No license file was found, but licenses were detected in source scan.

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under the License.\n *

=====\n\n*/\n\nimport {BatchMatMul, BatchMatMulAttrs, BatchMatMulInputs, KernelConfig, KernelFunc, util} from
'@tensorflow/tfjs-core';\n\nimport {BackendWasm} from './backend_wasm';\n\nimport {reshape} from
'./Reshape';\n\nlet wasmBatchMatMul: (\n aId: number, aShape: Uint8Array, aShapeSize: number, bId: number,\n bShape: Uint8Array, bShapeSize: number, transposeA: boolean,\n transposeB: boolean, outId: number) =>
void;\n\nfunction setup(backend: BackendWasm) {\n wasmBatchMatMul = backend.wasm.cwrap(BatchMatMul,
null /* void */, [\n 'number', // a_id\n 'array', // a_shape\n 'number', // a_shape.length\n 'number', // b_id\n 'array', // b_shape\n 'number', // b_shape.length\n 'number', // transpose_a\n 'number', // transpose_b\n 'number' // out_id\n]);\n\n function batchMatMul(args: {\n inputs: BatchMatMulInputs,\n backend:
BackendWasm,\n attrs: BatchMatMulAttrs\n }) {\n const {inputs, backend, attrs} = args;\n const {a, b} = inputs;\n const
{transposeA, transposeB} = attrs;\n\n if (a.dtype !== 'float32' || b.dtype !== 'float32') {\n throw new Error(`\n BatchMatMul for non non-float32 tensors not yet supported.`);\n }\n\n const aRank = a.shape.length;\n const
bRank = b.shape.length;\n\n const innerShapeA = transposeA ? a.shape[aRank - 2] : a.shape[aRank - 1];\n const
innerShapeB = transposeB ? b.shape[bRank - 1] : b.shape[bRank - 2];\n\n const outerShapeA = transposeA ?
a.shape[aRank - 1] : a.shape[aRank - 2];\n const outerShapeB = transposeB ? b.shape[bRank - 2] : b.shape[bRank -
1];\n\n const outerDimsA = a.shape.slice(0, -2);\n const outerDimsB = b.shape.slice(0, -2);\n\n const batchDimA =
util.sizeFromShape(outerDimsA);\n const batchDimB = util.sizeFromShape(outerDimsB);\n\n const
batchDimsCompatible =\n batchDimA === batchDimB || batchDimA === 1 || batchDimB === 1;\n\n util.assert(\n aRank >= 2 && bRank >= 2 && batchDimsCompatible,\n () => `Error in matMul: the input batch
dimensions must either be the ` +\n `same or at least one input batch dimension must be 1. Got input ` +\n `batch dimensions of (\${outerDimsA}) and (\${outerDimsB}).`);\n\n const outShapeOuterDims =\n batchDimA
> batchDimB ? a.shape.slice(0, -2) : b.shape.slice(0, -2);\n const outShape =
outShapeOuterDims.concat([outerShapeA, outerShapeB]);\n\n util.assert(\n innerShapeA === innerShapeB,\n () => `Error in matMul: inner shapes (\${innerShapeA}) and ` +\n `\${innerShapeB}) of Tensors with shapes

```

${a.shape} and ` +\n      `${b.shape} and transposeA=${transposeA}` +\n      ` and transposeB=${transposeB}
must match.`);\n\n const a3dShape = transposeA ? [batchDimA, innerShapeA, outerShapeA] :\n[batchDimA, outerShapeA, innerShapeA];\n const b3dShape = transposeB ? [batchDimB, outerShapeB,\ninnerShapeB] :\n      [batchDimB, innerShapeB, outerShapeB];\n\n // The rest of the implementation is designed to
operate on rank-3 tensors\n const a3d = reshape({inputs: {x: a}, backend, attrs: {shape: a3dShape}});\n const b3d
= reshape({inputs: {x: b}, backend, attrs: {shape: b3dShape}});\n\n const a3dId =
backend.dataIdMap.get(a3d.dataId).id;\n const b3dId = backend.dataIdMap.get(b3d.dataId).id;\n\n const leftDim =
transposeA ? a3d.shape[2] : a3d.shape[1];\n const rightDim = transposeB ? b3d.shape[1] : b3d.shape[2];\n const
batchDim = Math.max(batchDimA, batchDimB);\n\n const out = backend.makeOutput([batchDim, leftDim,\nrightDim], a3d.dtype);\n const outId = backend.dataIdMap.get(out.dataId).id;\n\n const aShapeBytes = new
Uint8Array(new Int32Array(a3d.shape).buffer);\n const bShapeBytes = new Uint8Array(new
Int32Array(b3d.shape).buffer);\n\n wasmBatchMatMul(\n      a3dId, aShapeBytes, a3d.shape.length, b3dId,\nbShapeBytes,\n      b3d.shape.length, transposeA, transposeB,\noutId);\n\n backend.disposeData(a3d.dataId);\n backend.disposeData(b3d.dataId);\n\n out.shape = outShape;\n
return out;\n\n\n\nexport const batchMatMulConfig: KernelConfig = {\n  kernelName: BatchMatMul,\n  backendName: 'wasm',\n  setupFunc: setup,\n  kernelFunc: batchMatMul as {} as KernelFunc\n};\n\n"]

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* /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/BatchMatMul.js.map

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on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
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License.\n
 * =====\n
*/\n\nimport {KernelConfig, Tanh} from '@tensorflow/tfjs-core';\n\nimport {createUnaryKernelConfig} from
'./unary_kernel';\n\nexport const tanhConfig: KernelConfig = createUnaryKernelConfig(Tanh);\n\n"]

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Found in path(s):

* /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Tanh.js.map

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=====
*/\n\nimport { All, AllAttrs, AllInputs, backend_util, KernelConfig, KernelFunc, TensorInfo, util } from
'@tensorflow/tfjs-core';\n\nimport { BackendWasm } from '../backend_wasm';\n\nimport
{ permuteAxesAndTranspose } from './kernel_utils';\n\nlet
wasmAll: (xId: number, reduceSize: number, outId: number) => void;\n\nfunction setup(backend: BackendWasm):
void {\n  wasmAll = backend.wasm.cwrap(All, null /*void*/, ['number, number, number']);\n}\n\nfunction all(args:
{ backend: BackendWasm, inputs: AllInputs, attrs: AllAttrs }):\n  TensorInfo {\n  const { backend, inputs, attrs } =
args;\n  const { axis, keepDims } = attrs;\n  const { x } = inputs;\n  const xId = backend.dataIdMap.get(x.dataId).id;\n
let inputId = xId;\n  let input = x;\n\n  const { transposed, axes, originalAxes, inputWasTransposed } =\n
permuteAxesAndTranspose(x, axis, backend);\n\n  if (inputWasTransposed) {\n    const transposedId =
backend.dataIdMap.get(transposed.dataId).id;\n    input = transposed;\n    inputId = transposedId;\n  }\n\n  const
inputRank = input.shape.length;\n  backend_util.assertAxesAreInnerMostDims('all', axes, inputRank);\n  const
[outShape, reduceShape] =\n    backend_util.computeOutAndReduceShapes(input.shape, axes);\n  const
reduceSize
= util.sizeFromShape(reduceShape);\n\n  const out = backend.makeOutput(outShape, x.dtype);\n  if
(util.sizeFromShape(input.shape) !== 0) {\n    const outId = backend.dataIdMap.get(out.dataId).id;\n
wasmAll(inputId, reduceSize, outId);\n  }\n\n  if (inputWasTransposed) {\n    // dispose of the transposed tensor.\n
backend.disposeData(transposed.dataId);\n  }\n\n  if (keepDims) {\n    // reshape\n    const newShape =
backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n    out.shape = newShape;\n  }\n\n  return
out;\n}\n\nexport const allConfig: KernelConfig = {\n  kernelName: All,\n  backendName: 'wasm',\n  setupFunc:
setup,\n  kernelFunc: all as {} as KernelFunc\n};\n"}]

```

Found in path(s):

* /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/All.js.map

No license file was found, but licenses were detected in source scan.

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","sourcesContent":["/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under  
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License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed  
on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or  
implied.\n * See the License for the specific language governing permissions and\n * limitations under the  
License.\n * =====\n */\n\nimport { KernelConfig, Sqrt } from '@tensorflow/tfjs-core';\nimport { createUnaryKernelConfig } from  
 './unary_kernel';\nexport const sqrtConfig: KernelConfig = createUnaryKernelConfig(Sqrt);\n"]}
```

Found in path(s):

* /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Sqrt.js.map

No license file was found, but licenses were detected in source scan.

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EAAE,MAAM;IACnB,UAAU,EAAE,MAA0B;CACvC,CAAC","sourcesContent":["/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version  
2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a  
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law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for  
the specific language governing permissions and\n * limitations under the License.\n * =====\n */\n\nimport { KernelConfig, KernelFunc, SplitV, SplitVAttrs, SplitVInputs, util } from '@tensorflow/tfjs-  
core';\nimport { backend_util } from '@tensorflow/tfjs-core';\nimport { BackendWasm } from  
 './backend_wasm';\nimport { slice } from './Slice';\nexport function splitV(\n  args: { inputs: SplitVInputs, attrs:  
SplitVAttrs, backend: BackendWasm }) {\n  const { inputs, attrs, backend } = args;\n  const { x } = inputs;\n  const  
 { numOrSizeSplits, axis } = attrs;\n  const $axis = util.parseAxisParam(axis, x.shape)[0];\n  const splitSizes =
```

```

backend_util.prepareSplitSize(x, numOrSizeSplits, $axis);\n const begin = new Array(x.shape.length).fill(0);\n
const size = x.shape.slice();\n return splitSizes.map(s => {\n const xSliceSize = [...size];\n xSliceSize[$axis] =
s;\n const xSlice =\n slice({inputs: {x}, attrs: {begin, size: xSliceSize}, backend});\n begin[$axis] += s;\n
return xSlice;\n });\n\n\nexport const
splitVConfig: KernelConfig = {\n kernelName: SplitV,\n backendName: 'wasm',\n kernelFunc: splitV as { } as
KernelFunc\n};\n"}

```

Found in path(s):

* /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/SplitV.js.map

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```

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OTHER TORTIOUS ACTION, ARISING OUT OF OR IN CONNECTION WITH THE USE OR
PERFORMANCE OF THIS SOFTWARE.
***** */
/**
 * @deprecated Use `setWasmPaths` instead.
 * Sets the path to the `.wasm` file which will be fetched when the wasm
 * backend is initialized. See
 * https://github.com/tensorflow/tfjs/blob/master/tfjs-backend-wasm/README.md#using-bundlers

```

```

* for more details.
* @param path wasm file path or url
* @param usePlatformFetch optional boolean to use platform fetch to download
* the wasm file, default to false.
*
* @doc {heading: 'Environment', namespace: 'wasm'}
*/

```

Found in path(s):

* /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/tf-backend-wasm.js

No license file was found, but licenses were detected in source scan.

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BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the
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=====
*\nimport {KernelConfig, NotEqual} from '@tensorflow/tfjs-core';\nimport {createBinaryKernelConfig} from
'./binary_kernel';\nconst supportsFullBroadcast = false;\nexport const notEqualConfig: KernelConfig =\ncreateBinaryKernelConfig(NotEqual, supportsFullBroadcast, 'bool');\n"]}]

```

Found in path(s):

* /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/NotEqual.js.map

No license file was found, but licenses were detected in source scan.

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```
=====\n\n/*\n\nimport { backend_util, KernelConfig, KernelFunc, Prod, ProdAttrs, ProdInputs, TensorInfo, util } from  
'@tensorflow/tfjs-core';\nimport { BackendWasm } from '../backend_wasm';\nimport  
{ permuteAxesAndTranspose } from './kernel_utils';\nimport { CppDType } from './types';\n\nlet wasmProd: (\n  xId: number, reduceSize: number,\n  dtype: number, outId: number) => void;\n\nfunction setup(backend:  
BackendWasm): void {\n  wasmProd = backend.wasm.cwrap(Prod, null /*void*/, [\n    'number',\n    'number',\n    'number',\n    'number'\n  ]);\n\n  function prod(args: {\n    backend: BackendWasm,\n    inputs: ProdInputs,\n    attrs: ProdAttrs\n  }): TensorInfo {\n    const { backend, inputs, attrs } = args;\n    const { axis, keepDims } = attrs;\n    const { x } = inputs;\n    const xId = backend.dataIdMap.get(x.dataId).id;\n    let inputId = xId;\n    let input = x;\n\n    const  
{ transposed, axes, originalAxes, inputWasTransposed } =\n      permuteAxesAndTranspose(x, axis, backend);\n\n    let reductionAxes = axes;\n    if (inputWasTransposed) {\n      const transposedId =  
backend.dataIdMap.get(transposed.dataId).id;\n      if (transposedId !== xId) {\n        // transpose was not a no-op. We  
will need to dispose of this\n        // once we are done.\n        input = transposed;\n        inputId = transposedId;\n      }\n      reductionAxes = backend_util.getInnerMostAxes(\n        reductionAxes.length, input.shape.length);\n    }\n    backend_util.assertAxesAreInnerMostDims(\n      'prod', reductionAxes, input.shape.length);\n    const [outShape,  
reduceShape] =\n      backend_util.computeOutAndReduceShapes(input.shape, reductionAxes);\n    const reduceSize  
= util.sizeFromShape(reduceShape);\n\n    const out = backend.makeOutput(outShape, input.dtype);\n    if  
(util.sizeFromShape(input.shape) !== 0) {\n      const outId = backend.dataIdMap.get(out.dataId).id;\n      wasmProd(inputId, reduceSize, CppDType[out.dtype], outId);\n    }\n\n    if (inputWasTransposed) {\n      // dispose of  
the transposed tensor.\n      backend.disposeData(transposed.dataId);\n    }\n\n    if (keepDims) {\n      // reshape\n      const newShape =  
backend_util.expandShapeToKeepDim(out.shape, originalAxes);\n      out.shape = newShape;\n    }\n\n    return  
out;\n  }\n\n  export const prodConfig: KernelConfig = {\n    kernelName: Prod,\n    backendName: 'wasm',\n    setupFunc:  
setup,\n    kernelFunc: prod as { } as KernelFunc\n  };
}
```

Found in path(s):

* /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Prod.js.map

No license file was found, but licenses were detected in source scan.

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=====*\n
*/\n\nimport { KernelConfig, KernelFunc, Pack, PackAttrs, PackInputs, TensorInfo, util } from '@tensorflow/tfjs-
core';\nimport { BackendWasm } from '../backend_wasm';\nimport { concat } from './Concat';\nimport
{ expandDims } from './ExpandDims';\n\nexport function pack(\n  args: { inputs: PackInputs, backend:
BackendWasm, attrs: PackAttrs }):\n  TensorInfo {\n    const { inputs, backend, attrs } = args;\n    const { axis } =
attrs;\n\n    if (inputs.length === 1) {\n      return expandDims(\n        { inputs: { input: inputs[0] }, backend, attrs: { dim:
axis } });\n    }\n\n    const shape = inputs[0].shape;\n    const dtype = inputs[0].dtype;\n\n    inputs.forEach(t => {\n      util.assertShapesMatch(\n        shape, t.shape,\n        'All tensors passed to stack must
have matching shapes');\n      util.assert(\n        dtype === t.dtype,\n        () => 'All tensors passed to stack must have
matching dtypes');\n    });\n\n    const intermediateTensorInfos: TensorInfo[] = [];\n    const expandedTensors =
inputs.map(t => {\n      const expandedT =\n        expandDims({ inputs: { input: t }, backend, attrs: { dim: axis } });\n      intermediateTensorInfos.push(expandedT);\n      return expandedT;\n    });\n\n    const result = concat({ inputs:
expandedTensors, backend, attrs: { axis } });\n\n    intermediateTensorInfos.forEach(t =>
backend.disposeData(t.dataId));\n\n    return result;\n  }\n\n  export const packConfig: KernelConfig = {\n    kernelName:
Pack,\n    backendName: 'wasm',\n    kernelFunc: pack as {} as KernelFunc\n  };\n}
}
```

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```
=====*\n
*/\n\nimport { KernelConfig, KernelFunc, Pack, PackAttrs, PackInputs, TensorInfo, util } from '@tensorflow/tfjs-
core';\nimport { BackendWasm } from '../backend_wasm';\nimport { concat } from './Concat';\nimport
{ expandDims } from './ExpandDims';\n\nexport function pack(\n  args: { inputs: PackInputs, backend:
BackendWasm, attrs: PackAttrs }):\n  TensorInfo {\n    const { inputs, backend, attrs } = args;\n    const { axis } =
attrs;\n\n    if (inputs.length === 1) {\n      return expandDims(\n        { inputs: { input: inputs[0] }, backend, attrs: { dim:
axis } });\n    }\n\n    const shape = inputs[0].shape;\n    const dtype = inputs[0].dtype;\n\n    inputs.forEach(t => {\n      util.assertShapesMatch(\n        shape, t.shape,\n        'All tensors passed to stack must
have matching shapes');\n      util.assert(\n        dtype === t.dtype,\n        () => 'All tensors passed to stack must have
matching dtypes');\n    });\n\n    const intermediateTensorInfos: TensorInfo[] = [];\n    const expandedTensors =
inputs.map(t => {\n      const expandedT =\n        expandDims({ inputs: { input: t }, backend, attrs: { dim: axis } });\n      intermediateTensorInfos.push(expandedT);\n      return expandedT;\n    });\n\n    const result = concat({ inputs:
expandedTensors, backend, attrs: { axis } });\n\n    intermediateTensorInfos.forEach(t =>
backend.disposeData(t.dataId));\n\n    return result;\n  }\n\n  export const packConfig: KernelConfig = {\n    kernelName:
Pack,\n    backendName: 'wasm',\n    kernelFunc: pack as {} as KernelFunc\n  };\n}
}
```

Found in path(s):

* /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/Pack.js.map

No license file was found, but licenses were detected in source scan.

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```
=====\n*\n\nimport {backend_util, KernelConfig, KernelFunc, MaxPool, MaxPoolAttrs, MaxPoolInputs, Tensor4D, util}  
from '@tensorflow/tfjs-core';\nimport {BackendWasm} from '../backend_wasm';\nlet wasmMaxPool: (\n  xId:  
number, batchSize: number, inputHeight: number, inputWidth: number,\n  filterHeight: number, filterWidth:  
number, padTop: number, padRight: number,\n  padBottom: number, padLeft: number, dilationHeight: number,\n  dilationWidth: number, strideHeight: number, strideWidth: number,\n  inputChannels: number, outputChannels:  
number, outId: number) => void;\nfunction setup(backend: BackendWasm) {\n  wasmMaxPool =  
backend.wasm.cwrap(MaxPool, null /* void */, [\n    'number', // xId\n    'number', // batchSize\n    'number', // inputHeight\n    'number', // inputWidth\n    'number',  
    // filterHeight\n    'number', // filterWidth\n    'number', // padTop\n    'number', // padRight\n    'number', // padBottom\n    'number', // padLeft\n    'number', // dilationHeight\n    'number', // dilationWidth\n    'number', // strideHeight\n    'number', // strideWidth\n    'number', // inputChannels\n    'number', // outputChannels\n  ]
```

```
'number', // outId\n ]);\n\nfunction maxPool(\n  args: {inputs: MaxPoolInputs, backend: BackendWasm, attrs:
MaxPoolAttrs}) {\n  const {inputs, attrs, backend} = args;\n\n  const x = inputs.x as Tensor4D;\n  const xId =
backend.dataIdMap.get(x.dataId).id;\n\n  // TF API supports int32 input. CPU and WebGL backend also support
int32\n  // input. WASM backend doesn't support it because it uses xnnpack which only\n  // supports float32.\n  // Add the following assert only for the WASM backend instead of at core op\n  // level.\n  // TODO: add
support for int32 input.\n  util.assert(\n    x.dtype === 'float32',\n
    () =>\n      `Error in MaxPool: only float32 input is supported. Got ${x.dtype}.`,\n\n    const {filterSize,
strides, pad, dimRoundingMode} = attrs;\n    const convInfo = backend_util.computePool2DInfo(\n      x.shape,
filterSize, strides, 1 /* dilations */, pad, dimRoundingMode);\n\n    const filterHeight = convInfo.filterHeight;\n    const
filterWidth = convInfo.filterWidth;\n    const padTop = convInfo.padInfo.top;\n    const padRight =
convInfo.padInfo.right;\n    const padBottom = convInfo.padInfo.bottom;\n    const padLeft = convInfo.padInfo.left;\n
const dilationHeight = convInfo.dilationHeight;\n    const dilationWidth = convInfo.dilationWidth;\n    const
strideHeight = convInfo.strideHeight;\n    const strideWidth = convInfo.strideWidth;\n    const inputChannels =
convInfo.inChannels;\n    const outputChannels = convInfo.outChannels;\n\n    if (convInfo.dataFormat !==
'channelsLast') {\n      throw new Error(\n        `wasm backend does not support dataFormat:~` +\n
`${convInfo.dataFormat}`.\n      Please use 'channelsLast'.`);\n    }\n\n    const out = backend.makeOutput(convInfo.outShape, 'float32');\n    const outId
= backend.dataIdMap.get(out.dataId).id;\n\n    wasmMaxPool(\n      xId, x.shape[0], x.shape[1], x.shape[2],
filterHeight, filterWidth,\n      padTop, padRight, padBottom, padLeft, dilationHeight, dilationWidth,\n
strideHeight, strideWidth, inputChannels, outputChannels, outId);\n    return out;\n  })\n\n  export const maxPoolConfig:
KernelConfig = {\n    kernelName: MaxPool,\n    backendName: 'wasm',\n    setupFunc: setup,\n    kernelFunc: maxPool
as {} as KernelFunc\n  };\n}]]
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Found in path(s):

* /tfjs-backend-wasm-zip/tfjs-backend-wasm/dist/kernels/MaxPool.js.map

No license file was found, but licenses were detected in source scan.

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=====\n */\n

We explicitly import the modular kernels so they get registered in the\n// global registry when we compile the library. A modular build would replace\n// the contents of this file and import only the kernels that are needed.\nimport {KernelConfig, registerKernel} from '@tensorflow/tfjs-core';\nimport {fusedMatMulConfig} from './kernels/_FusedMatMul';\nimport {absConfig} from './kernels/Abs';\nimport {addConfig} from './kernels/Add';\nimport {addNConfig} from './kernels/AddN';\nimport {allConfig} from './kernels/All';\nimport {anyConfig} from './kernels/Any';\nimport {argMaxConfig} from './kernels/ArgMax';\nimport {avgPoolConfig} from './kernels/AvgPool';\nimport {batchMatMulConfig} from './kernels/BatchMatMul';\nimport {batchToSpaceNDConfig} from './kernels/BatchToSpaceND';\nimport {castConfig} from './kernels/Cast';\nimport {ceilConfig} from './kernels/Ceil';\nimport {clipByValueConfig} from './kernels/ClipByValue';\nimport {concatConfig} from './kernels/Concat';\nimport {conv2DConfig} from './kernels/Conv2D';\nimport {conv2DBackpropInputConfig} from './kernels/Conv2DBackpropInput';\nimport {cosConfig} from './kernels/Cos';\nimport {coshConfig} from './kernels/Cosh';\nimport {cropAndResizeConfig} from './kernels/CropAndResize';\nimport {cumsumConfig} from './kernels/Cumsum';\nimport {depthToSpaceConfig} from './kernels/DepthToSpace';\nimport {depthwiseConv2dNativeConfig} from './kernels/DepthwiseConv2dNative';\nimport {eluConfig} from './kernels/Elu';\nimport {equalConfig} from './kernels/Equal';\nimport {expConfig} from './kernels/Exp';\nimport {expandDimsConfig} from './kernels/ExpandDims';\nimport {fillConfig} from './kernels/Fill';\nimport {flipLeftRightConfig} from './kernels/FlipLeftRight';\nimport {floorConfig} from './kernels/Floor';\nimport {floorDivConfig} from './kernels/FloorDiv';\nimport {fusedBatchNormConfig} from './kernels/FusedBatchNorm';\nimport {fusedConv2DConfig} from './kernels/FusedConv2D';\nimport {fusedDepthwiseConv2DConfig} from './kernels/FusedDepthwiseConv2D';\nimport {gatherNdConfig} from './kernels/GatherNd';\nimport {gatherV2Config} from './kernels/GatherV2';\nimport {greaterConfig} from './kernels/Greater';\nimport {greaterEqualConfig} from './kernels/GreaterEqual';\nimport {identityConfig} from './kernels/Identity';\nimport {leakyReluConfig} from './kernels/LeakyRelu';\nimport {lessConfig} from './kernels/Less';\nimport {lessEqualConfig} from './kernels/LessEqual';\nimport {logConfig} from './kernels/Log';\nimport {logicalAndConfig} from './kernels/LogicalAnd';\nimport {maxConfig} from './kernels/Max';\nimport {maximumConfig} from './kernels/Maximum';\nimport {maxPoolConfig} from './kernels/MaxPool';\nimport {meanConfig} from './kernels/Mean';\nimport {minConfig} from './kernels/Min';\nimport {minimumConfig} from './kernels/Minimum';\nimport {mirrorPadConfig} from './kernels/MirrorPad';\nimport {multiplyConfig} from './kernels/Multiply';\nimport {negConfig} from './kernels/Neg';\nimport {nonMaxSuppressionV3Config} from './kernels/NonMaxSuppressionV3';\nimport {nonMaxSuppressionV4Config} from './kernels/NonMaxSuppressionV4';\nimport {nonMaxSuppressionV5Config} from './kernels/NonMaxSuppressionV5';\nimport {notEqualConfig} from './kernels/NotEqual';\nimport {oneHotConfig} from './kernels/OneHot';\nimport {onesLikeConfig} from './kernels/OnesLike';\nimport {packConfig} from './kernels/Pack';\nimport {padV2Config} from './kernels/PadV2';\nimport {powConfig} from './kernels/Pow';\nimport {preluConfig} from './kernels/Prelu';\nimport {prodConfig} from './kernels/Prod';\nimport {rangeConfig} from './kernels/Range';\nimport {realDivConfig} from './kernels/RealDiv';\nimport

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=====\n\n*\n\nimport {backend_util, DepthwiseConv2dNative, DepthwiseConv2dNativeAttrs,
DepthwiseConv2dNativeInputs, KernelConfig, KernelFunc, Tensor4D} from '@tensorflow/tfjs-core';\n\nimport
{BackendWasm} from '../backend_wasm';\n\nlet wasmDepthwiseConv2d: (\n xId: number, batchSize: number,
inputHeight: number, inputWidth: number,\n filterId: number, filterHeight: number, filterWidth: number, padTop:
number,\n padRight: number, padBottom: number, padLeft: number, isSamePad: number,\n dilationHeight:
number, dilationWidth: number, strideHeight: number,\n strideWidth: number, inputChannels: number,
outputChannels:
number,\n outId: number) => void;\n\nfunction setup(backend: BackendWasm) {\n wasmDepthwiseConv2d =\n backend.wasm.cwrap(DepthwiseConv2dNative, null /* void */, [\n 'number', // xId\n 'number', //
batchSize\n 'number', // inputHeight\n 'number', // inputWidth\n 'number', // filterId\n 'number', //
filterHeight\n 'number', // filterWidth\n 'number', // padTop\n 'number', // padRight\n 'number', //
padBottom\n 'number', // padLeft\n 'number', // isSamePad\n 'number', // dilationHeight\n 'number', // dilationWidth\n 'number', // strideHeight\n 'number', // strideWidth\n 'number', //
inputChannels\n 'number', // outputChannels\n 'number', // outId\n]);\n\n function
depthwiseConv2d(args: {\n inputs: DepthwiseConv2dNativeInputs,\n backend: BackendWasm,\n attrs:
DepthwiseConv2dNativeAttrs\n }) {\n const {inputs, attrs,

```

    backend} = args;\n\n    const {x, filter} = inputs;\n    const xId = backend.dataIdMap.get(x.dataId).id;\n    const filterId = backend.dataIdMap.get(filter.dataId).id;\n\n    const {strides, dilations, pad, dimRoundingMode} = attrs;\n\n    const $dilations = dilations === null ? [1, 1] : dilations;\n\n    const convInfo = backend_util.computeConv2DInfo(\n      (x as Tensor4D).shape, (filter as Tensor4D).shape, strides,\n      ($dilations as number | [number, number]), pad,\n      dimRoundingMode,\n      true /* depthwise */);\n\n    const filterHeight = convInfo.filterHeight;\n    const filterWidth = convInfo.filterWidth;\n    const padTop = convInfo.padInfo.top;\n    const padRight = convInfo.padInfo.right;\n    const padBottom = convInfo.padInfo.bottom;\n    const padLeft = convInfo.padInfo.left;\n    const dilationHeight = convInfo.dilationHeight;\n    const dilationWidth = convInfo.dilationWidth;\n    const strideHeight = convInfo.strideHeight;\n    const strideWidth = convInfo.strideWidth;\n    const inputChannels = convInfo.inChannels;\n    const outputChannels = convInfo.outChannels;\n    const isSamePad = convInfo.padInfo.type === 'SAME' ? 1 : 0;\n\n    if (convInfo.dataFormat !== 'channelsLast') {\n      throw new Error(\n        `wasm backend DepthwiseConv2dNative does not support dataFormat: "${convInfo.dataFormat}". Please use 'channelsLast'.`);\n    }\n\n    const out = backend.makeOutput(convInfo.outShape, 'float32');\n    const outId = backend.dataIdMap.get(out.dataId).id;\n\n    wasmDepthwiseConv2d(\n      xId, x.shape[0], x.shape[1], x.shape[2], filterId, filterHeight,\n      filterWidth, padTop, padRight, padBottom, padLeft, isSamePad,\n      dilationHeight, dilationWidth, strideHeight, strideWidth,\n      inputChannels, outputChannels, outId);\n    return out;\n  }\n\n  export const depthwiseConv2dNativeConfig: KernelConfig = {\n    kernelName: 'DepthwiseConv2dNative',\n    backendName: 'wasm',\n    setupFunc: setup,\n    kernelFunc: depthwiseConv2d as { } as KernelFunc\n  };

```

Found in path(s):

* /tfjs-backend-wasm/tfjs-backend-wasm/dist/kernels/DepthwiseConv2dNative.js.map

1.315 @tensorflow/tfjs-backend-webgl 3.11.0

1.315.1 Available under license :

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1.316 @tensorflow/tfjs-backend-cpu 3.11.0

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*

=====

1.317 @tensorflow-models/body-pix 2.2

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*

=====

*/

Found in path(s):

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* /tensorflow-models-zip/@tensorflow-models/body-pix/dist/util_test.d.ts

* /tensorflow-models-zip/@tensorflow-models/body-pix/dist/body_pix_test.d.ts

*

```
/tensorflow-models-zip/@tensorflow-models/body-pix/dist/single_person/argmax2d_test.js
* /tensorflow-models-zip/@tensorflow-models/body-pix/dist/body_pix_test.js
* /tensorflow-models-zip/@tensorflow-models/body-pix/dist/single_person/argmax2d_test.d.ts
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 */
```

Found in path(s):

```
* /tensorflow-models-zip/@tensorflow-models/body-pix/dist/keypoints.d.ts
* /tensorflow-models-zip/@tensorflow-models/body-pix/dist/multi_person/decode_pose.d.ts
* /tensorflow-models-zip/@tensorflow-models/body-pix/dist/version_test.js
*
/tensorflow-models-zip/@tensorflow-models/body-pix/dist/blur.js
* /tensorflow-models-zip/@tensorflow-models/body-pix/dist/decode_part_map.d.ts
* /tensorflow-models-zip/@tensorflow-models/body-pix/dist/multi_person/util.d.ts
* /tensorflow-models-zip/@tensorflow-models/body-pix/dist/setup_test.js
* /tensorflow-models-zip/@tensorflow-models/body-pix/dist/version_test.d.ts
* /tensorflow-models-zip/@tensorflow-models/body-pix/dist/multi_person/util.js
* /tensorflow-models-zip/@tensorflow-models/body-pix/dist/single_person/decode_single_pose.d.ts
* /tensorflow-models-zip/@tensorflow-models/body-pix/dist/multi_person/build_part_with_score_queue.d.ts
* /tensorflow-models-zip/@tensorflow-models/body-pix/dist/setup_test.d.ts
* /tensorflow-models-zip/@tensorflow-models/body-pix/dist/single_person/argmax2d.js
* /tensorflow-models-zip/@tensorflow-models/body-pix/dist/single_person/util.js
* /tensorflow-models-zip/@tensorflow-models/body-pix/dist/output_rendering_util.js
*
/tensorflow-models-zip/@tensorflow-models/body-pix/dist/single_person/util.d.ts
* /tensorflow-models-zip/@tensorflow-models/body-pix/dist/single_person/argmax2d.d.ts
* /tensorflow-models-zip/@tensorflow-models/body-pix/dist/output_rendering_util.d.ts
* /tensorflow-models-zip/@tensorflow-models/body-pix/dist/multi_person/build_part_with_score_queue.js
* /tensorflow-models-zip/@tensorflow-models/body-pix/dist/multi_person/decode_pose.js
* /tensorflow-models-zip/@tensorflow-models/body-pix/dist/blur.d.ts
* /tensorflow-models-zip/@tensorflow-models/body-pix/dist/keypoints.js
* /tensorflow-models-zip/@tensorflow-models/body-pix/dist/decode_part_map.js
```

```
* /tensorflow-models-zip/@tensorflow-models/body-pix/run_tests.ts
* /tensorflow-models-zip/@tensorflow-models/body-pix/dist/single_person/decode_single_pose.js
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Found in path(s):

```
* /tensorflow-models-zip/@tensorflow-models/body-pix/dist/saved_models.d.ts
* /tensorflow-models-zip/@tensorflow-models/body-pix/dist/saved_models.js
* /tensorflow-models-zip/@tensorflow-models/body-pix/dist/index.d.ts
*
* /tensorflow-models-zip/@tensorflow-models/body-pix/dist/resnet.d.ts
* /tensorflow-models-zip/@tensorflow-models/body-pix/dist/index.js
* /tensorflow-models-zip/@tensorflow-models/body-pix/dist/resnet.js
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```
{ "version":3,"file":"body-
pix.esm.js","sources":["../src/decode_part_map.ts","../src/base_model.ts","../src/mobilenet.ts","../src/keypoints.ts","..
../src/multi_person/util.ts","../src/multi_person/decode_multiple_masks_cpu.ts","../src/multi_person/decode_multiple
_masks_webgl.ts","../src/multi_person/decode_instance_masks.ts","../src/multi_person/max_heap.ts","../src/multi_p
erson/build_part_with_score_queue.ts","../src/multi_person/decode_pose.ts","../src/multi_person/decode_multiple_p
oses.ts","../src/resnet.ts","../src/saved_models.ts","../src/util.ts","../src/body_pix_model.ts","../src/blur.ts","../src/outp
ut_rendering_util.ts","../src/part_channels.ts","../src/version.ts"],"sourcesContent":["/**\n * @license\n * Copyright
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=====
\n
*\n\nimport * as tf from '@tensorflow/tfjs-core';\n\n/**\n * Takes the sigmoid of the part heatmap output and
generates a 2d one-hot\n * tensor with ones where the part's score has the maximum value.\n *\n * @param
```

```

partHeatmapScores\n *\nfunction toFlattenedOneHotPartMap(partHeatmapScores: tf.Tensor3D): tf.Tensor2D {\n
const numParts = partHeatmapScores.shape[2];\n const partMapLocations = tf.argmax(partHeatmapScores, 2);\n
const partMapFlattened = tf.reshape(partMapLocations, [-1]);\n\n return tf.oneHot(partMapFlattened,\n
numParts) as tf.Tensor2D;\n}\n\nfunction clipByMask2d(image: tf.Tensor2D, mask: tf.Tensor2D): tf.Tensor2D {\n
return tf.mul(image, mask);\n}\n\n**\n * Takes the sigmoid of the segmentation output, and generates a\n
segmentation\n * mask with a 1 or 0 at each pixel where there is a person or not a person. The\n * segmentation\n
threshold determines the threshold of a score for a pixel for it\n * to be considered part of a person.\n * @param\n
segmentScores A 3d-tensor of the sigmoid of the segmentation output.\n * @param segmentationThreshold The\n
minimum that segmentation values must have\n * to be considered part of the person. Affects the generation of\n
the\n * segmentation mask and the clipping of the colored part image.\n * \n * @returns A segmentation mask with a\n
1 or 0 at each pixel where there is a\n * person or not a person.\n */\n\nexport function toMaskTensor(\n
segmentScores: tf.Tensor2D, threshold: number): tf.Tensor2D {\n return tf.tidy(\n    () =>\n
(tf.cast(tf.greater(\n        segmentScores, tf.scalar(threshold)), 'int32') as tf.Tensor2D));\n}\n\n**\n *
Takes the sigmoid of the person and part map output, and returns a 2d tensor\n * of an image with the corresponding\n
value at each pixel corresponding to the\n * part with the highest value. These part ids are clipped by the\n
segmentation\n * mask. Wherever the a pixel is clipped by the segmentation mask, its value\n * will set to -1,\n
indicating that there is no part in that pixel.\n * @param segmentScores A 3d-tensor of the sigmoid of the\n
segmentation output.\n * @param partHeatmapScores A 3d-tensor of the sigmoid of the part heatmap\n * output.\n
The third dimension corresponds to the part.\n * \n * @returns A 2d tensor of an image with the corresponding value\n
at each pixel\n * corresponding to the part with the highest value. These part ids are clipped\n * by the segmentation\n
mask. It will have values of -1 for pixels that are\n * outside of the body and do not have\n
a corresponding part.\n */\n\nexport function decodePartSegmentation(\n    segmentationMask: tf.Tensor2D,\n
partHeatmapScores: tf.Tensor3D): tf.Tensor2D {\n const [partMapHeight, partMapWidth, numParts] =\n
partHeatmapScores.shape;\n return tf.tidy(() => {\n    const flattenedMap =\n
toFlattenedOneHotPartMap(partHeatmapScores);\n    const partNumbers = tf.expandDims(tf.range(0, numParts, 1,\n
'int32'), 1);\n\n    const partMapFlattened =\n        tf.cast(tf.matmul(flattenedMap, partNumbers as tf.Tensor2D),\n
'int32');\n\n    const partMap = tf.reshape(partMapFlattened, [partMapHeight, partMapWidth]);\n\n    const\n
partMapShiftedUpForClipping = tf.add(partMap, tf.scalar(1, 'int32'));\n\n    return tf.sub(clipByMask2d(\n
partMapShiftedUpForClipping as tf.Tensor2D, segmentationMask)\n        , tf.scalar(1, 'int32'));\n    });\n}\n\nexport\n
function decodeOnlyPartSegmentation(partHeatmapScores: tf.Tensor3D):\n    tf.Tensor2D {\n const\n
[partMapHeight, partMapWidth, numParts] = partHeatmapScores.shape;\n
return tf.tidy(() => {\n    const flattenedMap = toFlattenedOneHotPartMap(partHeatmapScores);\n    const\n
partNumbers = tf.expandDims(tf.range(0, numParts, 1, 'int32'), 1);\n\n    const partMapFlattened =\n
tf.cast(tf.matmul(flattenedMap, partNumbers as tf.Tensor2D), 'int32');\n\n    return tf.reshape(partMapFlattened,\n
[partMapHeight, partMapWidth]);\n    });\n}\n\n**\n * @license\n * Copyright 2019 Google Inc. All Rights\n
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=====
\n
\n\nimport * as tfconv from '@tensorflow/tfjs-converter';\nimport * as tf from '@tensorflow/tfjs-core';\nimport\n
{BodyPixOutputStride} from './types';\n\n**\n * BodyPix supports using various convolution neural network\n
models\n * (e.g. ResNet and MobileNetV1) as its underlying base model.\n * The following BaseModel interface\n
defines a unified interface for\n * creating such BodyPix base models. Currently both MobileNet (in\n *
./mobilenet.ts) and ResNet (in ./resnet.ts) implements the BaseModel\n * interface. New base models that conform

```

```

to the BaseModel interface can be\n * added to BodyPix.\n */\n\nexport abstract class BaseModel {\n  constructor(\n    protected readonly model: tfconv.GraphModel,\n    public readonly outputStride: BodyPixOutputStride) {\n    const inputShape =\n      this.model.inputs[0].shape as [number, number, number, number];\n    tf.util.assert(\n      (inputShape[1] === -1) && (inputShape[2] === -1),\n      () => `Input shape [${inputShape[1]},\n      ${inputShape[2]}] ` +\n      `must both be equal to or -1`);\n  }\n\n  abstract preprocessInput(input: tf.Tensor3D):\n    tf.Tensor3D;\n\n  /**\n   * Predicts intermediate Tensor representations.\n   *\n   * @param input The input RGB\n   image of the base model.\n   * A Tensor of shape: [inputResolution, inputResolution, 3].\n   *\n   * @return A\n   dictionary of base model's intermediate predictions.\n   * The returned dictionary should contains the following\n   elements:\n   * - heatmapScores: A Tensor3D that represents the keypoint heatmap scores.\n   * - offsets: A\n   Tensor3D that represents the offsets.\n   * - displacementFwd: A Tensor3D that represents the forward\n   displacement.\n   * - displacementBwd: A Tensor3D that represents the backward displacement.\n   * -\n   segmentation: A Tensor3D that represents the segmentation of all\n   * people.\n   * - longOffsets: A Tensor3D\n   that represents the long offsets used for\n   * instance grouping.\n   * - partHeatmaps: A Tensor3D that represents\n   the body part segmentation.\n   */\n  predict(input: tf.Tensor3D): {\n    heatmapScores: tf.Tensor3D,\n    offsets:\n    tf.Tensor3D,\n    displacementFwd: tf.Tensor3D,\n    displacementBwd: tf.Tensor3D,\n    segmentation:\n    tf.Tensor3D,\n    partHeatmaps: tf.Tensor3D,\n    longOffsets: tf.Tensor3D,\n    partOffsets: tf.Tensor3D\n  } {\n    return tf.tidy(() => {\n      const asFloat = this.preprocessInput(tf.cast(input, 'float32'));\n      const asBatch =\n      tf.expandDims(asFloat, 0);\n      const results = this.model.predict(asBatch) as tf.Tensor4D[];\n      const results3d:\n      tf.Tensor3D[] = results.map(y => tf.squeeze(y, [0]));\n      const namedResults =\n      this.nameOutputResults(results3d);\n\n      return {\n        heatmapScores: tf.sigmoid(namedResults.heatmap),\n        offsets: namedResults.offsets,\n        displacementFwd: namedResults.displacementFwd,\n        displacementBwd:\n        namedResults.displacementBwd,\n        segmentation: namedResults.segmentation,\n        partHeatmaps:\n        namedResults.partHeatmaps,\n        longOffsets: namedResults.longOffsets,\n        partOffsets:\n        namedResults.partOffsets\n      };\n    });\n  }\n\n  // Because MobileNet and ResNet predict() methods output a\n  different order for\n  // these values, we have a method that needs to be implemented to order them.\n  abstract\n  nameOutputResults(results: tf.Tensor3D[]): {\n    heatmap: tf.Tensor3D,\n    offsets: tf.Tensor3D,\n    displacementFwd: tf.Tensor3D,\n    displacementBwd: tf.Tensor3D,\n    segmentation: tf.Tensor3D,\n    partHeatmaps: tf.Tensor3D,\n    longOffsets: tf.Tensor3D,\n    partOffsets: tf.Tensor3D\n  };\n\n  /**\n   * Releases\n   the CPU and GPU memory allocated by the model.\n   */\n  dispose() {\n    this.model.dispose();\n  }\n\n  /**\n   *\n   * @license\n   * Copyright 2019 Google Inc. All Rights Reserved.\n   * Licensed under the Apache License, Version 2.0\n   (the "License");\n   *\n   * you may not use this file except in compliance with the License.\n   * You may obtain a copy of the License at\n   *\n   * http://www.apache.org/licenses/LICENSE-2.0\n   *\n   * Unless required by applicable law or agreed to in\n   writing, software\n   * distributed under the License is distributed on an "AS IS" BASIS,\n   * WITHOUT\n   WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n   * See the License for the specific\n   language governing permissions and\n   * limitations under the License.\n   */\n\n  =====\n\n  *\n  *\n  import * as tf from '@tensorflow/tfjs-core';\n  import {BaseModel} from './base_model';\n\n  export class\n  MobileNet extends BaseModel {\n    preprocessInput(input: tf.Tensor3D): tf.Tensor3D {\n      // Normalize the pixels\n      [0, 255] to be between [-1, 1].\n      return tf.tidy(() => tf.sub(tf.div(input, 127.5), 1.0));\n    }\n\n    nameOutputResults(results: tf.Tensor3D[]) {\n      const [\n        offsets,\n        segmentation,\n        partHeatmaps,\n        longOffsets,\n        heatmap,\n        displacementFwd,\n        displacementBwd,\n        partOffsets,\n      ] = results;\n      return {\n        offsets,\n        segmentation,\n        partHeatmaps,\n        longOffsets,\n        heatmap,\n        displacementFwd,\n        displacementBwd,\n        partOffsets\n      };\n    }\n  }\n\n  /**\n   *\n   * @license\n   * Copyright 2019 Google LLC. All Rights Reserved.\n   * Licensed under the Apache License, Version 2.0 (the\n   "License");\n   *\n   * you may not use this file except in compliance with the License.\n   * You may obtain a copy of the\n   License at\n   *\n   * http://www.apache.org/licenses/LICENSE-2.0\n   *\n   * Unless required by applicable law or\n   agreed to in writing, software\n   * distributed under the License is distributed on an "AS IS" BASIS,\n   */

```


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```
=====
*/\n\nexport type Tuple<T> = [T, T];\nexport type StringTuple = Tuple<string>;\nexport type NumberTuple = Tuple<number>;\n\nexport const PART_NAMES = [\n  'nose', 'leftEye', 'rightEye', 'leftEar', 'rightEar',\n  'leftShoulder',\n  'rightShoulder', 'leftElbow', 'rightElbow', 'leftWrist', 'rightWrist',\n  'leftHip', 'rightHip', 'leftKnee', 'rightKnee', 'leftAnkle', 'rightAnkle'\n];\n\nexport const NUM_KEYPOINTS = PART_NAMES.length;\n\nexport interface NumberDict {\n  [jointName: string]: number;\n}\n\nexport const PART_IDS =\n  PART_NAMES.reduce((result: NumberDict, jointName, i): NumberDict => {\n    result[jointName] = i;\n    return result;\n  }, {});\n\nconst CONNECTED_PART_NAMES: StringTuple[] = [\n  ['leftHip', 'leftShoulder'],\n  ['leftElbow', 'leftShoulder'],\n  ['leftElbow', 'leftWrist'],\n  ['leftHip', 'leftKnee'],\n  ['leftKnee', 'leftAnkle'],\n  ['rightHip', 'rightShoulder'],\n  ['rightElbow', 'rightShoulder'],\n  ['rightElbow', 'rightWrist'],\n  ['rightHip', 'rightKnee'],\n  ['rightKnee', 'rightAnkle'],\n  ['leftShoulder', 'rightShoulder'],\n  ['leftHip', 'rightHip']\n];\n\n/*\n * Define the skeleton. This defines the parent->child relationships of our\n * tree. Arbitrarily this defines the nose as the root of the tree, however\n * since we will infer the displacement for both parent->child and\n * child->parent, we can define the tree root as any node.\n */\n\nexport const POSE_CHAIN: StringTuple[] =\n  [\n    'nose', 'leftEye', 'leftEye', 'leftEar', 'nose', 'rightEye',\n    'rightEye', 'rightEar', 'nose', 'leftShoulder',\n    'leftShoulder', 'leftElbow', 'leftElbow', 'leftWrist',\n    'leftShoulder', 'leftHip', 'leftHip', 'leftKnee',\n    'leftKnee', 'leftAnkle', 'nose', 'rightShoulder',\n    'rightShoulder', 'rightElbow', 'rightElbow', 'rightWrist',\n    'rightShoulder', 'rightHip', 'rightHip', 'rightKnee',\n    'rightKnee', 'rightAnkle'\n];\n\nexport const\n  CONNECTED_PART_INDICES = CONNECTED_PART_NAMES.map(\n    ([jointNameA, jointNameB]) =>\n      ([PART_IDS[jointNameA], PART_IDS[jointNameB]]);\n  );\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an\n * "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n
```

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=====
*/\n\nimport {NUM_KEYPOINTS} from '../keypoints';\nimport {Padding, Part, TensorBuffer3D, Vector2D} from\n  '../types';\n\nexport function getScale(\n  [height, width]: [number, number],\n  [inputResolutionY, inputResolutionX]: [number, number],\n  padding: Padding): [number, number] {\n  const {top: padT, bottom: padB, left: padL, right: padR} = padding;\n  const scaleY = inputResolutionY / (padT + padB + height);\n  const scaleX = inputResolutionX / (padL + padR + width);\n  return [scaleX, scaleY];\n}\n\nexport function getOffsetPoint(\n  y: number, x: number, keypoint: number, offsets:\n  TensorBuffer3D): Vector2D {\n  return {\n    y: offsets.get(y, x, keypoint),\n    x: offsets.get(y, x, keypoint + NUM_KEYPOINTS)\n  };\n}\n\nexport function getImageCoords(\n  part: Part, outputStride: number, offsets:\n  TensorBuffer3D): Vector2D {\n  const {heatmapY, heatmapX, id: keypoint} = part;\n  const {y, x} =\n    getOffsetPoint(heatmapY, heatmapX, keypoint, offsets);\n  return {\n    x: part.heatmapX * outputStride + x,\n    y: part.heatmapY * outputStride + y\n  };\n}\n\nexport function fillArray<T>(element: T, size: number): T[] {\n  const result: T[] = new Array(size);\n  for (let i = 0; i < size; i++) {\n    result[i] = element;\n  }\n  return result;\n}\n\nexport function clamp(a: number, min: number, max: number): number {\n  if (a < min) {\n    return min;\n  }\n  if (a > max) {\n    return max;\n  }\n  return a;\n}\n\nexport function squaredDistance(\n  y1: number, x1: number, y2: number, x2: number): number {\n  const dy = y2 - y1;\n  const dx = x2 - x1;\n  return dy * dy + dx * dx;\n}\n\nexport function addVectors(a: Vector2D, b: Vector2D): Vector2D {\n  return {x: a.x + b.x, y: a.y + b.y};\n}\n\nexport function clampVector(a: Vector2D, min: number, max: number): Vector2D {\n  return {y: clamp(a.y, min, max), x: clamp(a.x, min, max)};\n}\n\n"/**\n * @license\n * Copyright 2019 Google Inc. All Rights Reserved.\n * Licensed under the\n
```

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```
=====
*
import {NUM_KEYPOINTS} from '../keypoints';
import {Padding, Pose} from '../types';
import {getScale} from '../util';
interface Pair {
  x: number;
  y: number;
}
function computeDistance(embedding: Pair[], pose: Pose, minPartScore = 0.3) {
  let distance = 0.0;
  let numKpt = 0;
  for (let p = 0; p < embedding.length; p++) {
    if (pose.keypoints[p].score > minPartScore) {
      numKpt += 1;
      distance += (embedding[p].x - pose.keypoints[p].position.x) ** 2 + (embedding[p].y - pose.keypoints[p].position.y) ** 2;
    }
  }
  if (numKpt === 0) {
    distance = Infinity;
  } else {
    distance = distance / numKpt;
  }
  return distance;
}
function convertToPositionInOutput(position: Pair, [padT, padL]: [number, number], [scaleX, scaleY]: [number, number], stride: number): Pair {
  const y = Math.round(((padT + position.y + 1.0) * scaleY - 1.0) / stride);
  const x = Math.round(((padL + position.x + 1.0) * scaleX - 1.0) / stride);
  return {x, y};
}
function getEmbedding(location: Pair, keypointIndex: number, convertToPosition: (pair: Pair) => Pair, outputResolutionX: number, longOffsets: Float32Array, refineSteps: number, [height, width]: [number, number]): Pair {
  const newLocation = convertToPosition(location);
  const nn = newLocation.y * outputResolutionX + newLocation.x;
  let dy = longOffsets[NUM_KEYPOINTS * (2 * nn) + keypointIndex];
  let dx = longOffsets[NUM_KEYPOINTS * (2 * nn + 1) + keypointIndex];
  let y = location.y + dy;
  let x = location.x + dx;
  for (let t = 0; t < refineSteps; t++) {
    y = Math.min(y, height - 1);
    x = Math.min(x, width - 1);
    const newPos = convertToPosition({x, y});
    const nn = newPos.y * outputResolutionX + newPos.x;
    dy = longOffsets[NUM_KEYPOINTS * (2 * nn) + keypointIndex];
    dx = longOffsets[NUM_KEYPOINTS * (2 * nn + 1) + keypointIndex];
    y = y + dy;
    x = x + dx;
  }
  return {x, y};
}
function matchEmbeddingToInstance(location: Pair, longOffsets: Float32Array, poses: Pose[], numKptForMatching: number, [padT, padL]: [number, number], [scaleX, scaleY]: [number, number], outputResolutionX: number, [height, width]: [number, number], stride: number, refineSteps: number): number {
  const embed: Pair[] = [];
  const convertToPosition = (pair: Pair) => convertToPositionInOutput(pair, [padT, padL], [scaleX, scaleY], stride);
  for (let keypointsIndex = 0; keypointsIndex < numKptForMatching; keypointsIndex++) {
    const embedding = getEmbedding(location, keypointsIndex, convertToPosition, outputResolutionX, longOffsets, refineSteps, [height, width]);
    embed.push(embedding);
  }
  let kMin = -1;
  let kMinDist = Infinity;
  for (let k = 0; k < poses.length; k++) {
    const dist = computeDistance(embed, poses[k]);
    if (dist < kMinDist) {
      kMin = k;
      kMinDist = dist;
    }
  }
  return kMin;
}
function getOutputResolution([inputResolutionY, inputResolutionX]: [number, number], stride: number): [number, number] {
  const outputResolutionX = Math.round((inputResolutionX - 1.0) / stride + 1.0);
  const outputResolutionY = Math.round((inputResolutionY - 1.0) / stride + 1.0);
  return [outputResolutionX, outputResolutionY];
}
export function decodeMultipleMasksCPU(segmentation: Uint8Array, longOffsets: Float32Array, posesAboveScore: Pose[], height: number, width: number, stride: number, [inHeight, inWidth]: [number, number], padding: Padding, refineSteps: number, numKptForMatching = 5): Uint8Array[] {
  const dataArray = posesAboveScore.map(x => new Uint8Array(height * width).fill(0));
  const {top: padT, left: padL} = padding;
  const [scaleX, scaleY] = getScale([height, width], [inHeight, inWidth], padding);
  const [outputResolutionX, ] = getOutputResolution([inHeight, inWidth], stride);
  for (let i = 0; i < height; i += 1) {
    for (let j = 0; j < width; j += 1) {
      const n = i * width + j;
      const prob = segmentation[n];
      if (prob === 1) {
        const kMin = matchEmbeddingToInstance({x: j, y: i}, longOffsets, posesAboveScore, numKptForMatching, [padT, padL], [scaleX, scaleY], outputResolutionX, [height, width], stride,
```

```

refineSteps);\n    if (kMin >= 0) {\n        dataArrays[kMin][n] = 1;\n    }\n    }\n    }\n    }\n    return
dataArrays;\n}\n\nexport function decodeMultiplePartMasksCPU(\n
    segmentation: Uint8Array, longOffsets: Float32Array,\n    partSegmentaion: Uint8Array, posesAboveScore:
Pose[], height: number,\n    width: number, stride: number, [inHeight, inWidth]: [number, number],\n    padding:
Padding, refineSteps: number,\n    numKptForMatching = 5): Int32Array[] {\n    const dataArrays =\n    posesAboveScore.map(x => new Int32Array(height * width).fill(-1));\n    const {top: padT, left: padL} =
padding;\n    const [scaleX, scaleY] =\n        getScale([height, width], [inHeight, inWidth], padding);\n    const
[outputResolutionX, ] =\n        getOutputResolution([inHeight, inWidth], stride);\n    for (let i = 0; i < height; i += 1)
{\n        for (let j = 0; j < width; j += 1) {\n            const n = i * width + j;\n            const prob = segmentation[n];\n            if (prob
=== 1) {\n                const kMin = matchEmbeddingToInstance(\n                    {x: j, y: i}, longOffsets, posesAboveScore,
numKptForMatching,\n                    [padT, padL], [scaleX, scaleY], outputResolutionX, [height,
width],\n                    stride, refineSteps);\n                if (kMin >= 0) {\n                    dataArrays[kMin][n] = partSegmentaion[n];\n
                }\n            }\n        }\n    }\n    return dataArrays;\n}\n\n"/**\n * @license\n * Copyright 2019 Google Inc. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file
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http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
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=====
*\n\nimport * as tf from '@tensorflow/tfjs-core';\nimport * as tf_webgl from '@tensorflow/tfjs-backend-
webgl';\n\nimport
{NUM_KEYPOINTS} from '../keypoints';\nimport {Padding, Pose} from '../types';\nimport {getScale} from
'/util';\n\nexport function decodeMultipleMasksWebGL(\n    segmentation: tf.Tensor2D, longOffsets: tf.Tensor3D,\n    posesAboveScore: Pose[], height: number, width: number, stride: number,\n    [inHeight, inWidth]: [number,
number], padding: Padding,\n    refineSteps: number, minKptScore: number,\n    maxNumPeople: number):
tf.TensorInfo {\n    // The height/width of the image/canvas itself.\n    const [origHeight, origWidth] =
segmentation.shape;\n    // The height/width of the output of the model.\n    const [outHeight, outWidth] =
longOffsets.shape.slice(0, 2);\n    const shapedLongOffsets: tf.Tensor4D =\n        tf.reshape(longOffsets, [outHeight,
outWidth, 2, NUM_KEYPOINTS]);\n    // Make pose tensor of shape [MAX_NUM_PEOPLE,
NUM_KEYPOINTS, 3] where\n    // the last 3 coordinates correspond to the score, h and w coordinate of that\n    //
keypoint.\n    const poseVals
= new Float32Array(maxNumPeople * NUM_KEYPOINTS * 3).fill(0.0);\n    for (let i = 0; i <
posesAboveScore.length; i++) {\n        const poseOffset = i * NUM_KEYPOINTS * 3;\n        const pose =
posesAboveScore[i];\n        for (let kp = 0; kp < NUM_KEYPOINTS; kp++) {\n            const keypoint =
pose.keypoints[kp];\n            const offset = poseOffset + kp * 3;\n            poseVals[offset] = keypoint.score;\n
            poseVals[offset + 1] = keypoint.position.y;\n            poseVals[offset + 2] = keypoint.position.x;\n        }\n    }\n    const
[scaleX, scaleY] =\n        getScale([height, width], [inHeight, inWidth], padding);\n    const posesTensor =
tf.tensor(poseVals, [maxNumPeople, NUM_KEYPOINTS, 3]);\n    const {top: padT, left: padL} = padding;\n    const
program: tf_webgl.GPGPUProgram = {\n        variableNames: ['segmentation', 'longOffsets', 'poses'],\n        outputShape: [origHeight, origWidth],\n        userCode: `\n            int convertToPositionInOut(int pos, int pad, float
scale, int stride) {\n                return round(((float(pos +
pad) + 1.0) * scale - 1.0) / float(stride));\n            }\n\n            float convertToPositionInOutFloat(\n                int pos, int pad,
float scale, int stride) {\n                return ((float(pos + pad) + 1.0) * scale - 1.0) / float(stride);\n            }\n\n            float dist(float
x1, float y1, float x2, float y2) {\n                return pow(x1 - x2, 2.0) + pow(y1 - y2, 2.0);\n            }\n\n            float
sampleLongOffsets(float h, float w, int d, int k) {\n                float fh = fract(h);\n                float fw = fract(w);\n                int clH =
int(ceil(h));\n                int clW = int(ceil(w));\n                int flH = int(floor(h));\n                int flW = int(floor(w));\n                float o11 =
getLongOffsets(flH, flW, d, k);\n                float o12 = getLongOffsets(flH, clW, d, k);\n                float o21 =

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getLongOffsets(cIH, fIW, d, k);
float o22 = getLongOffsets(cIH, cIW, d, k);
float o1 = mix(o11, o12, fw);
float o2 = mix(o21, o22, fw);
return mix(o1, o2, fh);
}

int findNearestPose(int h, int w) {
    float prob = getSegmentation(h, w);

    if (prob < 1.0) {
        return -1;
    }

    // Done(Tyler): convert from output space h/w to strided space.
    float stridedH = convertToPositionInOutFloat(h, padT, scaleY, stride);
    float stridedW = convertToPositionInOutFloat(w, padL, scaleX, stride);
    float minDist = 1000000.0;
    int iMin = -1;
    for (int i = 0; i < maxNumPeople; i++) {
        float curDistSum = 0.0;
        int numKpt = 0;
        for (int k = 0; k < NUM_KEYPOINTS; k++) {
            float dy = sampleLongOffsets(stridedH, stridedW, 0, k);
            float dx = sampleLongOffsets(stridedH, stridedW, 1, k);
            float y = float(h) + dy;
            float x = float(w) + dx;
            for (int s = 0; s < refineSteps; s++) {
                int yRounded = round(min(y, float(height - 1.0)));
                int xRounded = round(min(x, float(width - 1.0)));
                float yStrided = convertToPositionInOutFloat(yRounded, padT, scaleY, stride);
                float xStrided = convertToPositionInOutFloat(xRounded, padL, scaleX, stride);
                float dy = sampleLongOffsets(yStrided, xStrided, 0, k);
                float dx = sampleLongOffsets(yStrided, xStrided, 1, k);
                y = y + dy;
                x = x + dx;
            }
            float poseScore = getPoses(i, k, 0);
            float poseY = getPoses(i, k, 1);
            float poseX = getPoses(i, k, 2);
            if (poseScore > minKptScore) {
                numKpt = numKpt + 1;
                curDistSum = curDistSum + dist(x, y, poseX, poseY);
            }
            if (numKpt > 0 && curDistSum / float(numKpt) < minDist) {
                minDist = curDistSum / float(numKpt);
                iMin = i;
            }
        }
        return iMin;
    }

    void main() {
        ivec2 coords = getOutputCoords();
        int nearestPose = findNearestPose(coords[0], coords[1]);

        setOutput(float(nearestPose));
    }

    const webglBackend = tf.backend() as tf_webgl.MathBackendWebGL;
    return webglBackend.compileAndRun(program, [segmentation, shapedLongOffsets, posesTensor]);
}

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 * software distributed under the License is distributed on an "AS IS" BASIS,
 * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.
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 * limitations under the License.
 */

import * as tf from '@tensorflow/tfjs-core';
import {getBackend} from '@tensorflow/tfjs-core';
import {Padding, PartSegmentation, PersonSegmentation, Pose} from './types';
import {decodeMultipleMasksCPU, decodeMultiplePartMasksCPU} from './decode_multiple_masks_cpu';
import {decodeMultipleMasksWebGl} from './decode_multiple_masks_webgl';

export function toPersonKSegmentation(segmentation: tf.Tensor2D, k: number): tf.Tensor2D {
    return tf.tidy(() => (tf.cast(tf.equal(segmentation, tf.scalar(k)), 'int32') as tf.Tensor2D));
}

export function toPersonKPartSegmentation(segmentation: tf.Tensor2D, bodyParts: tf.Tensor2D, k: number): tf.Tensor2D {
    return tf.tidy(() => tf.sub(tf.mul(tf.cast(tf.equal(segmentation, tf.scalar(k)), 'int32'), tf.add(bodyParts, 1)), 1));
}

function isWebGLBackend() {
    return getBackend() === 'webgl';
}

export async function decodePersonInstanceMasks(segmentation: tf.Tensor2D, longOffsets: tf.Tensor3D, poses: Pose[], height: number, width: number, stride: number, [inHeight, inWidth]: [number, number], padding: Padding, minPoseScore = 0.2, refineSteps = 8, minKeypointScore = 0.3, maxNumPeople = 10): Promise<PersonSegmentation[]> {
    // Filter out poses with smaller score.
    const posesAboveScore = poses.filter(pose => pose.score >= minPoseScore);

    let personSegmentationsData: Uint8Array[];

    if (isWebGLBackend()) {
        const personSegmentations = tf.tidy(() => {
            const masksTensorInfo = decodeMultipleMasksWebGl(segmentation, longOffsets, posesAboveScore, height, width, stride,

```

```

[inHeight, inWidth], padding, refineSteps, minKeypointScore,\n      maxNumPeople);\n  const masksTensor =
tf.engine().makeTensorFromDataId(\n      masksTensorInfo.dataId, masksTensorInfo.shape,\n      masksTensorInfo.dtype) as tf.Tensor2D;\n\n  return posesAboveScore.map(\n      (_, k) =>
toPersonKSegmentation(masksTensor, k));\n  });\n\n  personSegmentationsData =\n    (await Promise.all(personSegmentations.map(mask => mask.data()))) as\n    Uint8Array[];\n\n  personSegmentations.forEach(x => x.dispose());\n  } else {\n    const segmentationsData =
await segmentation.data() as Uint8Array;\n    const longOffsetsData = await longOffsets.data() as Float32Array;\n\n    personSegmentationsData = decodeMultipleMasksCPU(\n      segmentationsData, longOffsetsData,
posesAboveScore, height, width,\n      stride, [inHeight, inWidth], padding, refineSteps);\n\n    return
personSegmentationsData.map(\n      (data, i) => ({data, pose: posesAboveScore[i], width, height}));\n\n    }\n\n    next export
async function decodePersonInstancePartMasks(\n      segmentation: tf.Tensor2D, longOffsets: tf.Tensor3D,\n      partSegmentation: tf.Tensor2D, poses: Pose[], height: number, width: number,\n      stride: number, [inHeight,
inWidth]: [number, number], padding: Padding,\n      minPoseScore = 0.2, refineSteps = 8, minKeypointScore =
0.3,\n
      maxNumPeople = 10): Promise<PartSegmentation[]> {\n      const posesAboveScore = poses.filter(pose =>
pose.score >= minPoseScore);\n\n      let partSegmentationsByPersonData: Int32Array[];\n\n      if (isWebGLBackend())\n      {\n        const partSegmentations = tf.tidy(() => {\n          const masksTensorInfo = decodeMultipleMasksWebGL(\n
segmentation, longOffsets, posesAboveScore, height, width, stride,\n          [inHeight, inWidth], padding,
refineSteps, minKeypointScore,\n          maxNumPeople);\n          const masksTensor =
tf.engine().makeTensorFromDataId(\n            masksTensorInfo.dataId, masksTensorInfo.shape,\n            masksTensorInfo.dtype) as tf.Tensor2D;\n\n          return posesAboveScore.map(\n              (_, k) =>\n
toPersonKPartSegmentation(masksTensor, partSegmentation, k));\n          });\n\n          partSegmentationsByPersonData =\n            (await Promise.all(partSegmentations.map(x => x.data()))) as\n            Int32Array[];\n\n          partSegmentations.forEach(x => x.dispose());\n          } else\n          {\n            const segmentationsData = await segmentation.data() as Uint8Array;\n            const longOffsetsData = await
longOffsets.data() as Float32Array;\n            const partSegmentaionData = await partSegmentation.data() as
Uint8Array;\n\n            partSegmentationsByPersonData = decodeMultiplePartMasksCPU(\n              segmentationsData,
longOffsetsData, partSegmentaionData,\n              posesAboveScore, height, width, stride, [inHeight, inWidth],
padding,\n              refineSteps);\n          }\n\n          return partSegmentationsByPersonData.map(\n              (data, k) => ({pose:
posesAboveScore[k], data, height, width}));\n          }\n\n          "\n", "/*\n * @license\n * Copyright 2019 Google Inc. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License\n
is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n *\n
=====\\n
*\n\n// algorithm based on Coursera Lecture from Algorithms, Part 1:\n\n
https://www.coursera.org/learn/algorithms-part1/lecture/ZjoSM/heapsort\n\nfunction half(k: number) {\n  return
Math.floor(k / 2);\n}\n\nexport class MaxHeap<T> {\n  private priorityQueue: T[];\n  private numberOfElements:
number;\n  private getElementValue: (element: T) => number;\n\n  constructor(maxSize: number, getElementValue:
(element: T) => number) {\n    this.priorityQueue = new Array(maxSize);\n    this.numberOfElements = -1;\n
this.getElementValue = getElementValue;\n  }\n\n  public enqueue(x: T): void {\n
this.priorityQueue[++this.numberOfElements] = x;\n    this.swim(this.numberOfElements);\n
  }\n\n  public dequeue(): T {\n    const max = this.priorityQueue[0];\n    this.exchange(0, this.numberOfElements--
);\n    this.sink(0);\n    this.priorityQueue[this.numberOfElements + 1] = null;\n    return max;\n  }\n\n  public
empty(): boolean {\n    return this.numberOfElements === -1;\n  }\n\n  public size(): number {\n    return

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this.numberOfElements + 1;\n }\n\n public all(): T[] {\n return this.priorityQueue.slice(0, this.numberOfElements
+ 1);\n }\n\n public max(): T {\n return this.priorityQueue[0];\n }\n\n private swim(k: number): void {\n while
(k > 0 && this.less(half(k), k)) {\n this.exchange(k, half(k));\n k = half(k);\n }\n }\n\n private sink(k:
number): void {\n while (2 * k <= this.numberOfElements) {\n let j = 2 * k;\n if (j < this.numberOfElements
&& this.less(j, j + 1)) {\n j++;\n }\n if (!this.less(k, j)) {\n break;\n }\n this.exchange(k, j);\n
k = j;\n }\n }\n\n private getValueAt(i:
number): number {\n return this.getElementValue(this.priorityQueue[i]);\n }\n\n private less(i: number, j:
number): boolean {\n return this.getValueAt(i) < this.getValueAt(j);\n }\n\n private exchange(i: number, j:
number): void {\n const t = this.priorityQueue[i];\n this.priorityQueue[i] = this.priorityQueue[j];\n
this.priorityQueue[j] = t;\n }\n }\n\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n *
Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in
compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under
the License.\n *
=====
*\n\nimport { PartWithScore, TensorBuffer3D } from '../types';\n\nimport { MaxHeap } from
'./max_heap';\n\nfunction scoreIsMaximumInLocalWindow(\n keypointId: number, score: number, heatmapY:
number, heatmapX: number,\n localMaximumRadius: number, scores: TensorBuffer3D): boolean {\n const
[height, width] = scores.shape;\n\n let localMaximum = true;\n const yStart = Math.max(heatmapY -
localMaximumRadius, 0);\n const yEnd = Math.min(heatmapY + localMaximumRadius + 1, height);\n for (let
yCurrent = yStart; yCurrent < yEnd; ++yCurrent) {\n const xStart = Math.max(heatmapX - localMaximumRadius,
0);\n const xEnd = Math.min(heatmapX + localMaximumRadius + 1, width);\n for (let xCurrent = xStart;
xCurrent < xEnd; ++xCurrent) {\n if (scores.get(yCurrent, xCurrent, keypointId) > score) {\n localMaximum
= false;\n break;\n }\n }\n if (!localMaximum)
{\n break;\n }\n }\n\n return localMaximum;\n }\n\n/*\n * Builds a priority queue with part candidate
positions for a specific image in\n * the batch. For this we find all local maxima in the score maps with score\n *
values above a threshold. We create a single priority queue across all parts.\n */\n\nexport function
buildPartWithScoreQueue(\n scoreThreshold: number, localMaximumRadius: number,\n scores:
TensorBuffer3D): MaxHeap<PartWithScore> {\n const [height, width, numKeypoints] = scores.shape;\n\n const
queue = new MaxHeap<PartWithScore>(\n height * width * numKeypoints, ({score}) => score);\n\n for (let
heatmapY = 0; heatmapY < height; ++heatmapY) {\n for (let heatmapX = 0; heatmapX < width; ++heatmapX) {\n
for (let keypointId = 0; keypointId < numKeypoints; ++keypointId) {\n const score = scores.get(heatmapY,
heatmapX, keypointId);\n\n // Only consider parts with score greater or equal to threshold as\n // root
candidates.\n\n if (score < scoreThreshold) {\n continue;\n }\n\n // Only consider keypoints whose score is
maximum in a local window.\n if (scoreIsMaximumInLocalWindow(\n keypointId, score, heatmapY,
heatmapX, localMaximumRadius,\n scores)) {\n queue.enqueue({score, part: {heatmapY, heatmapX,
id: keypointId}});\n }\n }\n }\n }\n\n return queue;\n }\n\n", "/*\n * @license\n * Copyright 2019 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not
use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
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*/\n\nimport {NumberTuple, PART_IDS, PART_NAMES, POSE_CHAIN} from './keypoints';\nimport {Keypoint,
PartWithScore, TensorBuffer3D, Vector2D} from './types';\n\nimport {clamp, getOffsetPoint} from './util';\nimport
{addVectors, getImageCoords} from './util';\n\nconst parentChildrenTuples: NumberTuple[] =
POSE_CHAIN.map(\n  ([parentJoinName, childJoinName]): NumberTuple =>\n
([PART_IDS[parentJoinName], PART_IDS[childJoinName]]);\n\nconst parentToChildEdges: number[] =\n
parentChildrenTuples.map(([, childJointId]) => childJointId);\n\nconst childToParentEdges: number[] =\n
parentChildrenTuples.map(([, parentJointId,\n
parentJointId]);\n\nfunction getDisplacement(\n  edgeId: number, point: Vector2D, displacements:
TensorBuffer3D): Vector2D {\n  const numEdges =
displacements.shape[2] / 2;\n  return {\n    y: displacements.get(point.y, point.x, edgeId),\n    x:
displacements.get(point.y, point.x, numEdges + edgeId);\n  };\n\nfunction getStridedIndexNearPoint(\n  point:
Vector2D, outputStride: number, height: number,\n  width: number): Vector2D {\n  return {\n    y:
clamp(Math.round(point.y / outputStride), 0, height - 1),\n    x: clamp(Math.round(point.x / outputStride), 0, width -
1);\n  };\n\n}\n\n/**\n * We get a new keypoint along the `edgeId` for the pose instance, assuming\n * that the position
of the `idSource` part is already known. For this, we\n * follow the displacement vector from the source to target
part (stored in\n * the `i`-th channel of the displacement tensor). The displaced keypoint\n * vector is refined using
the offset vector by `offsetRefineStep` times.\n */\nfunction traverseToTargetKeypoint(\n  edgeId: number,
sourceKeypoint: Keypoint, targetKeypointId: number,\n  scoresBuffer: TensorBuffer3D, offsets: TensorBuffer3D,
outputStride: number,\n  displacements: TensorBuffer3D, offsetRefineStep = 2): Keypoint {\n  const [height,
width] = scoresBuffer.shape;\n\n  // Nearest neighbor interpolation for the source->target displacements.\n  const
sourceKeypointIndices = getStridedIndexNearPoint(\n    sourceKeypoint.position, outputStride, height, width);\n\n  const displacement =\n    getDisplacement(edgeId, sourceKeypointIndices, displacements);\n  const
displacedPoint = addVectors(sourceKeypoint.position, displacement);\n  let targetKeypoint = displacedPoint;\n  for
(let i = 0; i < offsetRefineStep; i++) {\n    const targetKeypointIndices =\n
getStridedIndexNearPoint(targetKeypoint, outputStride, height, width);\n\n    const offsetPoint = getOffsetPoint(\n
targetKeypointIndices.y, targetKeypointIndices.x, targetKeypointId,\n    offsets);\n\n    targetKeypoint =
addVectors(\n      {\n        x: targetKeypointIndices.x * outputStride,\n        y: targetKeypointIndices.y
* outputStride\n      },\n      {x: offsetPoint.x, y: offsetPoint.y});\n  }\n  const targetKeypointIndices =\n
getStridedIndexNearPoint(targetKeypoint, outputStride, height, width);\n  const score = scoresBuffer.get(\n
targetKeypointIndices.y, targetKeypointIndices.x, targetKeypointId);\n\n  return {position: targetKeypoint, part:
PART_NAMES[targetKeypointId], score};\n\n}\n\n/**\n * Follows the displacement fields to decode the full pose of
the object\n * instance given the position of a part that acts as root.\n */\n * @return An array of decoded keypoints
and their scores for a single pose\n */\nexport function decodePose(\n  root: PartWithScore, scores:
TensorBuffer3D, offsets: TensorBuffer3D,\n  outputStride: number, displacementsFwd: TensorBuffer3D,\n
displacementsBwd: TensorBuffer3D): Keypoint[] {\n  const numParts = scores.shape[2];\n  const numEdges =
parentToChildEdges.length;\n\n  const instanceKeypoints: Keypoint[] = new Array(numParts);\n  // Start a new
detection instance at the position of the root.\n  const {part: rootPart, score: rootScore} = root;\n  const rootPoint =
getImageCoords(rootPart, outputStride, offsets);\n\n  instanceKeypoints[rootPart.id] = {\n    score: rootScore,\n
part: PART_NAMES[rootPart.id],\n    position: rootPoint\n  };\n\n  // Decode the part positions upwards in the tree,
following the backward\n  // displacements.\n  for (let edge = numEdges - 1; edge >= 0; --edge) {\n    const
sourceKeypointId = parentToChildEdges[edge];\n    const targetKeypointId = childToParentEdges[edge];\n    if
(instanceKeypoints[sourceKeypointId] &&\n      !instanceKeypoints[targetKeypointId]) {\n
instanceKeypoints[targetKeypointId] = traverseToTargetKeypoint(\n      edge,\n
instanceKeypoints[sourceKeypointId], targetKeypointId, scores,\n      offsets, outputStride, displacementsBwd);\n
    }\n  }\n\n  // Decode the part positions downwards in the tree, following the forward\n  // displacements.\n  for (let
edge = 0;\n  edge < numEdges; ++edge) {\n    const sourceKeypointId = childToParentEdges[edge];\n    const targetKeypointId
= parentToChildEdges[edge];\n    if (instanceKeypoints[sourceKeypointId] &&\n

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!instanceKeypoints[targetKeypointId]) {\n    instanceKeypoints[targetKeypointId] = traverseToTargetKeypoint(\n
    edge, instanceKeypoints[sourceKeypointId], targetKeypointId, scores,\n        offsets, outputStride,\n    displacementsFwd);\n    }\n    }\n    }\n    return instanceKeypoints;\n    }\n    }"/**\n * @license\n * Copyright 2019 Google\n    Inc. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not\n    use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n    http://www.apache.org/licenses/LICENSE-2.0\n * \n    * Unless required by applicable law or agreed to in writing,\n    software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES\n    OR CONDITIONS OF ANY KIND, either express\n    or implied.\n * See the License for the specific language governing permissions and\n * limitations under the\n    License.\n */
=====
*\n\nimport {Keypoint, Pose, TensorBuffer3D} from '../types';\n\nimport {buildPartWithScoreQueue} from\n    './build_part_with_score_queue';\nimport {decodePose} from './decode_pose';\nimport {getImageCoords,\n    squaredDistance} from './util';\n\nfunction withinNmsRadiusOfCorrespondingPoint(\n    poses: Pose[],\n    squaredNmsRadius: number, {x, y}: {x: number, y: number},\n    keypointId: number): boolean {\n    return\n    poses.some(({keypoints}) => {\n        const correspondingKeypoint = keypoints[keypointId].position;\n        return\n        squaredDistance(\n            y, x, correspondingKeypoint.y, correspondingKeypoint.x) <= \n        squaredNmsRadius;\n    });\n}\n\n/* Score the newly proposed object instance without taking into account\n * the\n    scores of the parts that overlap with any previously detected\n    *\n    * instance.\n    */\nfunction getInstanceScore(\n    existingPoses: Pose[], squaredNmsRadius: number,\n    instanceKeypoints: Keypoint[]): number {\n    let notOverlappedKeypointScores = instanceKeypoints.reduce(\n    (result, {position, score}, keypointId): number => {\n        if (!withinNmsRadiusOfCorrespondingPoint(\n            existingPoses, squaredNmsRadius, position, keypointId)) {\n            result += score;\n        }\n        return result;\n    }, 0.0);\n    return notOverlappedKeypointScores / instanceKeypoints.length;\n}\n\n/* A point (y, x) is considered\n    as root part candidate if its score is a\n    // maximum in a window |y - y'| <= kLocalMaximumRadius, |x - x'| <= \n    // kLocalMaximumRadius.\n    const kLocalMaximumRadius = 1;\n    /**\n * Detects multiple poses and finds their parts\n    from part scores and\n * displacement vectors. It returns up to `maxDetections` object instance\n * detections in\n    decreasing root score order. It works as follows: We first\n * create a priority\n    queue with local part score maxima above\n * `scoreThreshold`, considering all parts at the same time. Then we\n * iteratively pull the top element of the queue (in decreasing score order)\n * and treat it as a root candidate for a new\n    object instance. To avoid\n * duplicate detections, we reject the root candidate if it is within a disk\n * of\n    `nmsRadius` pixels from the corresponding part of a previously detected\n * instance, which is a form of part-based\n    non-maximum suppression (NMS). If\n * the root candidate passes the NMS check, we start a new object instance\n * detection, treating the corresponding part as root and finding the\n * positions of the remaining parts by following\n    the displacement vectors\n * along the tree-structured part graph. We assign to the newly detected\n * instance a\n    score equal to the sum of scores of its parts which have not\n * been claimed by a previous instance (i.e., those at\n    least `nmsRadius`\n * pixels away from the corresponding part of all previously\n    detected\n * instances), divided by the total number of parts `numParts`.\n    */\n * @param heatmapScores 3-D tensor\n    with shape `[height, width, numParts]`.\n * The value of heatmapScores[y, x, k]` is the score of placing the `k`-th\n * object part at position `(y, x)`.\n    */\n * @param offsets 3-D tensor with shape `[height, width, numParts * 2]`.\n * The value of [offsets[y, x, k], offsets[y, x, k + numParts]]` is the\n * short range offset vector of the `k`-th object\n    part at heatmap\n * position `(y, x)`.\n    */\n * @param displacementsFwd 3-D tensor of shape\n * `[height, width, 2 * num_edges]`, where `num_edges = num_parts - 1` is the\n * number of edges (parent-child pairs) in the tree. It\n    contains the forward\n * displacements between consecutive part from the root towards the leaves.\n    */\n * @param\n    displacementsBwd 3-D tensor of shape\n * `[height, width, 2 * num_edges]`, where `num_edges = num_parts - 1` is\n    the\n * number of edges (parent-child pairs) in the tree. It contains\n    the backward\n * displacements between consecutive part from the root towards the leaves.\n    */\n * @param\n    outputStride The output stride that was used when feed-forwarding\n * through the PoseNet model. Must be 32, 16,

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or 8.\n * \n * @param maxPoseDetections Maximum number of returned instance detections per\n * image.\n * \n *
@param scoreThreshold Only return instance detections that have root part\n * score greater or equal to this value.
Defaults to 0.5.\n * \n * @param nmsRadius Non-maximum suppression part distance. It needs to be\n * strictly
positive. Two parts suppress each other if they are less than\n * `nmsRadius` pixels away. Defaults to 20.\n * \n *
@return An array of poses and their scores, each containing keypoints and\n * the corresponding keypoint scores.\n *
*/\n\nexport function decodeMultiplePoses(\n  scoresBuffer: TensorBuffer3D, offsetsBuffer: TensorBuffer3D,\n  displacementsFwdBuffer: TensorBuffer3D,\n  displacementsBwdBuffer: TensorBuffer3D, outputStride: number,\n  maxPoseDetections: number, scoreThreshold = 0.5, nmsRadius = 20): Pose[] {\n  const poses: Pose[] = [];\n  const queue = buildPartWithScoreQueue(\n    scoreThreshold, kLocalMaximumRadius, scoresBuffer);\n  const squaredNmsRadius = nmsRadius * nmsRadius;\n  // Generate at most maxDetections object instances per image
in\n  // decreasing root part score order.\n  while (poses.length < maxPoseDetections && !queue.empty()) {\n    //
The top element in the queue is the next root candidate.\n    const root = queue.dequeue();\n    // Part-based non-
maximum suppression: We reject a root candidate if it\n    // is within a disk of `nmsRadius` pixels from the
corresponding part of\n    // a previously detected instance.\n    const rootImageCoords =\n  getImageCoords(root.part, outputStride, offsetsBuffer);\n    if (withinNmsRadiusOfCorrespondingPoint(\n  poses, squaredNmsRadius, rootImageCoords, root.part.id)) {\n      continue;\n    }\n    // Start a new detection
instance at the position of the root.\n    const keypoints = decodePose(\n      root, scoresBuffer, offsetsBuffer,\n  outputStride, displacementsFwdBuffer,\n    displacementsBwdBuffer);\n    const score =\n  getInstanceScore(poses, squaredNmsRadius, keypoints);\n    poses.push([keypoints, score]);\n  }\n  return
poses;\n}\n\n"/**\n * @license\n * Copyright 2019 Google Inc. All Rights Reserved.\n * Licensed under the Apache
License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You
may obtain a copy of the License at\n * \n * https://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required
by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS"\n
BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the
License for the specific language governing permissions and\n * limitations under the License.\n */
=====
\n\n*/\n\nimport * as tf from 'tensorflow/tfjs-core';\n\nimport { BaseModel } from './base_model';\n\nconst
imageNetMean = [-123.15, -115.90, -103.06];\n\nexport class ResNet extends BaseModel {\n  preprocessInput(input: tf.Tensor3D): tf.Tensor3D {\n    return tf.add(input, imageNetMean);\n  }\n  nameOutputResults(results: tf.Tensor3D[]) {\n    const [\n      displacementBwd,\n      displacementFwd,\n      heatmap,\n      longOffsets,\n      offsets,\n      partHeatmaps,\n      segmentation,\n      partOffsets,\n    ] = results;\n    return [\n      offsets,\n      segmentation,\n      partHeatmaps,\n      longOffsets,\n      heatmap,\n      displacementFwd,\n      displacementBwd,\n      partOffsets\n    ];\n  }\n}\n\n"/**\n * @license\n * Copyright 2019
Google Inc. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you
may not use this file except in compliance with the License.\n * You
may obtain a copy of the License at\n * \n * https://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required
by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS"\n
BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the
License for the specific language governing permissions and\n * limitations under the License.\n */
=====
\n\n*/\n\nconst RESNET50_BASE_URL =\n  'https://storage.googleapis.com/tfjs-
models/savedmodel/bodypix/resnet50';\n\nconst MOBILENET_BASE_URL =\n  'https://storage.googleapis.com/tfjs-models/savedmodel/bodypix/mobilenet';\n\n// The BodyPix 2.0 ResNet50
models use the latest TensorFlow.js 1.0 model\n// format.\n\nexport function resNet50SavedModel(stride: number,\n  quantBytes: number): string {\n  const graphJson = `model-stride${stride}.json`;\n  // quantBytes=4 corresponding
to the non-quantized
full-precision SavedModel.\n  if (quantBytes === 4) {\n    return RESNET50_BASE_URL + `float^` + graphJson;\n  }
else {\n    return RESNET50_BASE_URL + `quant${quantBytes}^` + graphJson;\n  }\n}\n\n// The BodyPix 2.0

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MobileNetV1 models use the latest TensorFlow.js 1.0 model\n// format.\nexport function mobileNetSavedModel(\n
  stride: number, multiplier: number, quantBytes: number): string {\n  const toStr: {[key: number]: string} = {1.0:\n
  '100', 0.75: '075', 0.50: '050'};\n  const graphJson = `model-stride${stride}.json`;\n  // quantBytes=4 corresponding\n
  to the non-quantized full-precision SavedModel.\n  if (quantBytes === 4) {\n    return MOBILENET_BASE_URL +\n
  `float/${toStr[multiplier]}^ + graphJson;\n  } else {\n    return MOBILENET_BASE_URL +\n
  `quant${quantBytes}/${toStr[multiplier]}^ +\n    graphJson;\n  }\n}\n", "/*\n * @license\n * Copyright 2020\n
  Google Inc. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you\n
  may not use this\n
  file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *\n
  http://www.apache.org/licenses/LICENSE-2.0\n *\n *\n  Unless required by applicable law or agreed to in writing,\n
  software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES\n
  OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n
  governing permissions and\n * limitations under the License.\n *\n *\n
  =====\n
  *\n\nimport * as tf from 'tensorflow/tfjs-core';\n\nimport {BodyPixInput, BodyPixOutputStride, Padding} from\n
  './types';\nimport {Pose, TensorBuffer3D} from './types';\nimport {BodyPixInternalResolution} from\n
  './types';\n\nfunction getSizeFromImageLikeElement(input: HTMLImageElement|\n
  HTMLCanvasElement|\n      OffscreenCanvas): [number, number] {\n  if ('offsetHeight'\n
  in input && input.offsetHeight !== 0\n      && 'offsetWidth' in input && input.offsetWidth !== 0) {\n    return\n
  [input.offsetHeight, input.offsetWidth];\n  } else if (input.height !== null && input.width !== null) {\n    return\n
  [input.height, input.width];\n  } else {\n    throw new Error(\n      `HTMLImageElement must have height and\n
  width attributes set.`);\n  }\n}\n\nfunction getSizeFromVideoElement(input: HTMLVideoElement): [number,\n
  number] {\n  if (input.hasAttribute('height') && input.hasAttribute('width')) {\n    // Prioritizes user specified height\n
  and width.\n    // We can't test the .height and .width properties directly,\n    // because they evaluate to 0 if unset.\n
  return [input.height, input.width];\n  } else {\n    return [input.videoHeight, input.videoWidth];\n  }\n}\n\nexport\n
  function getInputSize(input: BodyPixInput): [number, number] {\n  if ((typeof (HTMLCanvasElement) !==\n
  'undefined' &&\n      input instanceof HTMLCanvasElement) ||\n      (typeof (OffscreenCanvas)\n
  !== 'undefined' &&\n      input instanceof OffscreenCanvas) ||\n      (typeof (HTMLImageElement) !==\n
  'undefined' &&\n      input instanceof HTMLImageElement)) {\n    return getSizeFromImageLikeElement(input);\n
  } else if (typeof (ImageData) !== 'undefined' && input instanceof ImageData) {\n    return [input.height,\n
  input.width];\n  } else if (\n      typeof (HTMLVideoElement) !== 'undefined' &&\n      input instanceof\n
  HTMLVideoElement) {\n    return getSizeFromVideoElement(input);\n  } else if (input instanceof tf.Tensor) {\n
  return [input.shape[0], input.shape[1]];\n  } else {\n    throw new Error(`error: Unknown input type: ${input}`);\n
  }\n}\n\nfunction isValidInputResolution(\n  resolution: number, outputStride: number): boolean {\n  return\n
  (resolution - 1) % outputStride === 0;\n}\n\nexport function toValidInputResolution(\n  inputResolution: number,\n
  outputStride: BodyPixOutputStride): number {\n  if (isValidInputResolution(inputResolution, outputStride)) {\n
  return inputResolution;\n  }\n  return Math.floor(inputResolution / outputStride) * outputStride + 1;\n}\n\nconst\n
  INTERNAL_RESOLUTION_STRING_OPTIONS = {\n    low: 'low',\n    medium: 'medium',\n    high: 'high',\n    full:\n
  'full'\n  };\n\nconst INTERNAL_RESOLUTION_PERCENTAGES = {\n
  [INTERNAL_RESOLUTION_STRING_OPTIONS.low]: 0.25,\n
  [INTERNAL_RESOLUTION_STRING_OPTIONS.medium]: 0.5,\n
  [INTERNAL_RESOLUTION_STRING_OPTIONS.high]: 0.75,\n
  [INTERNAL_RESOLUTION_STRING_OPTIONS.full]: 1.0\n};\n\nconst MIN_INTERNAL_RESOLUTION =\n
  0.1;\nconst MAX_INTERNAL_RESOLUTION = 2.0;\n\nfunction toInternalResolutionPercentage(\n
  internalResolution: BodyPixInternalResolution): number {\n  if (typeof internalResolution === 'string') {\n    const\n
  result = INTERNAL_RESOLUTION_PERCENTAGES[internalResolution];\n    tf.util.assert(\n      typeof result\n
  === 'number',\n      () => `string value of inputResolution must be one of ${\n
  Object.values(INTERNAL_RESOLUTION_STRING_OPTIONS)\n      .join(',')\n

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but was ${internalResolution}`);\n  return result;\n } else {\n  tf.util.assert(\n    typeof internalResolution ===
'number' &&\n    internalResolution <= MAX_INTERNAL_RESOLUTION &&\n    internalResolution
>= MIN_INTERNAL_RESOLUTION,\n    () =>\n      `inputResolution must be a string or number between
${\n        MIN_INTERNAL_RESOLUTION} and ${MAX_INTERNAL_RESOLUTION}, but ` +\n
`${internalResolution}`);\n  return internalResolution;\n }\n}\n\nexport function
toInputResolutionHeightAndWidth(\n  internalResolution: BodyPixInternalResolution,\n  outputStride:
BodyPixOutputStride,\n  [inputHeight, inputWidth]: [number, number]): [number, number] {\n  const
internalResolutionPercentage =\n    toInternalResolutionPercentage(internalResolution);\n  return [\n
toValidInputResolution(\n    inputHeight * internalResolutionPercentage, outputStride),\n
toValidInputResolution(\n    inputWidth * internalResolutionPercentage,\n
    outputStride)\n ];\n}\n\nexport function toInputTensor(input: BodyPixInput) {\n // TODO: tf.browser.fromPixels
types to support OffscreenCanvas\n // @ts-ignore\n return input instanceof tf.Tensor ? input :
tf.browser.fromPixels(input);\n}\n\nexport function resizeAndPadTo(\n  imageTensor: tf.Tensor3D, [targetH,
targetW]: [number, number],\n  flipHorizontal = false): {\n  resizedAndPadded: tf.Tensor3D,\n  paddedBy:
[[number, number], [number, number]]\n } {\n  const [height, width] = imageTensor.shape;\n  const targetAspect =
targetW / targetH;\n  const aspect = width / height;\n  let resizeW: number;\n  let resizeH: number;\n  let padL:
number;\n  let padR: number;\n  let padT: number;\n  let padB: number;\n  if (aspect > targetAspect) {\n    // resize
to have the larger dimension match the shape.\n    resizeW = targetW;\n    resizeH = Math.ceil(resizeW / aspect);\n\n
    const padHeight = targetH - resizeH;\n    padL = 0;\n    padR = 0;\n    padT = Math.floor(padHeight
/ 2);\n    padB = targetH - (resizeH + padT);\n  } else {\n    resizeH = targetH;\n    resizeW = Math.ceil(targetH *
aspect);\n\n    const padWidth = targetW - resizeW;\n    padL = Math.floor(padWidth / 2);\n    padR = targetW -
(resizeW + padL);\n    padT = 0;\n    padB = 0;\n  }\n  const resizedAndPadded = tf.tidy(() => {\n    // resize to
have largest dimension match image\n    let resized: tf.Tensor3D;\n    if (flipHorizontal) {\n      resized =
tf.image.resizeBilinear(\n        tf.reverse(imageTensor, 1), [resizeH, resizeW]);\n    } else {\n      resized =
tf.image.resizeBilinear(imageTensor, [resizeH, resizeW]);\n    }\n\n    const padded = tf.pad3d(resized, [[padT,
padB], [padL, padR], [0, 0]]);\n    return padded;\n  });\n  return {resizedAndPadded, paddedBy: [[padT, padB],
[padL, padR]]};\n}\n\nexport function scaleAndCropToInputTensorShape(\n  tensor: tf.Tensor3D,\n  [inputTensorHeight, inputTensorWidth]: [number, number],\n  [resizedAndPaddedHeight,
resizedAndPaddedWidth]: [number, number],\n  [[padT, padB], [padL, padR]]: [[number, number], [number,
number]],\n  applySigmoidActivation = false): tf.Tensor3D {\n  return tf.tidy(() => {\n    let inResizedAndPadded:
tf.Tensor3D = tf.image.resizeBilinear(tensor,\n      [resizedAndPaddedHeight, resizedAndPaddedWidth], true);\n    if (applySigmoidActivation) {\n      inResizedAndPadded = tf.sigmoid(inResizedAndPadded);\n    }\n\n    return
removePaddingAndResizeBack(\n      inResizedAndPadded, [inputTensorHeight, inputTensorWidth],\n      [[padT, padB], [padL, padR]]);\n  });\n}\n\nexport function removePaddingAndResizeBack(\n  resizedAndPadded:
tf.Tensor3D,\n  [originalHeight, originalWidth]: [number, number],\n  [[padT, padB], [padL, padR]]: [[number,
number], [number, number]],\n  tf.Tensor3D {\n  return tf.tidy(() => {\n    const batchedImage: tf.Tensor4D =
tf.expandDims(resizedAndPadded);\n    return tf.squeeze(tf.image\n      .cropAndResize(\n
        batchedImage, [[\n          padT / (originalHeight + padT + padB - 1.0),\n          padL / (originalWidth +
padL + padR - 1.0),\n          (padT + originalHeight - 1.0) /\n            (originalHeight + padT + padB - 1.0),\n
          (padL + originalWidth - 1.0) / (originalWidth + padL + padR - 1.0)\n        ]),\n        [0], [originalHeight,
originalWidth]), [0]);\n  });\n}\n\nexport function resize2d(\n  tensor: tf.Tensor2D, resolution: [number, number],\n
nearestNeighbor?: boolean): tf.Tensor2D {\n  return tf.tidy(() => {\n    const batchedImage: tf.Tensor4D =
tf.expandDims(tensor, 2);\n    return tf.squeeze(\n      tf.image.resizeBilinear(batchedImage, resolution,\n        nearestNeighbor));\n  });\n}\n\nexport function padAndResizeTo(\n  input: BodyPixInput, [targetH, targetW]:
[number, number]): {\n  resized: tf.Tensor3D, padding: Padding\n } {\n  const [height, width] = getInputSize(input);\n
const targetAspect = targetW / targetH;\n  const aspect
= width / height;\n  let [padT, padB, padL, padR] = [0, 0, 0, 0];\n  if (aspect < targetAspect) {\n    // pads the width\n
padT = 0;\n    padB = 0;\n    padL = Math.round(0.5 * (targetAspect * height - width));\n    padR = Math.round(0.5

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    * (targetAspect * height - width));\n } else {\n // pads the height\n padT = Math.round(0.5 * ((1.0 /
targetAspect) * width - height));\n padB = Math.round(0.5 * ((1.0 / targetAspect) * width - height));\n padL =
0;\n padR = 0;\n }\n\n const resized: tf.Tensor3D = tf.tidy(() => {\n let imageTensor = toInputTensor(input);\n
imageTensor = tf.pad3d(imageTensor, [[padT, padB], [padL, padR], [0, 0]]);\n\n return
tf.image.resizeBilinear(imageTensor, [targetH, targetW]);\n });\n\n return {resized, padding: {top: padT, left: padL,
right: padR, bottom: padB}};\n }\n\n\nexport async function toTensorBuffers3D(tensors: tf.Tensor3D[]):\n Promise<TensorBuffer3D[]> {\n return Promise.all(tensors.map(tensor => tensor.buffer()));\n }\n\n\nexport
function scalePose(\n pose: Pose, scaleY: number, scaleX: number, offsetY = 0,\n offsetX = 0): Pose {\n return
{\n score: pose.score,\n keypoints: pose.keypoints.map(({score, part, position}) => ({\n
score,\n part,\n position: {\n x: position.x *\nscaleX + offsetX,\n y: position.y * scaleY + offsetY\n })\n
}))\n };\n }\n\n\nexport function scalePoses(\n poses: Pose[], scaleY: number, scaleX: number, offsetY = 0,
offsetX = 0) {\n if (scaleX === 1 && scaleY === 1 && offsetY === 0 && offsetX === 0) {\n return poses;\n
}\n return poses.map(pose => scalePose(pose, scaleY, scaleX, offsetY, offsetX));\n }\n\n\nexport function
flipPoseHorizontal(pose: Pose, imageWidth: number): Pose {\n return {\n score: pose.score,\n
keypoints: pose.keypoints.map(\n ({score, part, position}) => ({\n score,\n part,\n position: {x:
imageWidth - 1 - position.x, y: position.y\n })\n )\n );\n }\n }\n\n\nexport function flipPosesHorizontal(poses: Pose[],
imageWidth: number) {\n if (imageWidth <= 0) {\n return poses;\n }\n return poses.map(pose =>
flipPoseHorizontal(pose, imageWidth));\n }\n\n\nexport function scaleAndFlipPoses(\n poses: Pose[], [height,
width]: [number, number],\n [inputResolutionHeight, inputResolutionWidth]: [number, number],\n padding:
Padding, flipHorizontal: boolean): Pose[] {\n const scaleY =\n (height + padding.top + padding.bottom) /\n
(inputResolutionHeight);\n const scaleX =\n (width + padding.left + padding.right) /\n
(inputResolutionWidth);\n\n const scaledPoses =\n scalePoses(poses, scaleY, scaleX, -padding.top, -
padding.left);\n\n if (flipHorizontal) {\n return flipPosesHorizontal(scaledPoses, width);\n } else {\n return
scaledPoses;\n }\n }\n }\n\n",""/>**\n * @license\n * Copyright 2019 Google Inc. All Rights Reserved.\n * Licensed under the Apache
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by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS"
BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the
License for the specific language governing permissions and\n * limitations under the License.\n *
======\n
*/\n\nimport * as tfconv from '@tensorflow/tfjs-converter';\nimport * as tf from '@tensorflow/tfjs-core';\n\nimport
{BaseModel} from './base_model';\nimport {decodeOnlyPartSegmentation, decodePartSegmentation,
toMaskTensor} from './decode_part_map';\nimport
{MobileNet} from './mobilenet';\nimport {decodePersonInstanceMasks, decodePersonInstancePartMasks} from
'./multi_person/decode_instance_masks';\nimport {decodeMultiplePoses} from
'./multi_person/decode_multiple_poses';\nimport {ResNet} from './resnet';\nimport {mobileNetSavedModel,
resNet50SavedModel} from './saved_models';\nimport {BodyPixArchitecture, BodyPixInput,
BodyPixInternalResolution, BodyPixMultiplier, BodyPixOutputStride, BodyPixQuantBytes, Padding} from
'./types';\nimport {PartSegmentation, PersonSegmentation, SemanticPartSegmentation,
SemanticPersonSegmentation} from './types';\nimport {getInputSize, padAndResizeTo,
scaleAndCropToInputTensorShape, scaleAndFlipPoses, toInputResolutionHeightAndWidth, toTensorBuffers3D}
from './util';\n\nconst APPLY_SIGMOID_ACTIVATION = true;\nconst FLIP_POSES_AFTER_SCALING =
false;\n\n/**\n * BodyPix model loading is configurable using the following config dictionary.\n **\n *
`architecture`: BodyPixArchitecture. It determines which BodyPix
architecture\n * to load. The supported architectures are: MobileNetV1 and ResNet50.\n **\n * `outputStride`:
Specifies the output stride of the BodyPix model.\n * The smaller the value, the larger the output resolution, and

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more accurate\n * the model at the cost of speed. Set this to a larger value to increase speed\n * at the cost of accuracy. Stride 32 is supported for ResNet and\n * stride 8,16,32 are supported for various MobileNetV1 models.\n *\n * `multiplier`: An optional number with values: 1.01, 1.0, 0.75, or\n * 0.50. The value is used only by MobileNet architecture. It is the float\n * multiplier for the depth (number of channels) for all convolution ops.\n * The larger the value, the larger the size of the layers, and more accurate\n * the model at the cost of speed. Set this to a smaller value to increase speed\n * at the cost of accuracy.\n *\n * `modelUrl`: An optional string that specifies custom url of the model. This\n * is useful for area/countries that don't have access

used to binarize the intermediate person segmentation probability. The probability of each pixel belongs to a person is in range [0, 1]. If the probability is greater than the `segmentationThreshold`, it will be set to 1 otherwise 0.

export interface InferenceConfig {
 flipHorizontal?: boolean;
 internalResolution?: BodyPixInternalResolution;
 segmentationThreshold?: number;
}

export interface PersonInferenceConfig extends InferenceConfig {
 maxDetections?: Defaults to 10. Maximum number of person pose detections per image.
 scoreThreshold?: Defaults to 0.4. Only return person pose that have root part score greater or equal to this value.
 nmsRadius?: Defaults to 20. Non-maximum suppression part distance in pixels. It needs to be strictly positive. Two pose keypoints suppress each other if they are less than `nmsRadius` pixels away.
}

export interface MultiPersonInstanceInferenceConfig extends InferenceConfig {
 maxDetections?: Defaults to 10. Maximum number of returned instance segmentation and pose detections per image.
 scoreThreshold?: Defaults to 0.4. Only returns and uses person poses for instance segmentation assignment when the pose has root part score greater or equal to this value.
 nmsRadius?: Defaults to 20. Non-maximum suppression part distance in pixels. It needs to be strictly positive. Two parts suppress each other if they are less than `nmsRadius` pixels away.
 minKeypointScore?: Default to 0.3. Keypoints above the score are used for matching and assigning segmentation mask to each person.
 refineSteps?: Default to 10. The number of refinement steps used when assigning the instance segmentation. It needs to be strictly positive. The larger the higher the accuracy and slower the inference.
}

const PERSON_INFERENCE_CONFIG: PersonInferenceConfig = {
 flipHorizontal: false,
 internalResolution: 'medium',
 segmentationThreshold: 0.7,
 maxDetections: 10,
 scoreThreshold: 0.4,
 nmsRadius: 20,
};

const MULTI_PERSON_INSTANCE_INFERENCE_CONFIG: MultiPersonInstanceInferenceConfig = {
 flipHorizontal: false,
 internalResolution: 'medium',
 segmentationThreshold: 0.7,
 maxDetections: 10,
 scoreThreshold: 0.4,
 nmsRadius: 20,
 minKeypointScore: 0.3,
 refineSteps: 10,
};

function validatePersonInferenceConfig(config: PersonInferenceConfig) {
 const { segmentationThreshold, maxDetections, scoreThreshold, nmsRadius } = config;
 if (segmentationThreshold < 0.0 || segmentationThreshold > 1.0) {
 throw new Error(`segmentationThreshold \${segmentationThreshold}. Should be in range [0.0, 1.0]`);
 }
 if (maxDetections <= 0) {
 throw new Error(`Invalid maxDetections \${maxDetections}. Should be > 0`);
 }
 if (scoreThreshold < 0.0 || scoreThreshold > 1.0) {
 throw new Error(`Invalid scoreThreshold \${scoreThreshold}. Should be in range [0.0, 1.0]`);
 }
 if (nmsRadius <= 0) {
 throw new Error(`Invalid nmsRadius \${nmsRadius}.`);
 }
}

function validateMultiPersonInstanceInferenceConfig(config: MultiPersonInstanceInferenceConfig) {
 const { segmentationThreshold, maxDetections, scoreThreshold, nmsRadius, minKeypointScore, refineSteps } = config;
 if (segmentationThreshold < 0.0 || segmentationThreshold > 1.0) {
 throw new Error(`segmentationThreshold \${segmentationThreshold}. Should be in range [0.0, 1.0]`);
 }
 if (maxDetections <= 0) {
 throw new Error(`Invalid maxDetections \${maxDetections}. Should be > 0`);
 }
 if (scoreThreshold < 0.0 || scoreThreshold > 1.0) {
 throw new Error(`Invalid scoreThreshold \${scoreThreshold}. Should be in range [0.0, 1.0]`);
 }
 if (nmsRadius <= 0) {
 throw new Error(`Invalid nmsRadius \${nmsRadius}.`);
 }
 if (minKeypointScore < 0 || minKeypointScore > 1) {
 throw new Error(`Invalid minKeypointScore \${minKeypointScore}. Should be in range [0.0, 1.0]`);
 }
 if (refineSteps <= 0 || refineSteps > 20) {
 throw new Error(`Invalid refineSteps \${refineSteps}. Should be in range [1, 20]`);
 }
}

export class BodyPix {
 baseModel: BaseModel;

 constructor(net: BaseModel) {
 this.baseModel = net;
 }

 private predictForPersonSegmentation(input: tf.Tensor3D): {
 segmentLogits: tf.Tensor3D;
 heatmapScores:

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tf.Tensor3D,\n offsets: tf.Tensor3D,\n displacementFwd: tf.Tensor3D,\n displacementBwd: tf.Tensor3D,\n }
{\n const {\n segmentation,\n heatmapScores,\n offsets,\n displacementFwd,\n displacementBwd,\n } = this.baseModel.predict(input);\n return {\n segmentLogits: segmentation,\n heatmapScores,\n offsets,\n displacementFwd,\n displacementBwd,\n };\n }\n\n private
predictForPersonSegmentationAndPart(input: tf.Tensor3D): {\n segmentLogits: tf.Tensor3D,\n partHeatmapLogits: tf.Tensor3D,\n heatmapScores: tf.Tensor3D,\n offsets: tf.Tensor3D,\n displacementFwd: tf.Tensor3D,\n displacementBwd: tf.Tensor3D,\n } {\n const {\n segmentation,\n partHeatmaps,\n heatmapScores,\n offsets,\n displacementFwd,\n displacementBwd,\n } = this.baseModel.predict(input);\n return {\n segmentLogits: segmentation,\n partHeatmapLogits: partHeatmaps,\n heatmapScores,\n offsets,\n displacementFwd,\n displacementBwd,\n };\n }\n\n private
predictForMultiPersonInstanceSegmentationAndPart(input: tf.Tensor3D):\n {\n segmentLogits: tf.Tensor3D,\n longOffsets: tf.Tensor3D,\n heatmapScores: tf.Tensor3D,\n offsets: tf.Tensor3D,\n displacementFwd: tf.Tensor3D,\n displacementBwd: tf.Tensor3D,\n partHeatmaps: tf.Tensor3D,\n } {\n const {\n segmentation,\n longOffsets,\n heatmapScores,\n offsets,\n displacementFwd,\n displacementBwd,\n partHeatmaps,\n } = this.baseModel.predict(input);\n return {\n segmentLogits: segmentation,\n longOffsets,\n heatmapScores,\n offsets,\n displacementFwd,\n displacementBwd,\n partHeatmaps,\n };\n }\n\n /**\n * Given an image with people, returns a dictionary of all intermediate\n * tensors including: 1) a binary array with 1 for the pixels that are part of\n * the person, and 0 otherwise, 2) heatmapScores, 3) offsets, and 4) paddings.\n * @param input ImageData|HTMLImageElement|HTMLCanvasElement|HTMLVideoElement)\n * The input image to feed through the network.\n * @param internalResolution Defaults to 'medium'. The internal resolution\n * that the input is resized to before inference. The larger the\n * internalResolution the more accurate the model at the cost of slower\n * prediction times. Available values are 'low', 'medium', 'high', 'full', or\n * a percentage value between 0 and 1. The values 'low', 'medium', 'high', and\n * 'full' map to 0.25, 0.5, 0.75, and 1.0 correspondingly.\n * @param segmentationThreshold The minimum that segmentation values must have\n * to be considered part of the person. Affects the generation of the\n * segmentation mask.\n * @return A dictionary containing\n * `segmentation`: A 2d Tensor with 1 for the pixels that are part of the\n * person, and 0 otherwise. The width and height correspond to the same\n * dimensions of the input image.\n * `heatmapScores`: A 3d Tensor of the keypoint heatmaps used by\n * pose estimation decoding.\n * `offsets`: A 3d Tensor of the keypoint offsets used by pose\n * estimation decoding.\n * `displacementFwd`: A 3d Tensor of the keypoint forward displacement used\n * by pose estimation decoding.\n * `displacementBwd`: A 3d Tensor of the keypoint backward displacement used\n * by pose estimation decoding.\n * `padding`: The padding (unit pixels) being applied to the input image\n * before it is fed into the model.\n */\n segmentPersonActivation(\n input: BodyPixInput, internalResolution: BodyPixInternalResolution,\n segmentationThreshold = 0.5): {\n segmentation: tf.Tensor2D,\n heatmapScores: tf.Tensor3D,\n offsets: tf.Tensor3D,\n displacementFwd: tf.Tensor3D,\n displacementBwd: tf.Tensor3D,\n padding: Padding,\n internalResolutionHeightAndWidth: [number, number]\n } {\n const [height, width] = getInputSize(input);\n const internalResolutionHeightAndWidth = toInputResolutionHeightAndWidth(\n internalResolution, this.baseModel.outputStride, [height, width]);\n const {resized, padding} =\n padAndResizeTo(input, internalResolutionHeightAndWidth);\n const {\n segmentation,\n heatmapScores,\n offsets,\n displacementFwd,\n displacementBwd,\n } = tf.tidy(() => {\n const {\n segmentLogits,\n heatmapScores,\n offsets,\n displacementFwd,\n displacementBwd,\n } =\n this.predictForPersonSegmentation(resized);\n const [resizedHeight, resizedWidth] = resized.shape;\n const scaledSegmentScores = scaleAndCropToInputTensorShape(\n segmentLogits, [height, width], [resizedHeight, resizedWidth],\n [[padding.top, padding.bottom], [padding.left, padding.right]],\n APPLY_SIGMOID_ACTIVATION);\n return {\n segmentation: toMaskTensor(\n tf.squeeze(scaledSegmentScores), segmentationThreshold),\n heatmapScores,\n offsets,\n };\n });\n }

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displacementFwd,\n    displacementBwd,\n    });\n    });\n    resized.dispose();\n    return {\n        segmentation,\n        heatmapScores,\n        offsets,\n        displacementFwd,\n        displacementBwd,\n        padding,\n        internalResolutionHeightAndWidth\n    });\n    }\n    }\n    /**\n     * Given an image with many people, returns a
PersonSegmentation dictionary\n     * that contains the segmentation mask for all people and a single pose.\n     *\n     * Note: The segmentation mask returned by this method covers all people but\n     * the pose works well for one
person. If you want to estimate instance-level\n     * multiple person segmentation & pose for each person, use\n     *
`segmentMultiPerson` instead.\n     *\n     * @param input
ImageData|HTMLImageElement|HTMLCanvasElement|HTMLVideoElement)\n
     * The input image to feed through the network.\n     *\n     * @param config PersonInferenceConfig object that
contains\n     * parameters for the BodyPix inference using person decoding.\n     *\n     * @return A
SemanticPersonSegmentation dictionary that contains height,\n     * width, the flattened binary segmentation mask
and the poses for all people.\n     * The width and height correspond to the same dimensions of the input image.\n     * -
`height`: The height of the segmentation data in pixel unit.\n     * - `width`: The width of the segmentation data in
pixel unit.\n     * - `data`: The flattened Uint8Array of segmentation data. 1 means the pixel\n     * belongs to a person
and 0 means the pixel doesn't belong to a person. The\n     * size of the array is equal to `height` x `width` in row-
major order.\n     * - `allPoses`: The 2d poses of all people.\n     */\n    async segmentPerson(\n        input:
BodyPixInput,\n        config: PersonInferenceConfig = PERSON_INFERENCE_CONFIG):\n        Promise<SemanticPersonSegmentation> {\n            config = {...PERSON_INFERENCE_CONFIG, ...config};\n            validatePersonInferenceConfig(config);\n            const {\n                segmentation,\n                heatmapScores,\n                offsets,\n                displacementFwd,\n                displacementBwd,\n                padding,\n                internalResolutionHeightAndWidth\n            } =\n                this.segmentPersonActivation(\n                    input, config.internalResolution, config.segmentationThreshold);\n            const [height, width] = segmentation.shape;\n            const result = await segmentation.data() as Uint8Array;\n            segmentation.dispose();\n            const tensorBuffers = await toTensorBuffers3D(\n                [heatmapScores, offsets,
                displacementFwd, displacementBwd]);\n            const [scoresBuf, offsetsBuf, displacementsFwdBuf,
                displacementsBwdBuf] =\n                tensorBuffers;\n            let poses = decodeMultiplePoses(\n                scoresBuf, offsetsBuf,
                displacementsFwdBuf, displacementsBwdBuf,\n                this.baseModel.outputStride, config.maxDetections,\n                config.scoreThreshold,
                config.nmsRadius);\n            poses = scaleAndFlipPoses(\n                poses, [height, width],
                internalResolutionHeightAndWidth, padding,\n                FLIP_POSES_AFTER_SCALING);\n            heatmapScores.dispose();\n            offsets.dispose();\n            displacementFwd.dispose();\n            displacementBwd.dispose();\n            return {height, width, data: result, allPoses: poses};\n        }\n    }\n    /**\n     * Given an image with multiple people, returns
an *array* of\n     * PersonSegmentation object. Each element in the array corresponding to one\n     * of the people in
the input image. In other words, it predicts\n     * instance-level multiple person segmentation & pose for each
person.\n     *\n     * The model does standard ImageNet pre-processing before inferring through\n     * the model. The
image pixels should have values [0-255].\n     *\n     * @param input\n     *
ImageData|HTMLImageElement|HTMLCanvasElement|HTMLVideoElement) The input\n     * image to feed
through the network.\n     *\n     * @param config MultiPersonInferenceConfig
object that contains\n     * parameters for the BodyPix inference using multi-person decoding.\n     *\n     * @return An
array of PersonSegmentation object, each containing a width,\n     * height, a binary array (1 for the pixels that are
part of the\n     * person, and 0 otherwise) and 2D pose. The array size corresponds to the\n     * number of pixels in the
image. The width and height correspond to the\n     * dimensions of the image the binary array is shaped to, which are
the same\n     * dimensions of the input image.\n     */\n    async segmentMultiPerson(\n        input: BodyPixInput,\n        config: MultiPersonInstanceInferenceConfig =\n            MULTI_PERSON_INSTANCE_INFERENCE_CONFIG):\n        Promise<PersonSegmentation[]> {\n            config = {...MULTI_PERSON_INSTANCE_INFERENCE_CONFIG,
            ...config};\n            validateMultiPersonInstanceInferenceConfig(config);\n            const [height, width] =
                getInputSize(input);\n            const internalResolutionHeightAndWidth = toInputResolutionHeightAndWidth(\n                config.internalResolution, this.baseModel.outputStride,\n                [height, width]);\n            const {resized, padding} =\n                padAndResizeTo(input, internalResolutionHeightAndWidth);\n            const {\n                segmentation,\n                longOffsets,\n

```



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heatmapScoresRaw,\n  offsetsRaw,\n  displacementFwdRaw,\n  displacementBwdRaw,\n  } = tf.tidy(() =>
{\n  const {\n    segmentLogits,\n    longOffsets,\n    heatmapScores,\n    offsets,\n    displacementFwd,\n    displacementBwd,\n  } =
this.predictForMultiPersonInstanceSegmentationAndPart(resized);\n  const scaledSegmentScores =
scaleAndCropToInputTensorShape(\n    segmentLogits, [height, width], internalResolutionHeightAndWidth,\n    [[padding.top, padding.bottom], [padding.left, padding.right]],\n    APPLY_SIGMOID_ACTIVATION);\n  const longOffsetsResized = false;\n  let scaledLongOffsets;\n  if (longOffsetsResized) {\n    scaledLongOffsets = scaleAndCropToInputTensorShape(\n      longOffsets, [height, width], internalResolutionHeightAndWidth,\n      [[padding.top, padding.bottom], [padding.left, padding.right]],\n      APPLY_SIGMOID_ACTIVATION);\n  } else {\n    scaledLongOffsets = longOffsets;\n  }\n  const segmentation = toMaskTensor(\n    tf.squeeze(scaledSegmentScores),\n    config.segmentationThreshold);\n  return {\n    segmentation,\n    longOffsets: scaledLongOffsets,\n    heatmapScoresRaw: heatmapScores,\n    offsetsRaw: offsets,\n    displacementFwdRaw: displacementFwd,\n    displacementBwdRaw: displacementBwd,\n  };\n});\nconst tensorBuffers = await toTensorBuffers3D(\n  [heatmapScoresRaw, offsetsRaw, displacementFwdRaw, displacementBwdRaw]);\nconst [scoresBuf,\noffsetsBuf, displacementsFwdBuf, displacementsBwdBuf] =\n  tensorBuffers;\nlet poses =\n  decodeMultiplePoses(\n    scoresBuf, offsetsBuf, displacementsFwdBuf, displacementsBwdBuf,\n    this.baseModel.outputStride, config.maxDetections,\n    config.scoreThreshold, config.nmsRadius);\nposes = scaleAndFlipPoses(\n  poses, [height, width], internalResolutionHeightAndWidth, padding,\n  FLIP_POSES_AFTER_SCALING);\nconst instanceMasks = await decodePersonInstanceMasks(\n  segmentation, longOffsets, poses, height, width,\n  this.baseModel.outputStride,\n  internalResolutionHeightAndWidth, padding,\n  config.scoreThreshold, config.refineSteps,\n  config.minKeypointScore,\n  config.maxDetections);\nresized.dispose();\nsegmentation.dispose();\nlongOffsets.dispose();\nheatmapScoresRaw.dispose();\noffsetsRaw.dispose();\ndisplacementFwdRaw.dispose();\ndisplacementBwdRaw.dispose();\nreturn instanceMasks;\n}\n\n/**\n * Given an image with many people, returns a dictionary containing: height,\n * width, a tensor with a part id from 0-24 for the pixels that are\n * part of a corresponding body part, and -1 otherwise. This does standard\n * ImageNet pre-processing before inferring through the model. The image\n * should have values [0-255].\n * @param input ImageData|HTMLImageElement|HTMLCanvasElement|HTMLVideoElement\n * The input image to feed through the network.\n * @param internalResolution Defaults to 'medium'. The internal resolution\n * percentage that the input is resized to before inference. The larger the\n * internalResolution the more accurate the model at the cost of slower\n * prediction times. Available values are 'low', 'medium', 'high', 'full', or\n * a percentage value between 0 and 1. The values 'low', 'medium', 'high', and\n * 'full' map to 0.25, 0.5, 0.75, and 1.0 correspondingly.\n * @param segmentationThreshold The minimum that segmentation values must have\n * to be considered part of the person. Affects the clipping of the colored\n * part image.\n * @return A dictionary\n * containing `partSegmentation`, `heatmapScores`, `offsets`, and `padding`:\n * - `partSegmentation`: A 2d Tensor with a part id from 0-24 for the pixels that are part of a corresponding body part, and -1 otherwise.\n * - `heatmapScores`: A 3d Tensor of the keypoint heatmaps used by single-person pose estimation decoding.\n * - `offsets`: A 3d Tensor of the keypoint offsets used by single-person pose estimation decoding.\n * - `displacementFwd`: A 3d Tensor of the keypoint forward displacement used by pose estimation decoding.\n * - `displacementBwd`: A 3d Tensor of the keypoint backward displacement used by pose estimation decoding.\n * - `padding`: The padding (unit pixels) being applied to the input image before it is fed into the model.\n */\nsegmentPersonPartsActivation(\n  input: BodyPixInput, internalResolution: BodyPixInternalResolution,\n  segmentationThreshold = 0.5): {\n  partSegmentation: tf.Tensor2D,\n  heatmapScores: tf.Tensor3D,\n  offsets: tf.Tensor3D,\n  displacementFwd: tf.Tensor3D,\n  displacementBwd: tf.Tensor3D,\n  padding: Padding,\n  internalResolutionHeightAndWidth: [number, number]\n } {\n  const

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[height, width] = getInputSize(input);\n  const internalResolutionHeightAndWidth =
toInputResolutionHeightAndWidth(\n    internalResolution, this.baseModel.outputStride, [height, width]);\n
const {\n  resized,\n  padding,\n} = padAndResizeTo(input, internalResolutionHeightAndWidth);\n\n  const {\n    partSegmentation,\n    heatmapScores,\n    offsets,\n    displacementFwd,\n    displacementBwd\n  } =
tf.tidy(() => {\n    const {\n      segmentLogits,\n      partHeatmapLogits,\n      heatmapScores,\n      offsets,\n      displacementFwd,\n      displacementBwd\n    } = this.predictForPersonSegmentationAndPart(resized);\n\n    const [resizedHeight, resizedWidth] = resized.shape;\n\n    const scaledSegmentScores
= scaleAndCropToInputTensorShape(\n      segmentLogits, [height, width], [resizedHeight, resizedWidth],\n      [[padding.top, padding.bottom], [padding.left, padding.right]],\n      APPLY_SIGMOID_ACTIVATION);\n\n    const scaledPartHeatmapScore = scaleAndCropToInputTensorShape(\n      partHeatmapLogits, [height, width],
[resizedHeight, resizedWidth],\n      [[padding.top, padding.bottom], [padding.left, padding.right]],\n      APPLY_SIGMOID_ACTIVATION);\n    const segmentation =\n    toMaskTensor(tf.squeeze(scaledSegmentScores), segmentationThreshold);\n    return {\n      partSegmentation:\n        decodePartSegmentation(segmentation, scaledPartHeatmapScore),\n      heatmapScores,\n      offsets,\n      displacementFwd,\n      displacementBwd,\n    };\n  });\n  resized.dispose();\n  return {\n    partSegmentation,\n    heatmapScores,\n    offsets,\n    displacementFwd,\n    displacementBwd,\n    padding,\n    internalResolutionHeightAndWidth\n  };\n}

/**\n * Given an image with many people, returns a PartSegmentation dictionary that\n * contains
the body part segmentation mask for all people and a single pose.\n * Note: The body part segmentation mask
returned by this method covers all\n * people but the pose works well when there is one person. If you want to\n *
estimate instance-level multiple person body part segmentation & pose for\n * each person, use
`segmentMultiPersonParts` instead.\n * @param input
ImageData|HTMLImageElement|HTMLCanvasElement|HTMLVideoElement)\n * The input image to feed
through the network.\n * @param config PersonInferenceConfig object that contains\n * parameters for the
BodyPix inference using single person decoding.\n * @return A SemanticPartSegmentation dictionary that
contains height, width,\n * the flattened binary segmentation mask and the pose for the person. The\n * width and
height correspond to
the same dimensions of the input image.\n * - `height`: The height of the person part segmentation data in pixel
unit.\n * - `width`: The width of the person part segmentation data in pixel unit.\n * - `data`: The flattened
Int32Array of person part segmentation data with a\n * part id from 0-24 for the pixels that are part of a
corresponding body\n * part, and -1 otherwise. The size of the array is equal to `height` x\n * `width` in row-
major order.\n * - `allPoses`: The 2d poses of all people.\n */
async segmentPersonParts(\n  input:
BodyPixInput,\n  config: PersonInferenceConfig = PERSON_INFERENCE_CONFIG):\n  Promise<SemanticPartSegmentation> {\n  config = {...PERSON_INFERENCE_CONFIG, ...config};\n
validatePersonInferenceConfig(config);\n  const {\n    partSegmentation,\n    heatmapScores,\n    offsets,\n    displacementFwd,\n    displacementBwd,\n    padding,\n    internalResolutionHeightAndWidth\n  } =\n  this.segmentPersonPartsActivation(\n
    input, config.internalResolution, config.segmentationThreshold);\n\n  const [height, width] =
partSegmentation.shape;\n  const data = await partSegmentation.data() as Int32Array;\n
partSegmentation.dispose();\n\n  const tensorBuffers = await toTensorBuffers3D(\n    [heatmapScores, offsets,
displacementFwd, displacementBwd]);\n  const [scoresBuf, offsetsBuf, displacementsFwdBuf,
displacementsBwdBuf] =\n    tensorBuffers;\n\n  let poses = decodeMultiplePoses(\n    scoresBuf, offsetsBuf,
displacementsFwdBuf, displacementsBwdBuf,\n    this.baseModel.outputStride, config.maxDetections,\n    config.scoreThreshold, config.nmsRadius);\n\n  poses = scaleAndFlipPoses(\n    poses, [height, width],
internalResolutionHeightAndWidth, padding,\n    FLIP_POSES_AFTER_SCALING);\n\n  heatmapScores.dispose();\n  offsets.dispose();\n  displacementFwd.dispose();\n  displacementBwd.dispose();\n\n  return {height, width, data,

```

allPoses: poses};\n }\n\n /**\n * Given an image with multiple people, returns an *array* of PartSegmentation\n * object. Each element in the array corresponding to one\n * of the people in the input image. In other words, it\n predicts\n * instance-level multiple person body part segmentation & pose for each\n * person.\n *\n * This\n does standard ImageNet pre-processing before inferring through\n * the model. The image pixels should have\n values [0-255].\n *\n * @param input\n * ImageData|HTMLImageElement|HTMLCanvasElement|HTMLVideoElement) The input\n * image to feed\n through the network.\n *\n * @param config MultiPersonInferenceConfig object that contains\n * parameters for\n the BodyPix inference using multi-person decoding.\n *\n * @return An array of PartSegmentation object, each\n containing a width,\n * height, a flattened array (with part id from 0-24 for the pixels that are\n * part of a\n corresponding body part, and -1 otherwise) and 2D pose.

The width\n * and height correspond to the dimensions of the image. Each flattened part\n * segmentation array\n size is equal to `height` x `width`.\n */\n\n async segmentMultiPersonParts(\n input: BodyPixInput,\n config:\n MultiPersonInstanceInferenceConfig =\n MULTI_PERSON_INSTANCE_INFERENCE_CONFIG):\n Promise<PartSegmentation[]> {\n config = {...MULTI_PERSON_INSTANCE_INFERENCE_CONFIG,\n ...config};\n\n validateMultiPersonInstanceInferenceConfig(config);\n\n const [height, width] =\n getInputSize(input);\n\n const internalResolutionHeightAndWidth = toInputResolutionHeightAndWidth(\n config.internalResolution, this.baseModel.outputStride,\n [height, width]);\n\n const {resized, padding} =\n padAndResizeTo(input, internalResolutionHeightAndWidth);\n\n const {\n segmentation,\n longOffsets,\n heatmapScoresRaw,\n offsetsRaw,\n displacementFwdRaw,\n displacementBwdRaw,\n partSegmentation,\n } = tf.tidy(()\n => {\n const {\n segmentLogits,\n longOffsets,\n heatmapScores,\n offsets,\n displacementFwd,\n displacementBwd,\n partHeatmaps\n } =\n this.predictForMultiPersonInstanceSegmentationAndPart(resized);\n\n // decoding with scaling.\n const\n scaledSegmentScores = scaleAndCropToInputTensorShape(\n segmentLogits, [height, width],\n internalResolutionHeightAndWidth,\n [[padding.top, padding.bottom], [padding.left, padding.right]],\n APPLY_SIGMOID_ACTIVATION);\n\n // decoding with scaling.\n const scaledPartSegmentationScores =\n scaleAndCropToInputTensorShape(\n partHeatmaps, [height, width], internalResolutionHeightAndWidth,\n [[padding.top, padding.bottom], [padding.left, padding.right]],\n APPLY_SIGMOID_ACTIVATION);\n\n const scaledLongOffsets = longOffsets;\n\n const segmentation = toMaskTensor(\n tf.squeeze(scaledSegmentScores), config.segmentationThreshold);\n\n const partSegmentation =\n decodeOnlyPartSegmentation(scaledPartSegmentationScores);\n\n return {\n segmentation,\n longOffsets: scaledLongOffsets,\n heatmapScoresRaw: heatmapScores,\n offsetsRaw: offsets,\n displacementFwdRaw: displacementFwd,\n displacementBwdRaw:\n displacementBwd,\n partSegmentation\n };\n });\n\n const tensorBuffers = await toTensorBuffers3D(\n [heatmapScoresRaw, offsetsRaw, displacementFwdRaw, displacementBwdRaw]);\n\n const [scoresBuf,\n offsetsBuf, displacementsFwdBuf, displacementsBwdBuf] =\n tensorBuffers;\n\n let poses =\n decodeMultiplePoses(\n scoresBuf, offsetsBuf, displacementsFwdBuf, displacementsBwdBuf,\n this.baseModel.outputStride, config.maxDetections,\n config.scoreThreshold, config.nmsRadius);\n\n poses =\n scaleAndFlipPoses(\n poses, [height, width], internalResolutionHeightAndWidth, padding,\n FLIP_POSES_AFTER_SCALING);\n\n const instanceMasks = await decodePersonInstancePartMasks(\n segmentation, longOffsets,\n partSegmentation, poses, height, width,\n this.baseModel.outputStride, internalResolutionHeightAndWidth,\n padding,\n config.scoreThreshold, config.refineSteps, config.minKeypointScore,\n config.maxDetections);\n\n resized.dispose();\n segmentation.dispose();\n longOffsets.dispose();\n\n heatmapScoresRaw.dispose();\n offsetsRaw.dispose();\n displacementFwdRaw.dispose();\n\n displacementBwdRaw.dispose();\n partSegmentation.dispose();\n\n return instanceMasks;\n };\n\n public\n dispose() {\n this.baseModel.dispose();\n }\n}\n\n /**\n * Loads the MobileNet BodyPix model.\n */\n\n async\n function loadMobileNet(config: ModelConfig): Promise<BodyPix> {\n const outputStride = config.outputStride;\n

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const quantBytes = config.quantBytes;\n const multiplier = config.multiplier;\n if (tf == null) {\n   throw new\nError(\n    `Cannot\n\n find TensorFlow.js. If you are using a <script> tag, please ` +\n      `also include @tensorflow/tfjs on the page\nbefore using this`\n    model.`);\n }\n\n const url = mobileNetSavedModel(outputStride, multiplier,\nquantBytes);\n const graphModel = await tfconv.loadGraphModel(config.modelUrl || url);\n const mobilenet = new\nMobileNet(graphModel, outputStride);\n return new BodyPix(mobilenet);\n}\n\n/**\n * Loads the ResNet BodyPix\nmodel.\n */\n\n async function loadResNet(config: ModelConfig): Promise<BodyPix> {\n  const outputStride =\nconfig.outputStride;\n  const quantBytes = config.quantBytes;\n  if (tf == null) {\n    throw new Error(\n\n`Cannot find TensorFlow.js. If you are using a <script> tag, please ` +\n      `also include @tensorflow/tfjs on the\npage before using this`\n    model.`);\n  }\n\n  const url = resNet50SavedModel(outputStride, quantBytes);\n  const\ngraphModel = await tfconv.loadGraphModel(config.modelUrl || url);\n  const resnet = new ResNet(graphModel,\noutputStride);\n  return new BodyPix(resnet);\n}\n\n/**\n * Loads the BodyPix model instance from a checkpoint,\nwith the ResNet\n * or MobileNet architecture. The model to be loaded is configurable using the\n * config\ndictionary ModelConfig. Please find more details in the\n * documentation of the ModelConfig.\n */\n\n @param\nconfig ModelConfig dictionary that contains parameters for\n * the BodyPix loading process. Please find more\ndetails of each parameters\n * in the documentation of the ModelConfig interface. The predefined\n *\n`MOBILENET_V1_CONFIG` and `RESNET_CONFIG` can also be used as references\n * for defining your\ncustomized config.\n */\n\n export async function load(config: ModelConfig = MOBILENET_V1_CONFIG):\nPromise<BodyPix> {\n  config = validateModelConfig(config);\n  if (config.architecture === 'ResNet50') {\n    return\nloadResNet(config);\n  } else if (config.architecture === 'MobileNetV1') {\n    return\nloadMobileNet(config);\n  } else {\n    return null;\n\n  }\n}\n\n","**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache\nLicense, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You\nmay obtain a copy of the License at\n * \n http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required\nby applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS"\nBASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the\nLicense for the specific language governing permissions and\n * limitations under the License.\n *\n\n=====\n\n*/\n\n// method copied from bGlur in https://codepen.io/zhaojun/pen/zZmRQe\n\n export function cpuBlur(\ncanvas: HTMLCanvasElement|OffscreenCanvas,\n  image:\nHTMLImageElement|HTMLVideoElement|HTMLCanvasElement|OffscreenCanvas,\n  blur: number) {\n  const\nctx = canvas.getContext('2d');\n\n  let sum = 0;\n  const delta = 5;\n  const alphaLeft = 1 / (2 * Math.PI * delta * delta);\n  const step = blur < 3 ? 1 :\n2;\n  for (let y = -blur; y <= blur; y += step) {\n    for (let x = -blur; x <= blur; x += step) {\n      const weight =\nalphaLeft * Math.exp(-(x * x + y * y) / (2 * delta * delta));\n      sum += weight;\n    }\n  }\n  for (let y = -blur; y <=\nblur; y += step) {\n    for (let x = -blur; x <= blur; x += step) {\n      ctx.globalAlpha = alphaLeft * \nMath.exp(-(x * x + y * y) / (2 * delta * delta)) / sum * blur;\n      ctx.drawImage(image, x, y);\n    }\n  }\n  ctx.globalAlpha = 1;\n}\n\n","**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed\nunder the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the\nLicense.\n * You may obtain a copy of the License at\n * \n http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable\nlaw or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\nthe specific language governing permissions and\n * limitations under the License.\n *\n\n=====\n\n*/\n\nimport {cpuBlur} from './blur';\nimport {Color, PartSegmentation, PersonSegmentation} from\n './types';\nimport {SemanticPartSegmentation, SemanticPersonSegmentation} from './types';\nimport {getInputSize}\nfrom './util';\n\n export type Canvas = HTMLCanvasElement | OffscreenCanvas;\n\n const offScreenCanvases:
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```
{[name: string]: Canvas} = {};\n\ntype ImageType = HTMLImageElement|HTMLVideoElement|Canvas;\ntype
HasDimensions = {\n  width: number,\n  height: number;\n};\n\nfunction isSafari() {\n  return
(/^(?!chrome|android).*safari/i.test(navigator.userAgent));\n}\n\nfunction assertSameDimensions(\n  { width:
widthA,
height: heightA}: HasDimensions,\n  { width: widthB, height: heightB}: HasDimensions, nameA: string,\n
nameB: string) {\n  if (widthA !== widthB || heightA !== heightB) {\n    throw new Error(`error: dimensions must
match. ${nameA} has dimensions ${\n    widthA}x${heightA}, ${nameB} has dimensions
${widthB}x${heightB}`);\n  }\n}\n\nfunction flipCanvasHorizontal(canvas: Canvas) {\n  const ctx =
canvas.getContext('2d');\n  ctx.scale(-1, 1);\n  ctx.translate(-canvas.width, 0);\n}\n\nfunction
drawWithCompositing(\n  ctx: CanvasRenderingContext2D|OffscreenCanvasRenderingContext2D,\n  image:
Canvas|ImageType,\n  compositeOperation: string) {\n  ctx.globalCompositeOperation = compositeOperation;\n
ctx.drawImage(image, 0, 0);\n}\n\nfunction createOffScreenCanvas(): Canvas {\n  if (typeof document !==
'undefined') {\n    return document.createElement('canvas');\n  } else if (typeof OffscreenCanvas !== 'undefined')
{\n    return new OffscreenCanvas(0, 0);\n  } else {\n    throw
new Error('Cannot create a canvas in this context');\n  }\n}\n\nfunction ensureOffscreenCanvasCreated(id: string):
Canvas {\n  if (!offScreenCanvases[id]) {\n    offScreenCanvases[id] = createOffScreenCanvas();\n  }\n  return
offScreenCanvases[id];\n}\n\nfunction drawAndBlurImageOnCanvas(\n  image: ImageType, blurAmount:
number, canvas: Canvas) {\n  const {height, width} = image;\n  const ctx = canvas.getContext('2d');\n  canvas.width
= width;\n  canvas.height = height;\n  ctx.clearRect(0, 0, width, height);\n  ctx.save();\n  if (isSafari()) {\n
cpuBlur(canvas, image, blurAmount);\n  } else {\n    // tslint:disable:no-any\n    (ctx as any).filter =
`blur(${blurAmount}px)`;\n    ctx.drawImage(image, 0, 0, width, height);\n  }\n  ctx.restore();\n}\n\nfunction
drawAndBlurImageOnOffScreenCanvas(\n  image: ImageType, blurAmount: number,\n  offscreenCanvasName:
string): Canvas {\n  const canvas = ensureOffscreenCanvasCreated(offscreenCanvasName);\n  if (blurAmount ===
0) {\n    renderImageToCanvas(image,
canvas);\n  } else {\n    drawAndBlurImageOnCanvas(image, blurAmount, canvas);\n  }\n  return
canvas;\n}\n\nfunction renderImageToCanvas(image: ImageType, canvas: Canvas) {\n  const {width, height} =
image;\n  canvas.width = width;\n  canvas.height = height;\n  const ctx = canvas.getContext('2d');\n  \n
ctx.drawImage(image, 0, 0, width, height);\n}\n\n/**\n * Draw an image on a canvas\n */\nfunction
renderImageDataToCanvas(image: ImageData, canvas: Canvas) {\n  canvas.width = image.width;\n  canvas.height
= image.height;\n  const ctx = canvas.getContext('2d');\n  \n  ctx.putImageData(image, 0, 0);\n}\n\nfunction
renderImageDataToOffScreenCanvas(\n  image: ImageData, canvasName: string): Canvas {\n  const canvas =
ensureOffscreenCanvasCreated(canvasName);\n  renderImageDataToCanvas(image, canvas);\n  \n  return
canvas;\n}\n\n/**\n * Given the output from estimating multi-person segmentation, generates an\n * image with
foreground and background color at each pixel determined
by the\n * corresponding binary segmentation value at the pixel from the output. In\n * other words, pixels where
there is a person will be colored with foreground\n * color and where there is not a person will be colored with
background color.\n */\n * @param personOrPartSegmentation The output from\n * `segmentPerson`,
`segmentMultiPerson`,\n * `segmentPersonParts` or `segmentMultiPersonParts`. They can\n * be
SemanticPersonSegmentation object, an array of PersonSegmentation object,\n * SemanticPartSegmentation object,
or an array of PartSegmentation object.\n */\n * @param foreground Default to {r:0, g:0, b:0, a: 0}. The foreground
color\n * (r,g,b,a) for visualizing pixels that belong to people.\n */\n * @param background Default to {r:0, g:0, b:0,
a: 255}. The background color\n * (r,g,b,a) for visualizing pixels that don't belong to people.\n */\n * @param
drawContour Default to false. Whether to draw the contour around each\n * person's segmentation mask or body
part mask.\n */\n * @param foregroundIds Default to [1]. The integer values that represent\n * foreground. For person
segmentation, 1 is the foreground. For body part\n * segmentation, it can be a subset of all body parts ids.\n */\n *
@returns An ImageData with the same width and height of\n * all the PersonSegmentation in
multiPersonSegmentation, with opacity and\n * transparency at each pixel determined by the corresponding binary\n
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* segmentation value at the pixel from the output.\n */
export function toMask(\n  personOrPartSegmentation:
SemanticPersonSegmentation|\n SemanticPartSegmentation|PersonSegmentation[]|PartSegmentation[],\n
foreground: Color = {\n   r: 0,\n   g: 0,\n   b: 0,\n   a: 0\n },\n background: Color = {\n   r: 0,\n   g: 0,\n   b: 0,\n   a: 255\n },\n drawContour = false, foregroundIds: number[] = [1]): ImageData {\n  if
(Array.isArray(personOrPartSegmentation) &&\n   personOrPartSegmentation.length === 0) {\n   return null;\n
}\n\n  let multiPersonOrPartSegmentation:\n   Array<SemanticPersonSegmentation|SemanticPartSegmentation|\n
PersonSegmentation|PartSegmentation>;\n\n  if (!Array.isArray(personOrPartSegmentation)) {\n
multiPersonOrPartSegmentation = [personOrPartSegmentation];\n  } else {\n   multiPersonOrPartSegmentation =
personOrPartSegmentation;\n  }\n\n  const {width, height} = multiPersonOrPartSegmentation[0];\n  const bytes =
new Uint8ClampedArray(width * height * 4);\n\n  function drawStroke(\n   bytes: Uint8ClampedArray, row:
number, column: number, width: number,\n   radius: number, color: Color = {r: 0, g: 255, b: 255, a: 255}) {\n
for (let i = -radius; i <= radius; i++) {\n   for (let j = -radius; j <= radius; j++) {\n   if (i !== 0 && j !== 0) {\n
const n = (row + i) * width + (column + j);\n   bytes[4 * n + 0] = color.r;\n   bytes[4 * n + 1] = color.g;\n
bytes[4 * n + 2] = color.b;\n   bytes[4 * n + 3] = color.a;\n
}\n   }\n }\n }\n\n  function isSegmentationBoundary(\n   segmentationData: Uint8Array|Int32Array,\n
row: number,\n   column: number,\n   width: number,\n   foregroundIds: number[] = [1],\n   radius = 1,\n
): boolean {\n   let numberBackgroundPixels = 0;\n   for (let i = -radius; i <= radius; i++) {\n   for (let j = -radius;
j <= radius; j++) {\n   if (i !== 0 && j !== 0) {\n   const n = (row + i) * width + (column + j);\n   if
(!foregroundIds.some(id => id === segmentationData[n])) {\n   numberBackgroundPixels += 1;\n   }\n
}\n   }\n }\n   return numberBackgroundPixels > 0;\n }\n\n  for (let i = 0; i < height; i += 1) {\n   for (let j = 0; j
< width; j += 1) {\n   const n = i * width + j;\n   bytes[4 * n + 0] = background.r;\n   bytes[4 * n + 1] =
background.g;\n   bytes[4 * n + 2] = background.b;\n   bytes[4 * n + 3] = background.a;\n   for (let k = 0; k <
multiPersonOrPartSegmentation.length;\n
k++) {\n   if (foregroundIds.some(\n   id => id === multiPersonOrPartSegmentation[k].data[n])) {\n
bytes[4 * n] = foreground.r;\n   bytes[4 * n + 1] = foreground.g;\n   bytes[4 * n + 2] = foreground.b;\n
bytes[4 * n + 3] = foreground.a;\n   const isBoundary = isSegmentationBoundary(\n
multiPersonOrPartSegmentation[k].data, i, j, width,\n   foregroundIds);\n   if (drawContour && i - 1 >= 0
&& i + 1 < height && j - 1 >= 0 &&\n   j + 1 < width && isBoundary) {\n   drawStroke(bytes, i, j,
width, 1);\n   }\n   }\n }\n }\n\n  return new ImageData(bytes, width, height);\n }\n\n  const
RAINBOW_PART_COLORS: Array<[number, number, number]> = [\n   [110, 64, 170], [143, 61, 178], [178, 60,
178], [210, 62, 167],\n   [238, 67, 149], [255, 78, 125], [255, 94, 99], [255, 115, 75],\n   [255, 140, 56], [239, 167,
47], [217, 194, 49], [194, 219, 64],\n   [175, 240, 91], [135, 245, 87], [96, 247, 96], [64, 243, 115],\n   [40, 234, 141], [28, 219, 169], [26, 199, 194], [33,
176, 213],\n   [47, 150, 224], [65, 125, 224], [84, 101, 214], [99, 81, 195]\n ];\n\n  /*\n   * Given the output from
person body part segmentation (or multi-person\n   * instance body part segmentation) and an array of colors indexed
by part id,\n   * generates an image with the corresponding color for each part at each pixel,\n   * and white pixels
where there is no part.\n   */\n   * @param partSegmentation The output from segmentPersonParts\n   * or
segmentMultiPersonParts. The former is a SemanticPartSegmentation\n   * object and later is an array of
PartSegmentation object.\n   * @param partColors A multi-dimensional array of rgb colors indexed by\n   * part id.
Must have 24 colors, one for every part.\n   * @returns An ImageData with the same width and height of all the
element in\n   * multiPersonPartSegmentation, with the corresponding color for each part at\n   * each pixel, and
black pixels where there is no part.\n   */\n   * export function toColoredPartMask(\n   partSegmentation:
SemanticPartSegmentation|PartSegmentation[],\n   partColors: Array<[number, number, number]> =\n
RAINBOW_PART_COLORS): ImageData {\n   if (Array.isArray(partSegmentation) && partSegmentation.length
=== 0) {\n   return null;\n   }\n\n   let multiPersonPartSegmentation;\n   if (!Array.isArray(partSegmentation)) {\n
multiPersonPartSegmentation = [partSegmentation];\n   } else {\n   multiPersonPartSegmentation =
partSegmentation;\n   }\n\n   const {width, height} = multiPersonPartSegmentation[0];\n   const bytes = new
Uint8ClampedArray(width * height * 4);\n\n   for (let i = 0; i < height * width; ++i) {\n   // invert mask. Invert the

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segmentation mask.\n  const j = i * 4;\n  bytes[j + 0] = 255;\n  bytes[j + 1] = 255;\n  bytes[j + 2] = 255;\n  bytes[j + 3] = 255;\n  for (let k = 0; k < multiPersonPartSegmentation.length; k++) {\n    const partId =
multiPersonPartSegmentation[k].data[i];\n
    if (partId !== -1) {\n      const color = partColors[partId];\n      if (!color) {\n        throw new Error('No color
could be found for part id ${partId}');\n      }\n      bytes[j + 0] = color[0];\n      bytes[j + 1] = color[1];\n
      bytes[j + 2] = color[2];\n      bytes[j + 3] = 255;\n    }\n  }\n  return new ImageData(bytes, width,
height);\n}\n\nconst CANVAS_NAMES = {\n  blurred: 'blurred',\n  blurredMask: 'blurred-mask',\n  mask: 'mask',\n
  lowresPartMask: 'lowres-part-mask',\n};\n\n/**\n * Given an image and a maskImage of type ImageData, draws the
image with the\n * mask on top of it onto a canvas.\n * \n * @param canvas The canvas to be drawn onto.\n * \n *
@param image The original image to apply the mask to.\n * \n * @param maskImage An ImageData containing the
mask. Ideally this should be\n * generated by toMask or toColoredPartMask.\n * \n * @param maskOpacity The
opacity of the mask when drawing it on top of the\n * image. Defaults
to 0.7. Should be a float between 0 and 1.\n * \n * @param maskBlurAmount How many pixels to blur the mask by.
Defaults to 0.\n * \n * Should be an integer between 0 and 20.\n * \n * @param flipHorizontal If the result should be
flipped horizontally. Defaults\n * to false.\n */\n\nexport function drawMask(\n  canvas: Canvas, image: ImageType,
maskImage: ImageData|null,\n  maskOpacity = 0.7, maskBlurAmount = 0, flipHorizontal = false) {\n  const
[height, width] = getInputSize(image);\n  canvas.width = width;\n  canvas.height = height;\n\n  const ctx =
canvas.getContext('2d');\n  ctx.save();\n  if (flipHorizontal) {\n    flipCanvasHorizontal(canvas);\n  }\n\n  ctx.drawImage(image, 0, 0);\n\n  ctx.globalAlpha = maskOpacity;\n  if (maskImage) {\n
    assertSameDimensions({width, height}, maskImage, 'image', 'mask');\n\n    const mask =
renderImageDataToOffScreenCanvas(maskImage, CANVAS_NAMES.mask);\n\n    const blurredMask =
drawAndBlurImageOnOffScreenCanvas(\n      mask, maskBlurAmount,
CANVAS_NAMES.blurredMask);\n    ctx.drawImage(blurredMask, 0, 0, width, height);\n  }\n  ctx.restore();\n}\n\n/**\n * Given an image and a maskImage of type ImageData, draws the image with the\n *
pixelated mask on top of it onto a canvas.\n * \n * @param canvas The canvas to be drawn onto.\n * \n * @param
image The original image to apply the mask to.\n * \n * @param maskImage An ImageData containing the mask.
Ideally this should be\n * generated by toColoredPartMask.\n * \n * @param maskOpacity The opacity of the mask
when drawing it on top of the\n * image. Defaults to 0.7. Should be a float between 0 and 1.\n * \n * @param
maskBlurAmount How many pixels to blur the mask by. Defaults to 0.\n * \n * Should be an integer between 0 and 20.\n * \n * @param flipHorizontal If the result should be flipped horizontally. Defaults\n * to false.\n * \n * @param
pixelCellWidth The width of each pixel cell. Default to 10 px.\n */\n\nexport function drawPixelatedMask(\n
canvas: Canvas, image: ImageType,
maskImage: ImageData,\n  maskOpacity = 0.7, maskBlurAmount = 0, flipHorizontal = false,\n  pixelCellWidth =
10.0) {\n  const [height, width] = getInputSize(image);\n  assertSameDimensions({width, height}, maskImage,
'image', 'mask');\n\n  const mask = renderImageDataToOffScreenCanvas(maskImage, CANVAS_NAMES.mask);\n
  const blurredMask = drawAndBlurImageOnOffScreenCanvas(\n    mask, maskBlurAmount,
CANVAS_NAMES.blurredMask);\n\n  canvas.width = blurredMask.width;\n  canvas.height =
blurredMask.height;\n\n  const ctx = canvas.getContext('2d');\n  ctx.save();\n  if (flipHorizontal) {\n
    flipCanvasHorizontal(canvas);\n  }\n\n  const offscreenCanvas =\n  ensureOffscreenCanvasCreated(CANVAS_NAMES.lowresPartMask);\n  const offscreenCanvasCtx =
offscreenCanvas.getContext('2d');\n  offscreenCanvas.width = blurredMask.width * (1.0 / pixelCellWidth);\n
  offscreenCanvas.height = blurredMask.height * (1.0 / pixelCellWidth);\n  offscreenCanvasCtx.drawImage(\n
blurredMask, 0, 0, blurredMask.width,
blurredMask.height, 0, 0,\n    offscreenCanvas.width, offscreenCanvas.height);\n  ctx.imageSmoothingEnabled =
false;\n  ctx.drawImage(\n    offscreenCanvas, 0, 0, offscreenCanvas.width, offscreenCanvas.height, 0,\n    0,
canvas.width, canvas.height);\n\n  // Draws vertical grid lines that are `pixelCellWidth` apart from each other.\n
  for (let i = 0; i < offscreenCanvas.width; i++) {\n    ctx.beginPath();\n    ctx.strokeStyle = '#ffffff';\n
    ctx.moveTo(pixelCellWidth * i, 0);\n    ctx.lineTo(pixelCellWidth * i, canvas.height);\n    ctx.stroke();\n  }\n\n  //

```

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Draws horizontal grid lines that are `pixelCellWidth` apart from each
// other.
for (let i = 0; i <
offscreenCanvas.height; i++) {
  ctx.beginPath();
  ctx.strokeStyle = '#ffffff';
  ctx.moveTo(0, pixelCellWidth
* i);
  ctx.lineTo(canvas.width, pixelCellWidth * i);
  ctx.stroke();
}
ctx.globalAlpha = 1.0 -
maskOpacity;
ctx.drawImage(image, 0, 0, blurredMask.width, blurredMask.height);
ctx.restore();
}
function createPersonMask(
  multiPersonSegmentation:
PersonSegmentation[] | SemanticPersonSegmentation,
  edgeBlurAmount: number): Canvas {
  const
backgroundMaskImage = toMask(
  multiPersonSegmentation, {r: 0, g: 0, b: 0, a: 255},
  {r: 0, g: 0, b: 0, a:
0});
  const backgroundMask =
  renderImageDataToOffScreenCanvas(backgroundMaskImage,
CANVAS_NAMES.mask);
  if (edgeBlurAmount === 0) {
    return backgroundMask;
  } else {
    return
drawAndBlurImageOnOffScreenCanvas(
  backgroundMask, edgeBlurAmount,
CANVAS_NAMES.blurredMask);
  }
}
/**
 * Given a personSegmentation and an image, draws the image
with its background
 * blurred onto the canvas.
 *
 * @param canvas The canvas to draw the background-blurred
image onto.
 * @param image The image to blur the background of and draw.
 * @param
personSegmentation A SemanticPersonSegmentation or an array of
 * PersonSegmentation object.
 * @param
backgroundBlurAmount
How many pixels in the background blend into each
 * other. Defaults to 3. Should be an integer between 1 and
20.
 * @param edgeBlurAmount How many pixels to blur on the edge between the person
 * and the
background by. Defaults to 3. Should be an integer between 0 and 20.
 * @param flipHorizontal If the output
should be flipped horizontally. Defaults
 * to false.
 */
export function drawBokehEffect(
  canvas: Canvas,
image: ImageType,
  multiPersonSegmentation: SemanticPersonSegmentation | PersonSegmentation[],
backgroundBlurAmount = 3, edgeBlurAmount = 3, flipHorizontal = false) {
  const blurredImage =
drawAndBlurImageOnOffScreenCanvas(
  image, backgroundBlurAmount, CANVAS_NAMES.blurred);
  canvas.width = blurredImage.width;
  canvas.height = blurredImage.height;
  const ctx =
canvas.getContext('2d');
  if (Array.isArray(multiPersonSegmentation) &&
  multiPersonSegmentation.length
=== 0) {
    ctx.drawImage(blurredImage,
0, 0);
    return;
  }
  const personMask = createPersonMask(multiPersonSegmentation, edgeBlurAmount);
  ctx.save();
  if (flipHorizontal) {
    flipCanvasHorizontal(canvas);
  }
  // draw the original image on the final
canvas
  const [height, width] = getInputSize(image);
  ctx.drawImage(image, 0, 0, width, height);
  //
"destination-in" - "The existing canvas content is kept where both the
// new shape and existing canvas content
overlap. Everything else is made
// transparent."
  // crop what's not the person using the mask from the original
image
  drawWithCompositing(ctx, personMask, 'destination-in');
  //
"destination-over" - "The existing canvas
content is kept where both the
// new shape and existing canvas content overlap. Everything else is made
//
transparent."
  // draw the blurred background on top of the original image where it doesn't
// overlap.
  drawWithCompositing(ctx, blurredImage, 'destination-over');
  ctx.restore();
}
function
createBodyPartMask(
  multiPersonPartSegmentation: SemanticPartSegmentation | PartSegmentation[],
bodyPartIdsToMask: number[], edgeBlurAmount: number): Canvas {
  const backgroundMaskImage = toMask(
  multiPersonPartSegmentation, {r: 0, g: 0, b: 0, a: 0},
  {r: 0, g: 0, b: 0, a: 255}, true, bodyPartIdsToMask);
  const backgroundMask =
  renderImageDataToOffScreenCanvas(backgroundMaskImage,
CANVAS_NAMES.mask);
  if (edgeBlurAmount === 0) {
    return backgroundMask;
  } else {
    return
drawAndBlurImageOnOffScreenCanvas(
  backgroundMask, edgeBlurAmount,
CANVAS_NAMES.blurredMask);
  }
}
/**
 * Given a personSegmentation and an image, draws the image
with its background
 * blurred onto the canvas.
 *
 * @param canvas The canvas to draw the background-blurred
image onto.
 * @param image The image to blur the background of and draw.
 * @param
partSegmentation A SemanticPartSegmentation or an array of
 * PartSegmentation
object.
 * @param bodyPartIdsToBlur Default to [0, 1] (left-face and right-face). An
 * array of body part ids
to blur. Each must be one of the 24 body part ids.
 * @param backgroundBlurAmount How many pixels in the
background blend into each
 * other. Defaults to 3. Should be an integer between 1 and 20.
 * @param
edgeBlurAmount How many pixels to blur on the edge between the person
 * and the background by. Defaults to

```



```

3. Should be an integer between 0 and 20.\n * \n * @param flipHorizontal If the output should be flipped
horizontally. Defaults\n * to false.\n * /\nexport function blurBodyPart(\n  canvas: Canvas, image: ImageType,\n  partSegmentation: SemanticPartSegmentation|PartSegmentation[],\n  bodyPartIdsToBlur = [0, 1],\n  backgroundBlurAmount = 3, edgeBlurAmount = 3,\n  flipHorizontal = false) {\n  const blurredImage =
drawAndBlurImageOnOffScreenCanvas(\n    image, backgroundBlurAmount, CANVAS_NAMES.blurred);\n  canvas.width = blurredImage.width;\n  canvas.height = blurredImage.height;\n  const ctx = canvas.getContext('2d');\n  if
(Array.isArray(partSegmentation) && partSegmentation.length === 0) {\n    ctx.drawImage(blurredImage, 0, 0);\n  }
return;\n} \n const bodyPartMask =\n  createBodyPartMask(partSegmentation, bodyPartIdsToBlur,
edgeBlurAmount);\n  ctx.save();\n  if (flipHorizontal) {\n    flipCanvasHorizontal(canvas);\n  } \n // draw the
original image on the final canvas\n  const [height, width] = getInputSize(image);\n  ctx.drawImage(image, 0, 0,
width, height);\n  // \"destination-in\" - \"The existing canvas content is kept where both the\n  // new shape and
existing canvas content overlap. Everything else is made\n  // transparent.\" \n // crop what's not the person using the
mask from the original image\n  drawWithCompositing(ctx, bodyPartMask, 'destination-in');\n  // \"destination-
over\" - \"The existing canvas content is kept where both the\n  // new shape and existing canvas content overlap.
Everything else is made\n  // transparent.\" \n // draw the blurred background on top of the original image where it
doesn't\n  // overlap.\n  drawWithCompositing(ctx, blurredImage, 'destination-over');\n  ctx.restore();\n} \n\", \"/*\n *
@license\n * Copyright 2020 Google Inc. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0
(the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of
the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n * \n *
===== \n
*/\n\nexport const PART_CHANNELS: string[] = [\n
'left_face',\n 'right_face',\n 'left_upper_arm_front',\n 'left_upper_arm_back',\n 'right_upper_arm_front',\n
'right_upper_arm_back',\n 'left_lower_arm_front',\n 'left_lower_arm_back',\n 'right_lower_arm_front',\n
'right_lower_arm_back',\n 'left_hand',\n 'right_hand',\n 'torso_front',\n 'torso_back',\n 'left_upper_leg_front',\n
'left_upper_leg_back',\n 'right_upper_leg_front',\n 'right_upper_leg_back',\n 'left_lower_leg_front',\n
'left_lower_leg_back',\n 'right_lower_leg_front',\n 'right_lower_leg_back',\n 'left_feet',\n 'right_feet'];\n\"/*
@license See the LICENSE file. */\n\n// This code is auto-generated, do not modify this file!\nconst version =
'2.2.0';\nexport
{ version};\n\"], \"names\": [\"toFlattenedOneHotPartMap\", \"partHeatmapScores\", \"numParts\", \"shape\", \"partMapLocation
s\", \"tf.argmax\", \"partMapFlattened\", \"tf.reshape\", \"tf.oneHot\", \"clipByMask2d\", \"image\", \"mask\", \"tf.mul\", \"toMaskTens
or\", \"segmentScores\", \"threshold\", \"tf.tidy\", \"tf.cast\", \"tf.greater\", \"tf.scalar\", \"decodePartSegmentation\", \"segmentation
Mask\", \"_a\", \"partMapHeight\", \"partMapWidth\", \"flattenedMap\", \"partNumbers\", \"tf.expandDims\", \"tf.range\", \"tf.matM
ul\", \"partMap\", \"partMapShiftedUpForClipping\", \"tf.add\", \"tf.sub\", \"decodeOnlyPartSegmentation\", \"model\", \"outputStr
ide\", \"this\", \"inputShape\", \"inputs\", \"tf.util\", \"assert\", \"BaseModel\", \"input\", \"asFloat\", \"_this\", \"preprocessInput\", \"asBatc
h\", \"results3d\", \"predict\", \"map\", \"y\", \"tf.squeeze\", \"namedResults\", \"nameOutputResults\", \"heatmapScores\", \"tf.sigmoid\",
\"heatmap\", \"offsets\", \"displacementFwd\", \"displacementBwd\", \"segmentation\", \"partHeatmaps\", \"longOffsets\", \"partOf
fsets\", \"dispose\", \"__extends\", \"MobileNet\", \"tf.div\", \"results\", \"PART_NAMES\", \"NUM_KEYPOINTS\", \"length\", \"PA
RT_IDS\", \"reduce\", \"result\", \"jointName\", \"i\", \"CONNECTED_PART_NAMES\", \"POSE_CHAIN\", \"CONNECTED_P
ART_INDICES\", \"jointNameA\", \"jointNameB\", \"getScale\", \"_b\", \"padding\", \"height\", \"width\", \"inputResolutionY\", \"inp
utResolutionX\", \"padT\", \"padB\", \"getOffsetPoint\", \"x\", \"keypoint\", \"get\", \"getImageCoords\", \"part\", \"heatmapX\", \"heatm
apY\", \"clamp\", \"a\", \"min\", \"max\", \"squaredDistance\", \"y1\", \"x1\", \"y2\", \"x2\", \"dy\", \"dx\", \"addVectors\", \"b\", \"computeDistan
ce\", \"embedding\", \"pose\", \"minPartScore\", \"distance\", \"numKpt\", \"p\", \"keypoints\", \"score\", \"Math\", \"position\", \"Infinity\",
\"convertToPositionInOuput\", \"stride\", \"padL\", \"scaleX\", \"scaleY\", \"round\", \"getEmbedding\", \"location\", \"keypointIndex\",
\"convertToPosition\", \"outputResolutionX\", \"refineSteps\", \"newLocation\", \"nn\", \"t\", \"newPos\", \"nn_1\", \"matchEmbeddin

```

gToInstance","poses","numKptForMatching","_c","embed","pair","keypointsIndex","push","kMin","kMinDist","k","dist","getOutputResolution","decodeMultipleMasksCPU","posesAboveScore","inHeight","inWidth","dataArrays","Uint8Array","fill","j","n","decodeMultiplePartMasksCPU","partSegmentaion","Int32Array","decodeMultipleMask sWebGl","minKptScore","maxNumPeople","origHeight","origWidth","slice","outHeight","outWidth","shapedLong Offsets","poseVals","Float32Array","poseOffset","kp","offset","_d","posesTensor","tf.tensor","program","variable Names","outputShape","userCode","tf.backend","compileAndRun","toPersonKSegmentation","tf.equal","toPersonK PartSegmentation","bodyParts","isWebGIBackend","getBackend","decodePersonInstanceMasks","minPoseScore"," minKeypointScore","filter","personSegmentations","masksTensorInfo","masksTensor","tf.engine","makeTensorFro mDataId","dataId","dtype","_","Promise","all","data","personSegmentationsData","forEach","segmentationsData"," longOffsetsData","decodePersonInstancePartMasks","partSegmentation","partSegmentations","partSegmentationsB yPersonData","partSegmentaionData","half","floor","maxSize","getElementValue","priorityQueue","Array","numb erOfElements","MaxHeap","swim","exchange","sink","less","getValueAt","scoreIsMaximumInLocalWindow","key pointId","localMaximumRadius","scores","localMaximum","yStart","yEnd","yCurrent","xStart","xEnd","xCurrent", "buildPartWithScoreQueue","scoreThreshold","numKeypoints","queue","enqueue","id","parentChildrenTuples","pa rentJoinName","childJoinName","parentToChildEdges","childToParentEdges","getDisplacement","edgeId","point", "displacements","numEdges","getStridedIndexNearPoint","traverseToTargetKeypoint","sourceKeypoint","targetKe ypointId","scoresBuffer","offsetRefineStep","displacement","targetKeypoint","targetKeypointIndices","offsetPoint ", "targetKeyPointIndices","decodePose","root","displacementsFwd","displacementsBwd","instanceKeypoints","root Part","rootScore","rootPoint","edge","sourceKeypointId","withinNmsRadiusOfCorrespondingPoint","squaredNmsR adius","some","correspondingKeypoint","getInstanceScore","existingPoses","kLocalMaximumRadius","decodeMul tiplePoses","offsetsBuffer","displacementsFwdBuffer","displacementsBwdBuffer","maxPoseDetections","nmsRadi us","empty","dequeue","imageNetMean","ResNet","RESNET50_BASE_URL","MOBILENET_BASE_URL","res Net50SavedModel","quantBytes","graphJson","mobileNetSavedModel","multiplier","toStr","1","0.75","0.5","getSi zeFromImageLikeElement","offsetHeight","offsetWidth","Error","getSizeFromVideoElement","hasAttribute","vide oHeight","videoWidth","getInputSize","HTMLCanvasElement","OffscreenCanvas","HTMLImageElement","Image Data","HTMLVideoElement","tf.Tensor","isValidInputResolution","resolution","toValidInputResolution","inputRe solution","INTERNAL_RESOLUTION_STRING_OPTIONS","low","medium","high","full","INTERNAL_RESO LUTION_PERCENTAGES","MIN_INTERNAL_RESOLUTION","MAX_INTERNAL_RESOLUTION","toIntern alResolutionPercentage","internalResolution","Object","values","join","toInputResolutionHeightAndWidth","input Height","inputWidth","internalResolutionPercentage","toInputTensor","tf.browser","fromPixels","resizeAndPadTo", "imageTensor","flipHorizontal","targetH","targetW","resizeW","resizeH","padR","aspect","padHeight","ceil","pad Width","resizedAndPadded","resized","tf.image","resizeBilinear","tf.reverse","tf.pad3d","paddedBy","scaleAndCro pToInputTensorShape","tensor","applySigmoidActivation","inputTensorHeight","inputTensorWidth","resizedAndP addedHeight","resizedAndPaddedWidth","_e","inResizedAndPadded","removePaddingAndResizeBack","originalH eight","originalWidth","batchedImage","cropAndResize","padAndResizeTo","targetAspect","top","left","right","bot tom","toTensorBuffers3D","tensors","buffer","scalePose","offsetY","offsetX","scalePoses","flipPoseHorizontal","i mageWidth","flipPosesHorizontal","scaleAndFlipPoses","inputResolutionHeight","inputResolutionWidth","scaledP oses","APPLY_SIGMOID_ACTIVATION","FLIP_POSES_AFTER_SCALING","MOBILENET_V1_CONFIG"," architecture","VALID_ARCHITECTURE","VALID_STRIDE","MobileNetV1","ResNet50","VALID_MULTIPLE R","VALID_QUANT_BYTES","validateModelConfig","config","indexOf","PERSON_INFERENCE_CONFIG","s egmentationThreshold","maxDetections","MULTI_PERSON_INSTANCE_INFERENCE_CONFIG","validatePerso nInferenceConfig","validateMultiPersonInstanceInferenceConfig","net","baseModel","BodyPix","segmentLogits"," partHeatmapLogits","internalResolutionHeightAndWidth","predictForPersonSegmentation","resizedHeight","resize dWidth","scaledSegmentScores","segmentPersonActivation","tensorBuffers","scoresBuf","offsetsBuf","displaceme ntsFwdBuf","displacementsBwdBuf","allPoses","scaledLongOffsets","predictForMultiPersonInstanceSegmentation AndPart","heatmapScoresRaw","offsetsRaw","displacementFwdRaw","displacementBwdRaw","instanceMasks","pr edictForPersonSegmentationAndPart","scaledPartHeatmapScore","segmentPersonPartsActivation","scaledPartSegm entationScores","loadMobileNet","tf","url","tfconv.loadGraphModel","modelUrl","graphModel","mobilenet","load

ResNet","resnet","load","cpuBlur","canvas","blur","ctx","getContext","sum","alphaLeft","PI","step","exp","globalAlpha","drawImage","offScreenCanvases","isSafari","test","navigator","userAgent","assertSameDimensions","nameA","nameB","widthA","heightA","widthB","heightB","flipCanvasHorizontal","scale","translate","drawWithCompositing","compositeOperation","globalCompositeOperation","createOffScreenCanvas","document","createElement","ensureOffscreenCanvasCreated","drawAndBlurImageOnCanvas","blurAmount","clearRect","save","restore","drawAndBlurImageOnOffScreenCanvas","offscreenCanvasName","renderImageToCanvas","renderImageDataToCanvas","putImageData","renderImageDataToOffScreenCanvas","canvasName","toMask","personOrPartSegmentation","foreground","background","drawContour","foregroundIds","r","g","isArray","multiPersonOrPartSegmentation","bytes","Uint8ClampedArray","drawStroke","row","column","radius","color","isSegmentationBoundary","segmentationData","numberBackgroundPixels","n_1","isBoundary","RAINBOW_PART_COLORS","toColoredPartMask","partColors","multiPersonPartSegmentation","partId","CANVAS_NAMES","blurred","blurredMask","lowresPartMask","drawMask","maskImage","maskOpacity","maskBlurAmount","drawPixelatedMask","pixelCellWidth","offscreenCanvas","offscreenCanvasCtx","imageSmoothingEnabled","beginPath","strokeStyle","moveTo","lineTo","stroke","createPersonMask","multiPersonSegmentation","edgeBlurAmount","backgroundMask","drawBokehEffect","backgroundBlurAmount","blurredImage","personMask","createBodyPartMask","bodyPartIdsToMask","blurBodyPart","bodyPartIdsToBlur","bodyPartMask","PART_CHANNELS","version"],"mappings":":;;;;;;;;;;;;;otEAYBA,SAASA,yBAAyBC,GAChC,IAAMC,EAAWD,EAakBE,MAAM,GACnCC,EAAmBC,OAAUJ,EAAMb,GAehDK,EAAmBC,QAAWH,IAAoB,IAExD,OAAOI,OAAUF,EAakBJ,GAGrC,SAASO,aAAaC,EAAoBC,GACxC,OAAOC,IAAOF,EAAOC,GAGbVb,SAAGBE,aACZC,EAA4BC,GAC9B,OAAOC,KACH,WACI,OAACC,KAAQC,QACLJ,EAAeK,OAAUJ,IAAa,WakBpD,SAAGBK,uBACZC,EACApB,GACI,IAAAqB,EAA0CrB,EAakBE,MAA3DoB,OAAeC,OAAcB,OACpC,OAAOc,KAAQ,WACb,IAAMS,EAAezB,yBAAYBC,GACxCyB,EAAcC,WAAcC,MAAS,EAAgIB,EAAU,EAAG,SAAU,GAEdI,EACFW,KAAQY,OAAUJ,EAAcC,GAA6B,SAE3DI,EAAUvB,QAAWD,GAAmBiB,EAAeC,IAEvDO,EAA8BC,IAAOF,EAASX,OAAU,EAAG,UAejE,OAAOc,IAAOxB,aACHsB,EAA4CV,GACjDF,OAAU,EAAG,YAIvB,SAAGBe,2BAA2BjC,GAEnC,IAAAqB,EAA0CrB,EAakBE,MAA3DoB,OAAeC,OAAcB,OACpC,OAAOc,KAAQ,WACb,IAAMS,EAAezB,yBAAYBC,GACxCyB,EAAcC,WAAcC,MAAS,EAAgIB,EAAU,EAAG,SAAU,GAEdI,EACFW,KAAQY,OAAUJ,EAAcC,GAA6B,SAejE,OAAOnB,QAAWD,GAAmBiB,EAAeC,MC1ExD,yBACE,WACuBW,EACHC,GADGC,WAAAF,EACHE,kBAAAD,EACIB,IAAME,EACFD,KAAKF,MAAMI,OAAO,GAAGpC,MACzBqC,KAAQC,QACgB,IAAnBH,EAAW,KAAkC,IAAnBA,EAAW,GACtC,WAAM,MAAA,gBAAGBA,EAAW,QAAOA,EAAW,qCAyE3D,OAjDEI,oBAAA,SAAQC,GAAR,WAUE,OAAO3B,KAAQ,WACb,IAAM4B,EAAUC,EAakC,gBAAGB7B,KAAQ0B,EAAO,YAC9CI,EAAUpB,WAAciB,EAAS,GAejCI,EADUH,EAakV,MAAMc,QAAQF,GACMG,IAAI,SAAAC,GAakC,OAAAC,QAAWD,GAaiM,AC3DE,EAAeR,EAakS,kBAakBN,GAe5C,OACEO,cAAeC,QAAWH,EAAaI,SACvCC,QAAASL,EAAaK,QACtBC,gBAaiBN,EAAaM,gBAC9BC,gBAaiBP,EAAaO,gBAC9BC,aAAcR,EAAaQ,aAC3BC,aAAcT,EAAaS,aAC3BC,YAAaV,EAAaU,YAC1BC,YAAaX,EAAaW,gBAqBhCtB,oBAAA,WACEL,KAAKF,MAAM8B,sCCzFf,4DA4BA,OA5B+BC,eAC7BC,4BAAA,SAAGBxB,GAEd,OAAO3B,KAAQ,WAAM,OAAAiB,IAAOmC,IAAOzB,EA AO,OAAQ,MAGpDwB,8BAAA,SAakBE,GAWhB,OACEx,QAFaw,KAGAR,aAHAQ,KAIAP,aAJAO,KAKAN,YALAM,KAMAZ,QANAY,KAOAV,gBAPAU,KAQAT,gBARAS,KASAL,YATAK,UAhByB3B,WCAiB4B,YACX,OAAQ,UAAW,WAAY,UAAW,WAAY,eACtD,gBAaiB,YAAa,aAAc,YAAa,aACzD,UAAW,WAAY,WAAY,YAAa,YAAa,cAGIDC,cAAgBD,WAAWE,OAM3BC,SACTH,WAAWI,OAAO,SAACC,EAAoBC,EAAWC,GAehD,OADAF,EAAOC,GAAaC,EACbF,OAGPG,uBACH,UAAW,iBAakB,YAAa,iBAC1C,YAAa,cAAe,UAAW,aACvC,WAAY,cAAe,WAAY,kBACvC,aAAc,kBAAMb,aAAc,eAC/C,WAAY,cAAe,YAAa,eACxC,eAAgB,kBAAMb,UAAW,aASpCC,aACV,OAAQ,YAAa,UAAW,YAAa,OAAQ,aACrD,WAAY,aAAc,OAAQ,iBAC1C,eAAgB,cAAe,YAAa,cAC5C,eAAgB,YAAa,UAAW,aACxC,WAAY,cAAe,OAAQ,kBACnC,gBAaiB,eAAgB,aAAc,eAC/C,gBAaiB,aAAc,WAAY,cAC3C,YAAa,eAGHC,uBAAYBF,qBAaqB5B,IACvD,SAAC5B,OAAC2D,OAAyC,OACV,OAAET,SAASQ,GAAaR,SAASS,MCIDzC,SAGgBC,SACZ7D,EACA8D,EACAC,OAFCC,OAAQC,OACRC,OAAkBC,OAETC,EAA+CL,MAAjCM,EAAiCN,SAG3D,OADeI,GAF4CJ,OAAAA,QAEVE,GADICC,GAAoBE,EAAOC,EAAOL,IAKnD,SAAGBM,eACZzC,EAAW0C,EAAWC,EAakBpC,GAC1C,OACEP,EAAGO,EAAQqC,IAAI5C,EAAG0C,EAAGC,GACrBD,EAAGnC,EAAQqC,IAAI5C,EAAG0C,EAAGC,EAAWvB,gBAIpC,SAAGBy

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Found

in path(s):

* /tensorflow-models-zip/@tensorflow-models/body-pix/dist/body-pix.esm.js.map

No license file was found, but licenses were detected in source scan.

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ONFIG","architecture","multiplier","inputResolution","VALID_ARCHITECTURE","VALID_STRIDE","MobileNetV1","ResNet50","VALID_INPUT_RESOLUTION","VALID_MULTIPLIER","VALID_QUANT_BYTES","validateModelConfig","quantBytes","SINGLE_PERSON_INFERENCE_CONFIG","flipHorizontal","MULTI_PERSON_INFERENCE_CONFIG","maxDetections","scoreThreshold","nmsRadius","validateMultiPersonInputConfig","PoseNet","baseModel","estimateMultiplePoses","I","E","N","T","estimateSinglePose","estimatePoses","decodingMethod","loadMobileNet","tf","modelUrl","loadResNet","COLOR","BOUNDING_BOX_COLOR","LINE_WIDTH","TRY_RESNET_BUTTON_NAME","TRY_RESNET_BUTTON_TEXT","TRY_RESNET_BUTTON_TEXT_CSS","TRY_RESNET_BUTTON_BACKGROUND_CSS","isAndroid","navigator","userAgent","isiOS","isMobile","setDatGuiPropertyCss","propertyText","liCssString","spanCssString","spans","getElementsByClassName","textContent","innerText","parentNode","updateTryResNetButtonDatGuiCss","toggleLoadingUI","showLoadingUI","loadingDivId","mainDivId","drawPoint","ctx","beginPath","arc","PI","fillStyle","fill","drawSegment","ay","ax","by","bx","scale","moveTo","lineTo","lineWidth","strokeStyle","stroke","drawSkeleton","minConfidence","toTuple","posenet","drawKeypoints","keypoint","drawBoundingBox","boundingBox","rect","boundingBoxColor","renderToCanvas","imageData","ImageData","j","putImageData","renderImageToCanvas","image","canvas","getContext","drawImage","drawHeatMapValues","heatMapValues","drawPoints","scalar","points","radius","buffer","values","pointY","pointX","drawOffsetVectors","offsetPoints","singlePose","heatmapData","offsetPointsData","rainbow","warm","spectral","stats","Stats","state","video","stream","net","videoConstraints","changingArchitecture","changingMultiplier","changingStride","changingResolution","changingQuantBytes","getVideoInputs","mediaDevices","enumerateDevices","console","videoDevices","filter","device","kind","stopExistingVideoCapture","srcObject","getTracks","track","stop","getDeviceIdForLabel","cameraLabel","videoInputs","videoInput","deviceId","getFacingMode","toLowerCase","includes","getConstraints","facingMode","setupCamera","getUserMedia","videoElement","resolve","onloadedmetadata","videoWidth","videoHeight","loadVideo","info","play","defaultQuantBytes","defaultMobileNetMultiplier","defaultMobileNetStride","defaultMobileNetInternalResolution","defaultResNetMultiplier","defaultResNetStride","defaultResNetInternalResolution","guiState","algorithm","estimate","camera","input","internalResolution","multiPersonDecoding","numKeypointForMatching","refineSteps","segmentation","segmentationThreshold","effect","maskBackground","backgroundBlurAmount","maskBlurAmount","edgeBlurAmount","partMap","colorScale","blurBodyPartAmount","bodyPartEdgeBlurAmount","showFps","toCameraOptions","cameras","default","setupGui","dat","architectureController","changingCamera","algorithmController","addFolder","outputStrideController","updateGuiOutputStride","outputStrideArray","internalResolutionController","updateGuiInternalResolution","internalResolutionArray","multiplierController","updateGuiMultiplier","multiplierArray","quantBytesController","updateGuiInputSection","updateGuiQuantBytes","quantBytesArray","open","estimateController","segmentationEffectController","darknessLevel","bokehBlurAmount","close","singlePersonDecoding","effectType","partColorScales","setShownPartColorScales","estimationType","colors","partColors","bodyPix","PART_CHANNELS","partColor","child","setupFPS","showPanel","estimateSegmentation","segmentMultiPerson","segmentPerson","multiPersonSegmentation","estimatePartSegmentation","segmentMultiPersonParts","segmentPersonParts","multiPersonPartSegmentation","drawPoses","personOrPersonPartSegmentation","flipHorizontally","personSegmentation","pose","allPoses","loadBodyPix","segmentBodyInRealTime","bodySegmentationFrame","begin","foregroundColor","backgroundColor","mask","toMask","drawMask","drawBokehEffect","coloredPartImageData","toColoredPartMask","pixelCellWidth","drawPixelatedMask","blurBodyPartIds","blurBodyPart","end","bindPage","webkitGetUserMedia","mozGetUserMedia"],"mappings": "AyDGA,aAAA,OAAA,eAAA,QAAA,aAAA,CAAA,OAAA,IAAA,QAAA,aAAA,EAAA,MAAM,EAAU,QAAhB,QAAA,QAAgB;AzDoJf,aAAA,OAAA,eAAA,QAAA,aAAA,CAAA,OAAA,IAAA,QAAA,cAAA,QAAA,YAAA,QAAA,gBAAA,QAAA,qBAAA,EAiM,MAAM,EAakB,KAmI9B,QAAA,gBAAA,EAiM,MAAM,EAakB,KAKI9B,QAAA,gBAAA,EA1GK,MAAO,EAIX,YAAoB,EAAGC,GAAhC,KAAA,QAAA,EAAGC,KAAA,UAAA,EAH5C,KAAA,KAAO,IAAI,QACX,KAAA,aAAe,EAiVB,IAAI,GAIK,OAHF,KAAK,KAAK,IAAI,IACZ,KAAA,UAAU,SAAS,KAAK,QAAS,GAejC,KAAK,KAAK,IAAI,GAGvB,IAAI,EAAGB,GACb,KAAA,eACA,KAAA,KAAK,IAAI,EAAGB,GAGxB,IAAI,GACK,OAAA,KAAK,KAAK,IAAI,GAGvB,OAAO,GAEE,OADF,KAAA,eACE,KAAK,KAAK,OAAO,GAG1B,aACS,OAAA,KAAK,cA8Ef,QAAA,YAAA,EArdK,MAAO,EACX,SAAS,GACA,OAA A,EAakB,YAE3B,OAAO,GACE,OAAA,EAakB,UAE3B,iBACS,OAAA,EAET,KAAK,GACI,OAAA,EAakB,Q

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Open Source Used In Cisco Meeting Server (formerly Acano Server) 3.7 5102

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EAAe,GA AK,GACtD,EA AW,KA AK,MA AM,EA AU,EA Ac,GA AK,OAC9C,CAAA,GA AmB,iBAAR,EA eV,MA
AA,oCAAoC,KAfR,CAC5B,MAAA,EA AqB,iBAAf,EA AgC,EA AI,GA AG,GA AK,EA AI,GA AG,GACzD,EA AwB
,iBAAf,EA AgC,EA AI,GA AG,GA AK,EA AI,GA AG,GAC5D,EA AsB,iBAAf,EA AgC,EA AI,GA AG,GA AK,EA AI,
GA AG,GAC1D,EA AuB,iBAAf,EA AgC,EA AI,GA AG,GA AK,EA AI,GA AG,GA IjE,EA AU,CA AC,IAAA,EA AK,O
AAA,EA AQ,KAAA,EA AM,MAAA,EA AO,KAHZ,IA AR,GA AwB,IA AX,GA AyB,IA AT,GA AwB,IA AV,EACxD,
QACA,YAEJ,EA AY,GACP,EA AW,EA Ae,EA AM,GA AU,EA Ae,EAC1D,GACJ,EA AW,GACN,EA AU,EA Ac,EA
AO,GA AS,EA Ac,EA AG,IA IzD,MAAA,CA AC,QAAA,EA AS,UAAA,EA AW,SAAA,GAG9B,SA AS,EACL,EA A4
B,EA AiB,EAC7C,EA AiB,EA AqB,EACtC,EA AqB,EA AqB,EAC1C,EA AqB,GAMnB,IAAA,EACA,EACA,EACA,
EAEA,GA Ae,iBAAR,EA AkB,CAE3B,EA AU,CACR,IA AK,EACL,OAAQ,EACR,KA AM,EACN,MAAO,EACP,
MAAO,EACP,KA AM,EACN,KARuB,IA AR,EA Aa,QAAU,UAUIC,MAAA,EA AW,EACb,CA AC,EA AS,EA AU,E
AAS,GA AI,EA Aa,EA AG,EA Aa,EAC9D,GACJ,EA AW,EA AS,GACpB,EA AY,EA AS,GACrB,EA AW,EA AS,QA
Cf,GA AY,SA AR,EA AgB,CA InB,MAAA,IA HN,EA AW,KA AK,KA AK,EA AU,IAGG,GA AK,EA Ac,EA Ac,EAC7
D,IA HN,EA AY,KA AK,KA AK,EA AW,IA IhB,GA AK,EA Ae,EA Ae,EAC9C,IAJN,EA AW,KA AK,KA AK,EA AU,I
AIG,GA AK,EA Ac,EA Ac,EAC7D,EA AQ,KA AK,MA AM,EA AgB,GACnB,EAAO,EA AgB,EACvB,EA AM,KA AK
,MA AM,EA AiB,GAC1C,EA AS,EA AiB,EAC1B,EAAO,KA AK,MA AM,EA AgB,GAGxC,EA AU,CA AC,IAAA,EA
AK,OAAA,EA AQ,KAAA,EA AM,MAFhB,EA AgB,EAEO,MAAA,EA AO,KAAA,EA AM,KA AM,YACnD,CAAA,
GA AY,UA AR,EAC h,MAAA,oCAAoC,KAb1C,EA AU,CACR,IA AK,EACL,OAAQ,EACR,KA AM,EACN,MAAO
,EACP,MAAO,EACP,KA AM,EACN,KA AM,SA ER,EA AW,KA AK,MA AM,EA AU,EA Ac,GA AK,GACnD,EA AY
,KA AK,MA AM,EA AW,EA Ae,GA AK,GACtD,EA AW,KA AK,MA AM,EA AU,EA Ac,GA AK,GA I9C,MAAA,CAA
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,EACZ,EA A0B,GACrB,OAAA,EA AkB,IA AY,EA AkB,GA UnD,SA AU,EA AwB,GA EIc,GA Ae,SA Af,EACK,MA
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,UA AW,WAG9C,EA AK,OACD,EA AU,+BAA+B,EAH3B,GA Id,IA AM,2EACa,uBAEnB,IAAA,EA AM,EACN,G
AAe,EACH,IA AZ,EA AG,OACL,GA Ae,EACf,GA AM,EA AQ,EAAA,SAAA,EA AI,CA AC,EA AG,EA AG,MA AM,
GA AI,EA AG,MA AM,GA AI,EA AG,MA AM,MAG3D,EA AK,OACY,IA Ab,EA AI,KACJ,uDAAYD,EA AI,SAE1C,

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Open Source Used In Cisco Meeting Server (formerly Acano Server) 3.7 5243

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AI,EA
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EAAgBIC,GAC7BxR,EAAY+T,EAAQC,cAeRb,IAAA,IAAIIt3B,EAAI,EAAGA,EAAIo3B,EAAWj4B,OAAQa,IAAK,CACpCu3B,MAAAA,EAAYH,EAAWp3B,GACvBw3B,EAAQvvB,SAASC,cAAc,MAErCsvB,EAAMjpB,UAC+CgpB,4DAAAA,OAAAA,EA AU,GAC3DA,KAAAA,OAAAA,EA AU,GAAMA,KAAAA,OAAAA,EA AU,GACxBjU,wBAAAA,OAAAA,EA AUtjB,IAEHbM3B,EAAOrpB,YAAY0pB,IAOVb,SAASC,IACPhH,EAAMiH,UAAU,GACZ7D,EAASoB,SACXhtB,SAASwN,KAAK3H,YAAY2iB,EAAM1nB,KAIpC,eAAe4uB,IAEL9D,OAA AA,EAASC,WACV,IAAA,wBACI,aAAMnD,EAAMG,IAAI8G,mBAAMbJH,EAAMC,MAAO,CACrDsD,mBA AoBL,EAASI,MAAMC,mBACnCK,sBA AU BV,EAASS,aAAaC,sBAC7CIK,cAAewJ,EAASM,oBAAoB9J,cAC5CC,eAAgBuJ,EAASM,oBAAoB7J,eAC7CC,UAAWsJ,EAASM,oBAAoB5J,UACxC6J,uBACIP,EAASM,oBAAoBC,uBACjCC,YAAaR,EAASM,oBAAoBE,cAEzC,IAAA,SACI,aAAM1D,EAAMG,IAAI+G,cAAcIH,EAAMC,MAAO,CACHDsD,mBA AoBL,EAASI,MAAMC,mBACnCK,sBA AU BV,EAASS,aAAaC,sBAC7CIK,cAAewJ,EAASM,oBAAoB9J,cAC5CC,eAAgBuJ,EAASM,oBAAoB7J,eAC7CC,UAAWsJ,EAASM,oBAAoB5J,YAKvCuN,OAXBuB,KA2BhC,eAAeC,IACLIe,OAAAA,EAASC,WACV,IAAA,wBACI,aAAMnD,EAAMG,IAAIkH,wBA AwBrH,EAAMC,MAAO,CAC1DsD,mBA AoBL,EAASI,MAAMC,mBACnCK,sBA AU BV,EAASS,aAAaC,sBAC7CIK,cAAewJ,EAASM,oBAAoB9J,cAC5CC,eAAgBuJ,EAASM,oBAAoB7J,eAC7CC,UAAWsJ,EAASM,oBAAoB5J,UACxC6J,uBACIP,EAASM,oBAAoBC,uBACjCC,YAAaR,EAASM,oBAAoBE,cAEzC,IAAA,SACI,aAAM1D,EAAMG,IAAI mH,mBA AMbH,EAAMC,MAAO,CACrDsD,mBA AoBL,EAASI,MAAMC,mBACnCK,sBA AU BV,EAASS,aAAaC,sBAC7CIK,cAAewJ,EAASM,oBAAoB9J,cAC5CC,eAAgBuJ,EAASM,oBAAoB7J,eAC7CC,UAAWsJ,EAASM,oBAAoB5J,YAKvC2N,OAAAA,4BAGT,SAASC,EAAUC,EAAgCC,EAakBnL,GAC/DptB,MAAMyE,QA AQ6zB,GACHBA,EAA+Bx1B,QAAQ01B,IACjCC,IAAAA,EAAOD,EAAMBC,KAC1BF,IACFE,EAAOIB,EAAQ jQ,mBA AMBmR,EAAMD,EAAMBzrB,SAE/C0rB,EAAAA,EAAAA,eAAAA,EA AK1T,UAAW,GA AKqI,IACtBqL,EAAAA,EAAAA,cAAAA,EA AK1T,UAAW,GA AKqI,KAGpCkL,EAA+BI,SAAS51B,QAAQ21B,IAC1CF,IAC FE,EAAOIB,EAAQjQ,mBACXmR,EAAMH,EAA+BvrB,SAE7B0rB,EAAAA,EAAAA,eAAAA,EA AK1T,UAAW,GA AKqI,IACtBqL,EAAAA,EAAAA,cAAAA,EA AK1T,UAAW,GA AKqI,KAKxC,eAAeuL,KACG,EAAA,EAA A,kBAAA,GACHB9H,EAAMG,UAAyUG,EAAQ5f,KAAK,CAC7B6R,aAAcuK,EAASI,MAAM3K,aAC7BtI,aAA c6S,EAASI,MAAMjT,aAC7BuI,WAAYsK,EAASI,MAAM1K,WAC3BU,WAAY4J,EAASI,MAAMhK,cAEb,EA AA,EAAA,kBAAA,GAOIB,SAASyO,IACDtJ,MAAAA,EAASnnB,SAASwV,eAAe,WAGxBkb,eAAAA,KAGThI,EAAMK,sBA AwBL,EAAMM,oBACpCN,EAAM6E,gBAakB7E,EAAMO,gBAC9BP,EAAMS,sBACRI,QAAQ/h B,IAAI,iBACZgpB,IACA9H,EAAMK,sBA AU B,EAC7BL,EAAMM,oBAAqB,EAC3BN,EAAMO,gBA AiB,EACv BP,EAAMS,oBAAqB,GAI7BX,EAAMmI,QAEAP,MAAAA,EAAMBxE,EAAS1J,eAE1B0J,OAAAA,EAASE,UA CV,IAAA,eACG+D,MAAAA,QAAgCH,IAC9B9D,OAAAA,EAASS,aAAaE,QACvB,IAAA,OACGtH,MAAAA,E AAMkC,EAAOC,WA AW,MACxBwJ,EAakB,CAAC92B,EAAG,IAAKG,EAAG,IAAKC,EAAG,IAAKC,EAAG, KAC9C02B,EAakB,CAAC/2B,EAAG,EAAGG,EAAG,EAAGC,EAAG,EAAGC,EAAG,KACxC22B,EAAO1B,E AAQ2B,OACjBIB,EAAyBe,EAAiBC,GAC1C,GA EJzB,EAAQ4B,SACJ7J,EAAQuB,EAAMC,MAAOmI,EAAMI F,EAASS,aAAa1e,QACjDie,EAASS,aAAaK,eAAgB0D,GAC1CF,EAAUL,EAAyBO,EAakBnL,GACrD,MACG,I AAA,QACHmK,EAAQ6B,gBACJ9J,EAAQuB,EAAMC,MAAOkH,GACpBjE,EAASS,aAAaI,qBACvBb,EAASS, aAAaM,eAAgByD,GAI9C,MACG,IAAA,UACGnL,MAAAA,EAAMkC,EAAOC,WA AW,MACxB6I,QAAoCH,I ACpCoB,EAAuB9B,EAAQ+B,kBACjCIB,EACAIB,EAAgBnD,EAASgB,QAAQC,aAE/BH,EAAiB,EACfd,OAA AA,EAASgB,QAAQL,QACIB,IAAA,aACG6E,MAAAA,EAAiB,GA EvBhC,EAAQiC,kBACJIK,EAAQuB,EAAM C,MAAOuI,EACrBtF,EAASgB,QAAQjf,QAAS+e,EAAgB0D,EAC1CgB,GACJ,MACG,IAAA,UACHhC,EAAQ4 B,SACJ7J,EAAQuB,EAAMC,MAAOuI,EAAStBf,EAASje,QACpD+e,EAAgB0D,GACpB,MACG,IAAA,eACGk B,MAAAA,EAakB,CAAC,EAAG,GAC5BIC,EAAQmC,aACJpK,EAAQuB,EAAMC,MAAOsH,EACrBqB,EAAi B1F,EAASgB,QAAQE,mBACICIB,EAASgB,QAAQD,eAAgByD,GA EzCF,EAAUD,EAA6BG,EAakBnL,GAO7 DuD,EAAMgJ,MAENZkB,sBAAsB2jB,GAGxBA,GAMK,eAAee,UAEdjB,IACNxBW,SAASwV,eAAe,WA AWvU ,MAAMyM,QAAU,OACnD1N,SAASwV,eAAe,QAAQvU,MAAMyM,QAAU,qBAE1Cwd,EAAUU,EAASG,QAE rBmB,IAAAA,QAAgB9D,IAEpBoG,IACApC,EAASF,GAETuD,IAIF3M,UAAU8G,aAAe9G,UAAU8G,cAC/B9G ,UAAU4N,oBAAsB5N,UAAU6N,gBAE9CF","file":"demos.ab0c720b.js","sourceRoot":"..","sourcesContent":["/**

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=====
*\n\nimport {Backend, DataId} from '../tensor';\nimport {BackendValues, DataType} from '../types';\n\nexport const EPSILON_FLOAT32 = 1e-7;\nexport const EPSILON_FLOAT16 = 1e-4;\n\nRequired information for all backends.\nexport interface BackendTimingInfo {\n  kernelMs: number | {\n    error: string;\n  };\n  getExtraProfileInfo?(): string; // a field for additional timing information\n  packing / unpacking for WebGL backend\n}\n\nexport interface TensorStorage {\n  read(dataId: DataId): Promise<BackendValues>;\n  readSync(dataId: DataId): BackendValues;\n  disposeData(dataId: DataId, force?: boolean): boolean;\n  write(values: BackendValues, shape: number[], dtype: DataType): DataId;\n  move(dataId: DataId, values: BackendValues, shape: number[], dtype: DataType, refCount: number): void;\n  memory(): {unreliable: boolean}; // Backend-specific information.\n  /** Returns number of data ids currently in the storage. */\n  numDataIds(): number;\n  refCount(dataId: DataId): number;\n}\n\n/** Convenient class for storing tensor-related data. */\nexport class DataStorage<T> {\n  private data = new WeakMap<DataId, T>();\n  private dataIdsCount = 0;\n  constructor(private backend: KernelBackend, private dataMover: DataMover) {\n    get(dataId: DataId) {\n      if (!this.data.has(dataId)) {\n        this.dataMover.moveData(this.backend, dataId);\n      }\n      return this.data.get(dataId);\n    }\n    set(dataId: DataId, value: T): void {\n      this.dataIdsCount++;\n      this.data.set(dataId, value);\n    }\n    has(dataId: DataId): boolean {\n      return this.data.has(dataId);\n    }\n    delete(dataId: DataId): boolean {\n      this.dataIdsCount--;\n      return this.data.delete(dataId);\n    }\n    numDataIds(): number {\n      return this.dataIdsCount;\n    }\n  }\n}\n\nexport interface DataMover {\n  /**\n   * To be called by backends whenever they see a dataId that they don't own.\n   * Upon calling this method, the mover will fetch the tensor from another\n   * backend and register it with the current active backend.\n   */\n  moveData(backend: KernelBackend, dataId: DataId): void;\n}\n\nexport interface BackendTimer {\n  // check if backend timer is available\n  timerAvailable(): boolean;\n  time(f: () => void): Promise<BackendTimingInfo>;\n}\n\n/**\n * The interface that defines the kernels that should be implemented when\n * adding a new backend. New backends don't need to implement every one of the\n * methods, this can be done gradually (throw an error for unimplemented\n * methods).\n */\nexport class KernelBackend implements TensorStorage, Backend, BackendTimer {\n  refCount(dataId: DataId): number {\n    return notYetImplemented('refCount');\n  }\n  incRef(dataId: DataId): void {\n    return notYetImplemented('incRef');\n  }\n  timerAvailable(): boolean {\n    return true;\n  }\n  time(f: () => void): Promise<BackendTimingInfo> {\n    return notYetImplemented('time');\n  }\n  read(dataId: object): Promise<BackendValues> {\n    return notYetImplemented('read');\n  }\n  readSync(dataId: object): BackendValues {\n    return notYetImplemented('readSync');\n  }\n  numDataIds(): number {\n    return notYetImplemented('numDataIds');\n  }\n  disposeData(dataId: object, force?: boolean): boolean {\n    return notYetImplemented('disposeData');\n  }\n  write(values: BackendValues, shape: number[], dtype: DataType): DataId {\n    return notYetImplemented('write');\n  }\n  move(dataId: DataId, values: BackendValues, shape: number[], dtype: DataType, refCount: number): void {\n    return notYetImplemented('move');\n  }\n  memory(): {unreliable: boolean; reasons?: string[]} {\n    return notYetImplemented('memory');\n  }\n  /** Returns the highest precision for floats in bits (e.g. 16 or 32) */\n  floatPrecision(): 16|32 {\n    return notYetImplemented('floatPrecision');\n  }\n  /** Returns the smallest representable number. */\n  epsilon(): number {\n    return this.floatPrecision() === 32 ? EPSILON_FLOAT32 : EPSILON_FLOAT16;\n  }\n  dispose(): void {\n    return notYetImplemented('dispose');\n  }\n}\n\nfunction notYetImplemented(kernelName: string): never {\n  throw new Error(`\n    `${kernelName}` not yet implemented or not found in the registry. `+\n    `This kernel may not be supported by the tfjs backend you have chosen`);\n}\n\n/**\n * @license\n * Copyright 2020 Google LLC. All Rights
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=====
*\n\nimport {DataType, DataTypeMap, FlatVector, NumericDataType, RecursiveArray, TensorLike, TypedArray}
from
'./types';\n\n/**\n * Shuffles the array in-place using Fisher-Yates algorithm.\n *\n * ```js\n * const a = [1, 2, 3, 4,
5];\n * tf.util.shuffle(a);\n * console.log(a);\n * ```\n *\n * @param array The array to shuffle in-place.\n *\n * @doc
{heading: 'Util', namespace: 'util'}\n */\n// tslint:disable-next-line:no-any\nexport function shuffle(array:
any[]|Uint32Array|Int32Array|Float32Array): void {\n  let counter = array.length;\n  let temp = 0;\n  let index = 0;\n  // While there are elements in the array\n  while (counter > 0) {\n    // Pick a random index\n    index
= (Math.random() * counter) | 0;\n    // Decrease counter by 1\n    counter--;\n    // And swap the last element with
it\n    temp = array[counter];\n    array[counter] = array[index];\n    array[index] = temp;\n  }\n}\n\n/**\n * Shuffles
two arrays in-place the same way using Fisher-Yates algorithm.\n *\n * ```js\n * const a = [1,2,3,4,5];\n * const b =
[11,22,33,44,55];\n * tf.util.shuffleCombo(a,
b);\n * console.log(a, b);\n * ```\n *\n * @param array The first array to shuffle in-place.\n *\n * @param array2 The
second array to shuffle in-place with the same permutation\n * as the first array.\n *\n * @doc {heading: 'Util',
namespace: 'util'}\n */\n// tslint:disable-next-line:no-any\nexport function shuffleCombo(array:
any[]|Uint32Array|Int32Array|Float32Array, array2:
any[]|Uint32Array|Int32Array|Float32Array): void {\n  if (array.length !== array2.length) {\n    throw Error(\n
`Array sizes must match to be shuffled together` +\n    `First array length was ${array.length}` +\n    `Second
array length was ${array2.length}`);\n  }\n  let counter = array.length;\n  let temp, temp2;\n  let index = 0;\n  //
While there are elements in the array\n  while (counter > 0) {\n    // Pick a random index\n    index = (Math.random()
* counter) | 0;\n    // Decrease counter by 1\n    counter--;\n    // And swap the
last element of each array with it\n    temp = array[counter];\n    temp2 = array2[counter];\n    array[counter] =
array[index];\n    array2[counter] = array2[index];\n    array[index] = temp;\n    array2[index] = temp2;\n  }\n}\n\n/** Clamps a value to a specified range. */\nexport function clamp(min: number, x: number, max: number):
number {\n  return Math.max(min, Math.min(x, max));\n}\n\nexport function nearestLargerEven(val: number):
number {\n  return val % 2 === 0 ? val : val + 1;\n}\n\nexport function sum(arr: number[]): number {\n  let sum =
0;\n  for (let i = 0; i < arr.length; i++) {\n    sum += arr[i];\n  }\n  return sum;\n}\n\n/**\n * Returns a sample from a
uniform [a, b) distribution.\n *\n * @param a The minimum support (inclusive).\n *\n * @param b The maximum
support (exclusive).\n *\n * @return A pseudorandom number on the half-open interval [a,b).\n */\nexport function
randUniform(a: number, b: number) {\n  const r = Math.random();\n  return (b * r) + (1 - r) * a;\n}\n\n/**
Returns the squared Euclidean distance between two vectors. */\nexport function distSquared(a: FlatVector, b:
FlatVector): number {\n  let result = 0;\n  for (let i = 0; i < a.length; i++) {\n    const diff = Number(a[i]) -
Number(b[i]);\n    result += diff * diff;\n  }\n  return result;\n}\n\n/**\n * Asserts that the expression is true.
Otherwise throws an error with the\n * provided message.\n *\n * ```js\n * const x = 2;\n * tf.util.assert(x === 2, 'x is
not 2');\n * ```\n *\n * @param expr The expression to assert (as a boolean).\n *\n * @param msg A function that returns
the message to report when throwing an\n * error. We use a function for performance reasons.\n *\n * @doc
{heading: 'Util', namespace: 'util'}\n */\nexport function assert(expr: boolean, msg: () => string) {\n  if (!expr) {\n    throw new Error(typeof msg === 'string' ? msg : msg());\n  }\n}\n\nexport function assertShapesMatch(\n  shapeA:
number[], shapeB: number[], errorMessagePrefix = ''): void {\n  assert(\n    arraysEqual(shapeA, shapeB),\n    () => errorMessagePrefix + ` Shapes ${shapeA} and ${shapeB} must
match`);\n}\n\nexport function assertNonNull(a: TensorLike): void {\n  assert(\n    a != null,\n    () => `The input
to the tensor constructor must be a non-null value.`);\n}\n\n// NOTE: We explicitly type out what T extends instead

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of any so that\n// util.flatten on a nested array of number doesn't try to infer T as a\n// number[[]], causing us to
explicitly type util.flatten<number>().\n/**\n * Flattens an arbitrarily nested array.\n * \n * `js\n * const a = [[1, 2],
[3, 4], [5, [6, [7]]]];\n * const flat = tf.util.flatten(a);\n * console.log(flat);\n * ``\n * \n * @param arr The nested
array to flatten.\n * @param result The destination array which holds the elements.\n * @param skipTypedArray If
true, avoids flattening the typed arrays. Defaults\n * to false.\n * \n * @doc {heading: 'Util', namespace: 'util'}\n
*/\nexport function\nflatten<T extends number|boolean|string|Promise<number>|TypedArray>(\n
arr: T|RecursiveArray<T>, result: T[] = [], skipTypedArray = false): T[] {\n if (result == null) {\n result = [];\n
}\n if (Array.isArray(arr) || isTypedArray(arr) && !skipTypedArray) {\n for (let i = 0; i < arr.length; ++i) {\n
flatten(arr[i], result, skipTypedArray);\n }\n } else {\n result.push(arr as T);\n }\n return result;\n }\n\n/**\n *
Returns the size (number of elements) of the tensor given its shape.\n * \n * `js\n * const shape = [3, 4, 2];\n * const
size = tf.util.sizeFromShape(shape);\n * console.log(size);\n * ``\n * \n * @doc {heading: 'Util', namespace: 'util'}\n
*/\nexport function sizeFromShape(shape: number[]): number {\n if (shape.length === 0) {\n // Scalar.\n return
1;\n }\n let size = shape[0];\n for (let i = 1; i < shape.length; i++) {\n size *= shape[i];\n }\n return
size;\n }\n\nexport function isScalarShape(shape: number[]): boolean {\n return shape.length === 0;\n }\n\nexport
function
arraysEqual(n1: FlatVector, n2: FlatVector) {\n if (n1 === n2) {\n return true;\n }\n if (n1 == null || n2 == null)
{\n return false;\n }\n\n if (n1.length !== n2.length) {\n return false;\n }\n for (let i = 0; i < n1.length; i++) {\n
if (n1[i] !== n2[i]) {\n return false;\n }\n }\n return true;\n }\n\nexport function isInt(a: number): boolean {\n
return a % 1 === 0;\n }\n\nexport function tanh(x: number): number {\n // tslint:disable-next-line:no-any\n if
((Math as any).tanh != null) {\n // tslint:disable-next-line:no-any\n return (Math as any).tanh(x);\n }\n if (x ===
Infinity) {\n return 1;\n }\n else if (x === -Infinity) {\n return -1;\n }\n else {\n const e2x = Math.exp(2 * x);\n
return (e2x - 1) / (e2x + 1);\n }\n }\n\nexport function sizeToSquarishShape(size: number): [number, number] {\n
const width = Math.ceil(Math.sqrt(size));\n return [width, Math.ceil(size / width)];\n }\n\n\n/**\n * Creates a new
array with randomized
indicies to a given quantity.\n * \n * `js\n * const randomTen = tf.util.createShuffledIndices(10);\n *
console.log(randomTen);\n * ``\n * \n * @param number Quantity of how many shuffled indicies to create.\n * \n *
@doc {heading: 'Util', namespace: 'util'}\n */\nexport function createShuffledIndices(n: number): Uint32Array {\n
const shuffledIndices = new Uint32Array(n);\n for (let i = 0; i < n; ++i) {\n shuffledIndices[i] = i;\n }\n
shuffle(shuffledIndices);\n return shuffledIndices;\n }\n\nexport function rightPad(a: string, size: number): string {\n
if (size <= a.length) {\n return a;\n }\n return a + '.repeat(size - a.length);\n }\n\nexport function repeatedTry(\n
checkFn: () => boolean, delayFn = (counter: number) => 0, \n maxCounter?: number): Promise<void> {\n return
new Promise<void>((resolve, reject) => {\n let tryCount = 0;\n const tryFn = () => {\n if (checkFn()) {\n
resolve();\n return;\n }\n\n tryCount++;\n\n const
nextBackoff = delayFn(tryCount);\n\n if (maxCounter != null && tryCount >= maxCounter) {\n reject();\n
return;\n }\n\n setTimeout(tryFn, nextBackoff);\n });\n\n tryFn();\n });\n }\n\n\n/**\n * Given the full size of
the array and a shape that may contain -1 as the\n * implicit dimension, returns the inferred shape where -1 is
replaced.\n * E.g. For shape=[2, -1, 3] and size=24, it will return [2, 4, 3].\n * \n * @param shape The shape, which
may contain -1 in some dimension.\n * @param size The full size (number of elements) of the array.\n * @return
The inferred shape where -1 is replaced with the inferred size.\n */\nexport function inferFromImplicitShape(\n
shape: number[], size: number): number[] {\n let shapeProd = 1;\n let implicitIdx = -1;\n\n for (let i = 0; i <
shape.length; ++i) {\n if (shape[i] >= 0) {\n shapeProd *= shape[i];\n } else if (shape[i] === -1) {\n if
(implicitIdx !== -1) {\n throw Error(\n
`Shapes can only have 1 implicit size. ` +\n `Found -1 at dim ${implicitIdx} and dim ${i}`);\n }\n\n
implicitIdx = i;\n } else if (shape[i] < 0) {\n throw Error(`Shapes can not be < 0. Found ${shape[i]} at dim
${i}`);\n }\n }\n\n if (implicitIdx === -1) {\n if (size > 0 && size !== shapeProd) {\n throw
Error(`Size(${size}) must match the product of shape ${shape}`);\n }\n return shape;\n }\n\n if (shapeProd ===
0) {\n throw Error(\n `Cannot infer the missing size in [${shape}] when ` +\n `there are 0 elements`);\n
}\n\n if (size % shapeProd !== 0) {\n throw Error(\n `The implicit shape can't be a fractional number. ` +\n

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Got ${size} / ${shapeProd}`);\n }\n\n const newShape = shape.slice();\n newShape[implicitIdx] = size /\n shapeProd;\n return newShape;\n}\n\nexport function parseAxisParam(\n  axis: number|number[], shape:\n  number[]): number[] {\n  const rank = shape.length;\n  // Normalize input\n  axis = axis == null ? shape.map((s, i) => i) : [].concat(axis);\n  // Check for valid range\n  assert(\n    axis.every(ax => ax >= -rank && ax < rank),\n    () =>\n      `All values in axis param must be in range [-\n      ${rank}, ${rank}) but ` +\n      `got axis ${axis}`);\n  // Check for only integers\n  assert(\n    axis.every(ax =>\n      isInt(ax)),\n    () =>\n      `All values in axis param must be integers but ` +\n      `got axis ${axis}`);\n  // Handle\n  negative axis.\n  return axis.map(a => a < 0 ? rank + a : a);\n}\n\n/** Reduces the shape by removing all dimensions\n  of shape 1. */\nexport function squeezeShape(shape: number[], axis?: number[]):\n  {newShape: number[],\n  keptDims: number[]} {\n  const newShape: number[] = [];\n  const keptDims: number[] = [];\n  const isEmptyArray\n  = axis != null && Array.isArray(axis) && axis.length === 0;\n  const axes = (axis == null || isEmptyArray) ?\n  null :\n  parseAxisParam(axis, shape).sort();\n  let j = 0;\n  for (let\n  i = 0; i < shape.length; ++i) {\n    if (axes != null) {\n      if (axes[j] === i && shape[i] !== 1) {\n        throw new\n        Error(\n          `Can't squeeze axis ${i} since its dim '${shape[i]}' is not 1`);\n      }\n      if ((axes[j] == null || axes[j]\n      > i) && shape[i] === 1) {\n        newShape.push(shape[i]);\n        keptDims.push(i);\n      }\n      if (axes[j] <= i) {\n        j++;\n      }\n    }\n    if (shape[i] !== 1) {\n      newShape.push(shape[i]);\n      keptDims.push(i);\n    }\n  }\n  return {newShape, keptDims};\n}\n\nexport function getTypedArrayFromDType<D extends NumericDataType>(\n  dtype: D, size: number): DataTypeMap[D] {\n  let values = null;\n  if (dtype == null || dtype === 'float32') {\n    values = new Float32Array(size);\n  } else if (dtype === 'int32') {\n    values = new Int32Array(size);\n  } else if\n  (dtype === 'bool') {\n    values = new Uint8Array(size);\n  } else {\n    throw new Error(`Unknown data type\n    ${dtype}`);\n  }\n  return values as DataTypeMap[D];\n}\n\nexport\n  function getArrayFromDType<D extends DataType>(\n    dtype: D, size: number): DataTypeMap[D] {\n    let values\n    = null;\n    if (dtype == null || dtype === 'float32') {\n      values = new Float32Array(size);\n    } else if (dtype ===\n    'int32') {\n      values = new Int32Array(size);\n    } else if (dtype === 'bool') {\n      values = new Uint8Array(size);\n    }\n    else if (dtype === 'string') {\n      values = new Array<'string'>(size);\n    } else {\n      throw new Error(`Unknown data\n      type ${dtype}`);\n    }\n    return values as DataTypeMap[D];\n  }\n\n  export function checkConversionForErrors<D\n  extends DataType>(\n    vals: DataTypeMap[D]|number[], dtype: D): void {\n    for (let i = 0; i < vals.length; ++i) {\n      const num = vals[i] as number;\n      if (isNaN(num) || !isFinite(num)) {\n        throw Error(`A tensor of type ${dtype}\n        being uploaded contains ${num}.`);\n      }\n    }\n  }\n\n  /** Returns true if the dtype is valid. */\n  export function\n  isValidDtype(dtype: DataType): boolean {\n    return\n    dtype === 'bool' || dtype === 'complex64' || dtype === 'float32' ||\n    dtype === 'int32' || dtype ===\n    'string';\n  }\n\n  /** Returns true if the new type can't encode the old type without loss of\n  * precision. */\n  export function\n  hasEncodingLoss(oldType: DataType, newType: DataType): boolean {\n    if (newType ===\n    'complex64') {\n      return false;\n    }\n    if (newType === 'float32' && oldType !== 'complex64') {\n      return false;\n    }\n    if\n    (newType === 'int32' && oldType !== 'float32' && oldType !== 'complex64') {\n      return false;\n    }\n    if\n    (newType === 'bool' && oldType === 'bool') {\n      return false;\n    }\n    return true;\n  }\n\n  export function\n  isArray(a: {}): a is Float32Array|Int32Array|Uint8Array {\n    return a instanceof Float32Array || a instanceof\n    Int32Array ||\n    a instanceof Uint8Array;\n  }\n\n  export function bytesPerElement(dtype: DataType): number {\n    if\n    (dtype === 'float32' || dtype === 'int32') {\n      return 4;\n    }\n    else if (dtype === 'complex64') {\n      return 8;\n    }\n    else if (dtype === 'bool') {\n      return 1;\n    }\n    else {\n      throw new Error(`Unknown dtype\n      ${dtype}`);\n    }\n  }\n\n  /** Returns the approximate number of bytes allocated in the string array - 2 * bytes per\n  character. Computing the exact bytes for a native string in JS is\n  * not possible since it depends on the encoding of\n  the html page that serves\n  * the website. */\n  export function bytesFromStringArray(arr: Uint8Array[]): number {\n    if\n    (arr == null) {\n      return 0;\n    }\n    let bytes = 0;\n    arr.forEach(x => bytes += x.length);\n    return\n    bytes;\n  }\n\n  /** Returns true if the value is a string. */\n  export function\n  isString(value: {}): value is string {\n    return\n    typeof value === 'string' || value instanceof String;\n  }\n\n  export function\n  isBoolean(value: {}): boolean {\n    return\n    typeof value === 'boolean';\n  }\n\n  export function\n  isNumber(value: {}): boolean {\n    return\n    typeof value === 'number';\n  }\n\n  export function\n  inferDtype(values: TensorLike): DataType {\n    if

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(Array.isArray(values)) {\n  return inferDtype(values[0]);\n }\n if (values instanceof Float32Array) {\n  return 'float32';\n } else if (values instanceof Int32Array || values instanceof Uint8Array) {\n  return 'int32';\n } else if (isNumber(values)) {\n  return 'float32';\n } else if (isString(values)) {\n  return 'string';\n } else if (isBoolean(values)) {\n  return 'bool';\n }\n\n\nexport function isFunction(f: Function) {\n  return !!f && f.constructor && f.call && f.apply;\n}\n\n\nexport function nearestDivisor(size: number, start: number): number {\n  for (let i = start; i < size; ++i) {\n    if (size % i === 0) {\n      return i;\n    }\n  }\n  return size;\n}\n\n\nexport function computeStrides(shape: number[]): number[] {\n  const rank = shape.length;\n  if (rank < 2) {\n    return [];\n  }\n  // Last dimension has implicit stride of 1, thus having D-1 (instead of D)\n  // strides.\n  const strides = new Array(rank - 1);\n  strides[rank - 2] = shape[rank - 1];\n  for (let i = rank - 3; i >= 0; --i) {\n    strides[i] = strides[i + 1] * shape[i + 1];\n  }\n  return strides;\n}\n\n\nfunction createNestedArray(offset: number, shape: number[], a: TypedArray) {\n  const ret = new Array();\n  if (shape.length === 1) {\n    const d = shape[0];\n    for (let i = 0; i < d; i++) {\n      ret[i] = a[offset + i];\n    }\n  } else {\n    const d = shape[0];\n    const rest = shape.slice(1);\n    const len = rest.reduce((acc, c) => acc * c);\n    for (let i = 0; i < d; i++) {\n      ret[i] = createNestedArray(offset + i * len, rest, a);\n    }\n  }\n  return ret;\n}\n\n\n// Provide a nested array of TypedArray in given shape.\nexport function toNestedArray(shape: number[], a: TypedArray) {\n  if (shape.length === 0) {\n    // Scalar type should return a single number.\n    return a[0];\n  }\n  const size = shape.reduce((acc, c) => acc * c);\n  if (size === 0) {\n    // A tensor with shape zero should be turned into empty list.\n    return [];\n  }\n  if (size !== a.length) {\n    throw new Error(`[${shape}] does not match the input size ${a.length}.`);\n  }\n  return createNestedArray(0, shape, a);\n}\n\n\nexport function makeOnesTypedArray<D extends DataType>(\n  size: number, dtype: D): DataTypeMap[D] {\n  const array = makeZerosTypedArray(size, dtype);\n  for (let i = 0; i < array.length; i++) {\n    array[i] = 1;\n  }\n  return array;\n}\n\n\nexport function makeZerosTypedArray<D extends DataType>(\n  size: number, dtype: D): DataTypeMap[D] {\n  if (dtype === null || dtype === 'float32' || dtype === 'complex64') {\n    return new Float32Array(size) as DataTypeMap[D];\n  } else if (dtype === 'int32') {\n    return new Int32Array(size) as DataTypeMap[D];\n  } else if (dtype === 'bool') {\n    return new Uint8Array(size) as DataTypeMap[D];\n  } else {\n    throw new Error('Unknown data type ${dtype}');\n  }\n}\n\n\n// **\n * Make nested `TypedArray` filled with zeros.\n * @param shape The shape information for the nested array.\n * @param dtype dtype of the array element.\n * ^\nexport function makeZerosNestedTypedArray<D extends DataType>(\n  shape: number[], dtype: D) {\n  const size = shape.reduce((prev, curr) => prev * curr, 1);\n  if (dtype === null || dtype === 'float32') {\n    return toNestedArray(shape, new Float32Array(size));\n  } else if (dtype === 'int32') {\n    return toNestedArray(shape, new Int32Array(size));\n  } else if (dtype === 'bool') {\n    return toNestedArray(shape, new Uint8Array(size));\n  } else {\n    throw new Error('Unknown data type ${dtype}');\n  }\n}\n\n\nexport function assertNonNegativeIntegerDimensions(shape: number[]) {\n  shape.forEach(dimSize => {\n    assert(\n      Number.isInteger(dimSize) && dimSize >= 0,\n      () =>\n        `Tensor must have a shape comprised of positive integers but got ` +\n          `shape [${shape}].`);\n  });\n}\n\n\n// **\n * Computes flat index for a given location (multidimensional index) in a\n * Tensor/multidimensional array.\n * @param locs Location in the tensor.\n * @param rank Rank of the tensor.\n * @param strides Tensor strides.\n * ^\nexport function locToIndex(\n  locs: number[], rank: number, strides: number[]): number {\n  if (rank === 0) {\n    return 0;\n  } else if (rank === 1) {\n    return locs[0];\n  }\n  let index = locs[locs.length - 1];\n  for (let i = 0; i < locs.length - 1; ++i) {\n    index += strides[i] * locs[i];\n  }\n  return index;\n}\n\n\n// **\n * Computes the location (multidimensional index) in a tensor/multidimensional\n * array for a given flat index.\n * @param index Index in flat array.\n * @param rank Rank of tensor.\n * @param strides Strides of tensor.\n * ^\nexport function indexToLoc(\n  index: number, rank: number, strides: number[]): number[] {\n  if (rank === 0) {\n    return [];\n  } else if (rank === 1) {\n    return [index];\n  }\n  const locs: number[] = new Array(rank);\n  for (let i = 0; i < locs.length - 1; ++i) {\n    locs[i] = Math.floor(index / strides[i]);\n    index -= locs[i] * strides[i];\n  }\n  locs[locs.length - 1] = index;\n  return locs;\n}\n\n\n// **\n * This method asserts whether an object is a Promise instance.\n * @param object\n * ^\n// tslint:disable-next-line: no-

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any\nexport function isPromise(object: any) {\n // We chose to not use 'obj instanceof Promise' for two reasons:\n // 1. It only reliably works for es6 Promise, not other Promise\n // implementations.\n // 2. It doesn't work with\n framework that uses zone.js. zone.js monkey patch\n // the async calls, so it is possible the obj (patched) is\n comparing to a\n // pre-patched Promise.\n return object && object.then && typeof object.then ===\n 'function';\n}\n"/**\n * @license\n * Copyright 2017 Google LLC. All Rights Reserved.\n * Licensed under the\n Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the\n License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is\n distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either\n express or implied.\n * See the License for the specific language governing permissions and\n * limitations under\n the License.\n */

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*\n\nimport {Platform} from './platforms/platform';\nimport {isPromise} from './util_base';\n\n// Expects flags from\n URL in the format ?tfjsflags=FLAG1:1,FLAG2:true.\nconst TENSORFLOWJS_FLAGS_PREFIX =\n 'tfjsflags';\n\ntype FlagValue = number|boolean;\ntype FlagEvaluationFn = (() => FlagValue)|((() =>\n Promise<FlagValue>));\nexport type Flags = {\n [featureName: string]: FlagValue\n};\nexport type\n FlagRegistryEntry = {\n evaluationFn: FlagEvaluationFn;\n setHook?: (value: FlagValue) => void;\n};\n\n/**\n * The environment contains evaluated flags as well as the registered\n platform.\n * This is always used as a global singleton and can be retrieved with\n * `tf.env()`. \n * @doc\n {heading: 'Environment'}\n *\nexport class Environment {\n private flags: Flags = {};\n private flagRegistry:\n {[flagName: string]: FlagRegistryEntry} = {};\n\n private urlFlags: Flags = {};\n\n platformName: string;\n\n platform: Platform;\n\n tslint:disable-next-line: no-any\n constructor(public global: any) {\n this.populateURLFlags();\n }\n\n setPlatform(platformName: string, platform: Platform) {\n if (this.platform !=\n null) {\n console.warn(\n `Platform ${this.platformName} has already been set. ` +\n `Overwriting the\n platform with ${platform}.`);\n }\n this.platformName = platformName;\n this.platform = platform;\n }\n\n registerFlag(\n flagName: string, evaluationFn: FlagEvaluationFn,\n setHook?: (value: FlagValue) => void)\n {\n this.flagRegistry[flagName] = {evaluationFn, setHook};\n\n // Override\n the flag value from the URL. This has to happen here because the\n // environment is initialized before flags get\n registered.\n if (this.urlFlags[flagName] != null) {\n const flagValue = this.urlFlags[flagName];\n console.warn(\n `Setting feature override from URL ${flagName}: ${flagValue}.`);\n this.set(flagName,\n flagValue);\n }\n }\n\n async getAsync(flagName: string): Promise<FlagValue> {\n if (flagName in this.flags)\n {\n return this.flags[flagName];\n }\n\n this.flags[flagName] = await this.evaluateFlag(flagName);\n return\n this.flags[flagName];\n }\n\n get(flagName: string): FlagValue {\n if (flagName in this.flags) {\n return\n this.flags[flagName];\n }\n\n const flagValue = this.evaluateFlag(flagName);\n if (isPromise(flagValue)) {\n throw new Error(\n `Flag ${flagName} cannot be synchronously evaluated. ` +\n `Please use getAsync()\n instead. `);\n }\n\n this.flags[flagName] = flagValue\n as number | boolean;\n return this.flags[flagName];\n }\n\n getNumber(flagName: string): number {\n return\n this.get(flagName) as number;\n }\n\n getBool(flagName: string): boolean {\n return this.get(flagName) as\n boolean;\n }\n\n getFlags(): Flags {\n return this.flags;\n }\n\n // For backwards compatibility.\n get features():\n Flags {\n return this.flags;\n }\n\n set(flagName: string, value: FlagValue): void {\n if\n (this.flagRegistry[flagName] == null) {\n throw new Error(\n `Cannot set flag ${flagName} as it has not\n been registered. `);\n }\n\n this.flags[flagName] = value;\n if (this.flagRegistry[flagName].setHook != null) {\n this.flagRegistry[flagName].setHook(value);\n }\n }\n\n private evaluateFlag(flagName: string):\n FlagValue|Promise<FlagValue> {\n if (this.flagRegistry[flagName] == null) {\n throw new Error(\n `Cannot evaluate flag '${flagName}': no evaluation function found. `);\n }\n\n return\n this.flagRegistry[flagName].evaluationFn();\n }\n\n setFlags(flags: Flags) {\n this.flags = Object.assign({}, flags);\n }\n\n reset() {\n this.flags = {};\n\n this.urlFlags = {};\n this.populateURLFlags();\n }\n\n private populateURLFlags(): void {\n if (typeof

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this.global === 'undefined' ||\n    typeof this.global.location === 'undefined' ||\n    typeof
this.global.location.search === 'undefined') {\n    return;\n }\n\n const urlParams =
getQueryParams(this.global.location.search);\n if (TensorFlowJS_FLAGS_PREFIX in urlParams) {\n
const keyValues = urlParams[TensorFlowJS_FLAGS_PREFIX].split(',');\n    keyValues.forEach(keyValue =>
{\n    const [key, value] = keyValue.split(':') as [string, string];\n    this.urlFlags[key] = parseValue(key,
value);\n    });\n }\n }\n\n\nexport function getQueryParams(queryString: string): {[key: string]: string} {\n
const params = {};\n    queryString.replace(/(?:&)([^\s?&+])(?:=([^\s&*])?)?/g, (s, ...t)
=> {\n    decodeParam(params, t[0], t[1]);\n    return t.join('=');\n });\n    return params;\n }\n\n\nfunction
decodeParam(\n    params: {[key: string]: string}, name: string, value?: string) {\n
params[decodeURIComponent(name)] = decodeURIComponent(value || '');\n }\n\n\nfunction parseValue(flagName:
string, value: string): FlagValue {\n    value = value.toLowerCase();\n    if (value === 'true' || value === 'false') {\n
return value === 'true';\n    } else if (`$${+ value}` === value) {\n    return +value;\n    }\n    throw new Error(\n
`Could not parse value flag value ${value} for flag ${flagName}.`);\n }\n }\n\n\n**\n * Returns the current environment
(a global singleton).\n *\n * The environment object contains the evaluated feature values as well as the\n * active
platform.\n *\n * @doc {heading: 'Environment'}\n */\n\nexport function env() {\n    return ENV;\n }\n\n\nexport let
ENV: Environment = null;\n\nexport function setEnvironmentGlobal(environment: Environment) {\n    ENV =
environment;\n }\n\n\n", "//
\n    shim for using process in browser\n\nvar process = module.exports = {};\n\n// cached from whatever global is present
so that test runners that stub it\n// don't break things. But we need to wrap it in a try catch in case it is\n// wrapped in
strict mode code which doesn't define any globals. It's inside a\n// function because try/catches deoptimize in certain
engines.\n\n\nvar cachedSetTimeout;\nvar cachedClearTimeout;\n\n\nfunction defaultSetTimeout() {\n    throw new
Error('setTimeout has not been defined');\n }\n\n\nfunction defaultClearTimeout () {\n    throw new Error('clearTimeout
has not been defined');\n }\n\n\n(function () {\n    try {\n        if (typeof setTimeout === 'function') {\n
cachedSetTimeout = setTimeout;\n        } else {\n            cachedSetTimeout = defaultSetTimeout;\n        }\n    } catch
(e) {\n        cachedSetTimeout = defaultSetTimeout;\n    }\n    try {\n        if (typeof clearTimeout === 'function') {\n
cachedClearTimeout = clearTimeout;\n        } else {\n            cachedClearTimeout = defaultClearTimeout;\n        }\n    } catch
(e) {\n        cachedClearTimeout = defaultClearTimeout;\n    }\n }\n\n\nfunction runTimeout(fun) {\n    if (cachedSetTimeout
=== setTimeout) {\n        //normal environments in sane situations\n        return setTimeout(fun, 0);\n    }\n    // if
setTimeout wasn't available but was latter defined\n    if ((cachedSetTimeout === defaultSetTimeout ||
!cachedSetTimeout) && setTimeout) {\n        cachedSetTimeout = setTimeout;\n        return setTimeout(fun, 0);\n    }\n    try {\n        // when when somebody has screwed with setTimeout but no I.E. maddness\n        return
cachedSetTimeout(fun, 0);\n    } catch(e){\n        try {\n            // When we are in I.E. but the script has been eveled
so I.E. doesn't trust the global object when called normally\n            return cachedSetTimeout.call(null, fun, 0);\n        }
catch(e){\n            // same as above but when it's a version of I.E. that must
have the global object for 'this', hopefully our context correct otherwise it will throw a global error\n            return
cachedSetTimeout.call(this, fun, 0);\n        }\n    }\n }\n\n\nfunction runClearTimeout(marker) {\n    if
(cachedClearTimeout === clearTimeout) {\n        //normal environments in sane situations\n        return
clearTimeout(marker);\n    }\n    // if clearTimeout wasn't available but was latter defined\n    if
((cachedClearTimeout === defaultClearTimeout || !cachedClearTimeout) && clearTimeout) {\n
cachedClearTimeout = clearTimeout;\n        return clearTimeout(marker);\n    }\n    try {\n        // when when
somebody has screwed with setTimeout but no I.E. maddness\n        return cachedClearTimeout(marker);\n    }
catch (e){\n        try {\n            // When we are in I.E. but the script has been eveled so I.E. doesn't trust the global
object when called normally\n            return cachedClearTimeout.call(null, marker);\n        } catch (e){\n            //
same as above but when it's a version of I.E. that must have the global object for 'this', hopefully our context
correct otherwise it will throw a global error.\n            // Some versions of I.E. have different rules for clearTimeout
vs setTimeout\n            return cachedClearTimeout.call(this, marker);\n        }\n    }\n }\n\n\n\n\n\nvar queue = [];\nvar
draining = false;\nvar currentQueue;\nvar queueIndex = -1;\n\nfunction cleanUpNextTick() {\n    if (!draining ||

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!currentQueue) {\n    return;\n } \n draining = false;\n if (currentQueue.length) {\n    queue =
currentQueue.concat(queue);\n } else {\n    queueIndex = -1;\n } \n if (queue.length) {\n    drainQueue();\n
}\n}\n\nfunction drainQueue() {\n    if (draining) {\n        return;\n    } \n    var timeout =
runTimeout(cleanUpNextTick);\n    draining = true;\n    \n    var len = queue.length;\n    while(len) {\n
currentQueue = queue;\n        queue = [];\n        while (++queueIndex <
len) {\n            if (currentQueue) {\n                currentQueue[queueIndex].run();\n            } \n        } \n
queueIndex = -1;\n        len = queue.length;\n    } \n    currentQueue = null;\n    draining = false;\n
runClearTimeout(timeout);\n}\n\n\nprocess.nextTick = function (fun) {\n    var args = new Array(arguments.length -
1);\n    if (arguments.length > 1) {\n        for (var i = 1; i < arguments.length; i++) {\n            args[i - 1] =
arguments[i];\n        } \n    } \n    queue.push(new Item(fun, args));\n    if (queue.length === 1 && !draining) {\n
runTimeout(drainQueue);\n    } \n};\n\n// v8 likes predictable objects\nfunction Item(fun, array) {\n    this.fun =
fun;\n    this.array = array;\n}\n\nItem.prototype.run = function () {\n    this.fun.apply(null,
this.array);\n};\n\nprocess.title = 'browser';\nprocess.browser = true;\nprocess.env = {};\nprocess.argv =
[];\nprocess.version = ""; // empty string to avoid regexp issues\nprocess.versions = {};\n\nfunction
noop() {} \n\nprocess.on = noop;\nprocess.addListener = noop;\nprocess.once = noop;\nprocess.off =
noop;\nprocess.removeListener = noop;\nprocess.removeAllListeners = noop;\nprocess.emit =
noop;\nprocess.prependListener = noop;\nprocess.prependOnceListener = noop;\n\nprocess.listeners = function
(name) { return [] } \n\nprocess.binding = function (name) {\n    throw new Error('process.binding is not
supported');\n};\n\nprocess.cwd = function () { return '/' };\nprocess.chdir = function (dir) {\n    throw new
Error('process.chdir is not supported');\n};\n\nprocess.umask = function() { return 0; };\n\n"/**\n * @license\n *
Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
"License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or
agreed to in writing, software\n * distributed
under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF
ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n *
limitations under the License.\n *
===== \n
*\n\n// Note that the identifier globalNameSpace is scoped to this module, but will\n// always resolve to the same
global object regardless of how the module is\n// resolved.\n\n// tslint:disable-next-line:no-any\nlet globalNameSpace:
{ _tfGlobals: Map<string, any> };\n\n// tslint:disable-next-line:no-any\nexport function getGlobalNameSpace():
{ _tfGlobals: Map<string, any> } {\n    if (globalNameSpace == null) {\n        // tslint:disable-next-line:no-any\n        let ns:
any;\n        if (typeof (window) !== 'undefined') {\n            ns = window;\n        } else if (typeof (global) !== 'undefined') {\n
ns = global;\n        } else if (typeof (process) !== 'undefined') {\n            ns = process;\n        }
else if (typeof (self) !== 'undefined') {\n            ns = self;\n        } else {\n            throw new Error('Could not find a global
object');\n        } \n        globalNameSpace = ns;\n    } \n    return globalNameSpace;\n}\n\n// tslint:disable-next-line:no-
any\nfunction getGlobalMap(): Map<string, any> {\n    const ns = getGlobalNameSpace();\n    if (ns._tfGlobals ===
null) {\n        ns._tfGlobals = new Map();\n    } \n    return ns._tfGlobals;\n}\n\n/**\n * Returns a globally accessible
'singleton' object.\n * \n * @param key the name of the object\n * @param init a function to initialize to initialize
this object\n * \n        the first time it is fetched.\n * \n\nexport function getGlobal<T>(key: string, init: () => T): T {\n
const globalMap = getGlobalMap();\n    if (globalMap.has(key)) {\n        return globalMap.get(key);\n    } else {\n
const singleton = init();\n        globalMap.set(key, singleton);\n        return globalMap.get(key);\n    } \n}\n\n"/**\n *
@license\n * Copyright 2020 Google LLC. All Rights Reserved.\n *
Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in
compliance with the License.\n * You may obtain a copy of the License at\n * \n *
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=====\\n *\\n//  
Allow UpperCamelCase variable names\\n// tslint:disable: variable-name\\n// Unfortunately just enabling PascalCase  
per file (tslint:enable:\\n// allow-pascal-case) doesn't work.\\nimport {NamedTensorInfoMap, TensorInfo} from  
'./kernel_registry';\\nimport {ExplicitPadding} from './ops/conv_util';\\nimport {Activation} from  
'./ops/fused_types';\\nimport  
{DataType, PixelData} from './types';\\n\\nexport const Abs = 'Abs';\\nexport type AbsInputs =  
UnaryInputs;\\n\\nexport const Acos = 'Acos';\\nexport type AcosInputs = UnaryInputs;\\n\\nexport const Acosh =  
'Acosh';\\nexport type AcoshInputs = UnaryInputs;\\n\\nexport const Add = 'Add';\\nexport type AddInputs =  
BinaryInputs;\\n\\nexport const AddN = 'AddN';\\nexport type AddNInputs = TensorInfo[];\\n\\nexport const All =  
'All';\\nexport type AllInputs = Pick<NamedTensorInfoMap, 'x'>;\\nexport interface AllAttrs {\\n  axis:  
number|number[];\\n  keepDims: boolean;\\n}\\n\\nexport const Any = 'Any';\\nexport type AnyInputs =  
Pick<NamedTensorInfoMap, 'x'>;\\nexport interface AnyAttrs {\\n  axis: number|number[];\\n  keepDims:  
boolean;\\n}\\n\\nexport const ArgMax = 'ArgMax';\\nexport type ArgMaxInputs = Pick<NamedTensorInfoMap,  
'x'>;\\nexport interface ArgMaxAttrs {\\n  axis: number;\\n}\\n\\nexport const ArgMin = 'ArgMin';\\nexport type  
ArgMinInputs = Pick<NamedTensorInfoMap, 'x'>;\\nexport interface ArgMinAttrs {\\n  axis:  
number;\\n}\\n\\nexport const Asin = 'Asin';\\nexport type AsinInputs = UnaryInputs;\\n\\nexport const Asinh =  
'Asinh';\\nexport type AsinhInputs = UnaryInputs;\\n\\nexport const Atan = 'Atan';\\nexport type AtanInputs =  
UnaryInputs;\\n\\nexport const Atanh = 'Atanh';\\nexport type AtanhInputs = UnaryInputs;\\n\\nexport const Atan2 =  
'Atan2';\\nexport type Atan2Inputs = BinaryInputs;\\n\\nexport const AvgPool = 'AvgPool';\\nexport type  
AvgPoolInputs = Pick<NamedTensorInfoMap, 'x'>;\\nexport interface AvgPoolAttrs {\\n  filterSize: [number,  
number]|number;\\n  strides: [number, number]|number;\\n  pad: 'valid'|'same'|number;\\n  dimRoundingMode?:  
'floor'|'round'|'ceil';\\n}\\n\\nexport const AvgPoolGrad = 'AvgPoolGrad';\\nexport type AvgPoolGradInputs =  
Pick<NamedTensorInfoMap, 'dy'|'input'>;\\nexport interface AvgPoolGradAttrs {\\n  filterSize: [number,  
number]|number;\\n  strides: [number, number]|number;\\n  pad: 'valid'|'same'|number;\\n}\\n\\nexport const AvgPool3D  
= 'AvgPool3D';\\nexport type AvgPool3DInputs = Pick<NamedTensorInfoMap,  
'x'>;\\nexport interface AvgPool3DAttrs {\\n  filterSize: [number, number, number]|number;\\n  strides: [number,  
number, number]|number;\\n  pad: 'valid'|'same'|number;\\n  dimRoundingMode?: 'floor'|'round'|'ceil';\\n  dataFormat:  
'NDHWC'|'NCDHW';\\n}\\n\\nexport const AvgPool3DGrad = 'AvgPool3DGrad';\\nexport type  
AvgPool3DGradInputs = Pick<NamedTensorInfoMap, 'dy'|'input'>;\\nexport interface AvgPool3DGradAttrs {\\n  
filterSize: [number, number, number]|number;\\n  strides: [number, number, number]|number;\\n  pad:  
'valid'|'same'|number;\\n  dimRoundingMode?: 'floor'|'round'|'ceil';\\n}\\n\\nexport const BatchMatMul =  
'BatchMatMul';\\nexport type BatchMatMulInputs = Pick<NamedTensorInfoMap, 'a'|'b'>;\\nexport interface  
BatchMatMulAttrs {\\n  transposeA: boolean;\\n  transposeB: boolean;\\n}\\n\\nexport const BatchToSpaceND =  
'BatchToSpaceND';\\nexport type BatchToSpaceNDInputs = Pick<NamedTensorInfoMap, 'x'>;\\nexport interface  
BatchToSpaceNDAttrs {\\n  blockShape: number[];\\n  crops: number[][];\\n}\\n\\nexport  
type BinaryInputs = Pick<NamedTensorInfoMap, 'a'|'b'>;\\n\\nexport const Bincount = 'Bincount';\\nexport type  
BincountInputs = Pick<NamedTensorInfoMap, 'x'|'weights'>;\\nexport interface BincountAttrs {\\n  size:  
number;\\n}\\n\\nexport const BroadcastTo = 'BroadcastTo';\\nexport type BroadcastToInputs =  
Pick<NamedTensorInfoMap, 'x'>;\\nexport interface BroadCastToAttrs {\\n  shape: number[];\\n  inputShape:  
number[]; // for gradient\\n}\\n\\nexport const Cast = 'Cast';\\nexport type CastInputs = UnaryInputs;\\nexport interface  
CastAttrs {\\n  dtype: DataType;\\n}\\n\\nexport const Ceil = 'Ceil';\\nexport type CeilInputs = UnaryInputs;\\n\\nexport  
const ClipByValue = 'ClipByValue';\\nexport type ClipByValueInputs = UnaryInputs;\\nexport interface  
ClipByValueAttrs {\\n  clipValueMin: number;\\n  clipValueMax: number;\\n}\\n\\nexport const Complex =  
'Complex';\\nexport type ComplexInputs = Pick<NamedTensorInfoMap, 'real'|'imag'>;\\n\\nexport const ComplexAbs  
= 'ComplexAbs';\\nexport type ComplexAbsInputs  
= UnaryInputs;\\n\\nexport const Concat = 'Concat';\\nexport type ConcatInputs = TensorInfo[];\\nexport interface  
ConcatAttrs {\\n  axis: number;\\n}\\n\\nexport const Conv2D = 'Conv2D';\\nexport type Conv2DInputs =
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Pick<NamedTensorInfoMap, 'x'|'filter'>;\nexport interface Conv2DAttrs {\n  strides: [number, number]|number;\n  pad: 'valid'|'same'|number|ExplicitPadding;\n  dataFormat: 'NHWC'|'NCHW';\n  dilations: [number, number]|number;\n  dimRoundingMode?: 'floor'|'round'|'ceil';\n}\n\nexport const Conv2DBackpropFilter = 'Conv2DBackpropFilter';\nexport type Conv2DBackpropFilterInputs = Pick<NamedTensorInfoMap, 'x'|'dy'>;\nexport interface Conv2DBackpropFilterAttrs {\n  strides: [number, number]|number;\n  pad: 'valid'|'same'|number|ExplicitPadding;\n  dataFormat: 'NHWC'|'NCHW';\n  dimRoundingMode?: 'floor'|'round'|'ceil';\n  filterShape: [number, number, number, number];\n}\n\nexport const Conv2DBackpropInput = 'Conv2DBackpropInput';\nexport type Conv2DBackpropInputInputs = Pick<NamedTensorInfoMap, 'dy'|'filter'>;\nexport interface Conv2DBackpropInputAttrs {\n  strides: [number, number]|number;\n  pad: 'valid'|'same'|number|ExplicitPadding;\n  dataFormat: 'NHWC'|'NCHW';\n  dimRoundingMode?: 'floor'|'round'|'ceil';\n  inputShape: [number, number, number, number];\n}\n\nexport const Conv3D = 'Conv3D';\nexport type Conv3DInputs = Pick<NamedTensorInfoMap, 'x'|'filter'>;\nexport interface Conv3DAttrs {\n  strides: [number, number, number]|number;\n  pad: 'valid'|'same';\n  dataFormat: 'NDHWC'|'NCDHW';\n  dilations: [number, number, number]|number;\n}\n\nexport const Conv3DBackpropFilterV2 = 'Conv3DBackpropFilterV2';\nexport type Conv3DBackpropFilterV2Inputs = Pick<NamedTensorInfoMap, 'x'|'dy'>;\n\nexport interface Conv3DBackpropFilterV2Attrs {\n  strides: [number, number, number]|number;\n  pad: 'valid'|'same';\n  filterShape: [number, number, number, number, number];\n}\n\nexport const Conv3DBackpropInputV2 = 'Conv3DBackpropInputV2';\nexport type Conv3DBackpropInputV2Inputs =\n  \n  Pick<NamedTensorInfoMap, 'dy'|'filter'>;\nexport interface Conv3DBackpropInputV2Attrs {\n  strides: [number, number, number]|number;\n  pad: 'valid'|'same';\n  inputShape: [number, number, number, number, number];\n}\n\nexport const Cos = 'Cos';\nexport type CosInputs = UnaryInputs;\n\nexport const Cosh = 'Cosh';\nexport type CoshInputs = UnaryInputs;\n\nexport const Cumsum = 'Cumsum';\nexport type CumsumInputs = Pick<NamedTensorInfoMap, 'x'>;\nexport interface CumsumAttrs {\n  axis: number;\n  exclusive: boolean;\n  reverse: boolean;\n}\n\nexport const CropAndResize = 'CropAndResize';\nexport type CropAndResizeInputs =\n  \n  Pick<NamedTensorInfoMap, 'image'|'boxes'|'boxInd'>;\nexport interface CropAndResizeAttrs {\n  cropSize: [number, number];\n  method: 'bilinear'|'nearest';\n  extrapolationValue: number;\n}\n\nexport const DenseBincount = 'DenseBincount';\nexport type DenseBincountInputs = Pick<NamedTensorInfoMap, 'x'|'weights'>;\nexport interface DenseBincountAttrs {\n  size: number;\n  binaryOutput?: boolean;\n}\n\nexport const DepthToSpace = 'DepthToSpace';\nexport type DepthToSpaceInputs = Pick<NamedTensorInfoMap, 'x'>;\nexport interface DepthToSpaceAttrs {\n  blockSize: number;\n  dataFormat: 'NHWC'|'NCHW';\n}\n\nexport const DepthwiseConv2dNative = 'DepthwiseConv2dNative';\nexport type DepthwiseConv2dNativeInputs =\n  \n  Pick<NamedTensorInfoMap, 'x'|'filter'>;\nexport interface DepthwiseConv2dNativeAttrs {\n  strides: [number, number]|number;\n  pad: 'valid'|'same'|number;\n  dataFormat: 'NHWC'|'NCHW';\n  dilations: [number, number]|number;\n  dimRoundingMode?: 'floor'|'round'|'ceil';\n}\n\nexport const DepthwiseConv2dNativeBackpropFilter =\n  'DepthwiseConv2dNativeBackpropFilter';\nexport type DepthwiseConv2dNativeBackpropFilterInputs =\n  \n  Pick<NamedTensorInfoMap, 'x'|'dy'>;\nexport interface DepthwiseConv2dNativeBackpropFilterAttrs {\n  strides: [number, number]|number;\n  dilations: [number, number]|number;\n  pad: 'valid'|'same'|number;\n  dimRoundingMode?: 'floor'|'round'|'ceil';\n  filterShape: [number, number, number, number];\n}\n\nexport const DepthwiseConv2dNativeBackpropInput =\n  'DepthwiseConv2dNativeBackpropInput';\nexport type DepthwiseConv2dNativeBackpropInputInputs =\n  \n  Pick<NamedTensorInfoMap, 'dy'|'filter'>;\nexport interface DepthwiseConv2dNativeBackpropInputAttrs {\n  strides: [number, number]|number;\n  dilations: [number, number]|number;\n  pad: 'valid'|'same'|number;\n  dimRoundingMode?: 'floor'|'round'|'ceil';\n  inputShape: [number, number, number, number];\n}\n\nexport const Diag = 'Diag';\nexport type DiagInputs = Pick<NamedTensorInfoMap, 'x'>;\n\nexport const Dilation2D = 'Dilation2D';\nexport type Dilation2DInputs = Pick<NamedTensorInfoMap, 'x'|'filter'>;\nexport interface Dilation2DAttrs {\n  strides: [number, number]|number;\n  pad: 'valid'|'same'|number;\n  dilations: [number, number]|number;\n}\n\nexport const Dilation2DBackpropInput =

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'Dilation2DBackpropInput';\nextport type Dilation2DBackpropInputInputs
=\n Pick<NamedTensorInfoMap, 'x'|'filter'|'dy'>;\nextport const Dilation2DBackpropFilter =
'Dilation2DBackpropFilter';\nextport type Dilation2DBackpropFilterInputs =\n Pick<NamedTensorInfoMap,
'x'|'filter'|'dy'>;\n\nnextport const RealDiv = 'RealDiv';\nextport type RealDivInputs = BinaryInputs;\n\nnextport const
Elu = 'Elu';\nextport type EluInputs = Pick<NamedTensorInfoMap, 'x'>;\n\nnextport const EluGrad =
'EluGrad';\nextport type EluGradInputs = Pick<NamedTensorInfoMap, 'dy'|'y'>;\n\nnextport const Erf = 'Erf';\nextport
type ErfInputs = UnaryInputs;\n\nnextport const Equal = 'Equal';\nextport type EqualInputs = BinaryInputs;\n\nnextport
const Exp = 'Exp';\nextport type ExpInputs = UnaryInputs;\n\nnextport const ExpandDims = 'ExpandDims';\nextport
type ExpandDimsInputs = Pick<NamedTensorInfoMap, 'input'>;\nextport interface ExpandDimsAttrs {\n dim:
number;\n}\n\nnextport const Expm1 = 'Expm1';\nextport type Expm1Inputs = UnaryInputs;\n\nnextport const FFT =
'FFT';\nextport type FFTInputs =
Pick<NamedTensorInfoMap, 'input'>;\n\nnextport const Fill = 'Fill';\nextport interface FillAttrs {\n shape:
number[];\n value: number|string;\n dtype: DataType;\n}\n\nnextport const FlipLeftRight = 'FlipLeftRight';\nextport
type FlipLeftRightInputs = Pick<NamedTensorInfoMap, 'image'>;\n\nnextport const Floor = 'Floor';\nextport type
FloorInputs = UnaryInputs;\n\nnextport const FloorDiv = 'FloorDiv';\nextport type FloorDivInputs =
BinaryInputs;\n\nnextport const FusedBatchNorm = 'FusedBatchNorm';\nextport type FusedBatchNormInputs =\n
Pick<NamedTensorInfoMap, 'x'|'scale'|'offset'|'mean'|'variance'>;\nextport interface FusedBatchNormAttrs {\n
varianceEpsilon: number;\n}\n\nnextport const GatherV2 = 'GatherV2';\nextport type GatherV2Inputs =
Pick<NamedTensorInfoMap, 'x'|'indices'>;\nextport interface GatherV2Attrs {\n axis: number;\n batchDims:
number;\n}\n\nnextport const GatherNd = 'GatherNd';\nextport type GatherNdInputs = Pick<NamedTensorInfoMap,
'params'|'indices'>;\n\nnextport const Greater = 'Greater';\nextport
type GreaterInputs = BinaryInputs;\n\nnextport const GreaterEqual = 'GreaterEqual';\nextport type GreaterEqualInputs
= BinaryInputs;\n\nnextport const Identity = 'Identity';\nextport type IdentityInputs = Pick<NamedTensorInfoMap,
'x'>;\n\nnextport const IFFT = 'IFFT';\nextport type IFFTInputs = Pick<NamedTensorInfoMap, 'input'>;\n\nnextport
const Imag = 'Imag';\nextport type ImagInputs = Pick<NamedTensorInfoMap, 'input'>;\n\nnextport const IsFinite =
'IsFinite';\nextport type IsFiniteInputs = UnaryInputs;\n\nnextport const IsInf = 'IsInf';\nextport type IsInfInputs =
UnaryInputs;\n\nnextport const IsNan = 'IsNan';\nextport type IsNanInputs = UnaryInputs;\n\nnextport const LeakyRelu
= 'LeakyRelu';\nextport type LeakyReluInputs = Pick<NamedTensorInfoMap, 'x'>;\nextport interface LeakyReluAttrs
{\n alpha: number;\n}\n\nnextport const Less = 'Less';\nextport type LessInputs = BinaryInputs;\n\nnextport const
LessEqual = 'LessEqual';\nextport type LessEqualInputs = BinaryInputs;\n\nnextport const LinSpace =
'LinSpace';\nextport interface LinSpaceAttrs {\n start: number;\n stop: number;\n num: number;\n}\n\nnextport const
Log = 'Log';\nextport type LogInputs = UnaryInputs;\n\nnextport const Log1p = 'Log1p';\nextport type Log1pInputs =
UnaryInputs;\n\nnextport const LogicalAnd = 'LogicalAnd';\nextport type LogicalAndInputs = BinaryInputs;\n\nnextport
const LogicalNot = 'LogicalNot';\nextport type LogicalNotInputs = Pick<NamedTensorInfoMap, 'x'>;\n\nnextport
const LogicalOr = 'LogicalOr';\nextport type LogicalOrInputs = BinaryInputs;\n\nnextport const LogSoftmax =
'LogSoftmax';\nextport type LogSoftmaxInputs = Pick<NamedTensorInfoMap, 'logits'>;\nextport interface
LogSoftmaxAttrs {\n axis: number;\n}\n\nnextport const LRN = 'LRN';\nextport type LRNInputs =
Pick<NamedTensorInfoMap, 'x'>;\nextport interface LRNAttrs {\n depthRadius: number;\n bias: number;\n alpha:
number;\n beta: number;\n}\n\nnextport const LRNGrad = 'LRNGrad';\nextport type LRNGradInputs =
Pick<NamedTensorInfoMap, 'x'|'y'|'dy'>;\nextport interface
LRNGradAttrs {\n depthRadius: number;\n bias: number;\n alpha: number;\n beta: number;\n}\n\nnextport const
Max = 'Max';\nextport type MaxInputs = Pick<NamedTensorInfoMap, 'x'>;\nextport interface MaxAttrs {\n
reductionIndices: number|number[];\n keepDims: boolean;\n}\n\nnextport const Maximum = 'Maximum';\nextport
type MaximumInputs = BinaryInputs;\n\nnextport const MaxPool = 'MaxPool';\nextport type MaxPoolInputs =
Pick<NamedTensorInfoMap, 'x'>;\nextport interface MaxPoolAttrs {\n filterSize: [number, number]|number;\n
strides: [number, number]|number;\n pad: 'valid'|'same'|number;\n dimRoundingMode?:
'floor'|'round'|'ceil';\n}\n\nnextport const MaxPoolGrad = 'MaxPoolGrad';\nextport type MaxPoolGradInputs =
Pick<NamedTensorInfoMap, 'dy'|'input'|'output'>;\nextport interface MaxPoolGradAttrs {\n filterSize: [number,

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number]]number;\n strides: [number, number]]number;\n pad: 'valid'|'same'|number;\n dimRoundingMode?:
'floor'|'round'|'ceil';\n}\n\n\nexport const MaxPool3D = 'MaxPool3D';\n\nexport
type MaxPool3DInputs = Pick<NamedTensorInfoMap, 'x'>;\n\nexport interface MaxPool3DAttrs {\n filterSize:
[number, number, number]]number;\n strides: [number, number, number]]number;\n pad: 'valid'|'same'|number;\n
dataFormat: 'NDHWC'|'NCDHW';\n dimRoundingMode?: 'floor'|'round'|'ceil';\n}\n\n\nexport const MaxPool3DGrad
= 'MaxPool3DGrad';\n\nexport type MaxPool3DGradInputs =\n Pick<NamedTensorInfoMap,
'dy'|'input'|'output'>;\n\nexport interface MaxPool3DGradAttrs {\n filterSize: [number, number, number]]number;\n
strides: [number, number, number]]number;\n pad: 'valid'|'same'|number;\n dimRoundingMode?:
'floor'|'round'|'ceil';\n}\n\n\nexport const MaxPoolWithArgmax = 'MaxPoolWithArgmax';\n\nexport type
MaxPoolWithArgmaxInputs = Pick<NamedTensorInfoMap, 'x'>;\n\nexport interface MaxPoolWithArgmaxAttrs {\n
filterSize: [number, number]]number;\n strides: [number, number]]number;\n pad: 'valid'|'same'|number;\n
includeBatchInIndex: boolean;\n}\n\n\nexport const Mean = 'Mean';\n\nexport
type MeanInputs = Pick<NamedTensorInfoMap, 'x'>;\n\nexport interface MeanAttrs {\n axis: number|number[];\n
keepDims: boolean;\n}\n\n\nexport const Min = 'Min';\n\nexport type MinInputs = Pick<NamedTensorInfoMap,
'x'>;\n\nexport interface MinAttrs {\n axis: number|number[];\n keepDims: boolean;\n}\n\n\nexport const Minimum =
'Minimum';\n\nexport type MinimumInputs = BinaryInputs;\n\nexport const MirrorPad = 'MirrorPad';\n\nexport type
MirrorPadInputs = Pick<NamedTensorInfoMap, 'x'>;\n\nexport interface MirrorPadAttrs {\n paddings:
Array<[number, number]>;\n mode: 'reflect'|'symmetric';\n}\n\n\nexport const Mod = 'Mod';\n\nexport type ModInputs
= BinaryInputs;\n\nexport const Multinomial = 'Multinomial';\n\nexport type MultinomialInputs =
Pick<NamedTensorInfoMap, 'logits'>;\n\nexport interface MultinomialAttrs {\n numSamples: number;\n seed:
number;\n normalized: boolean;\n}\n\n\nexport const Multiply = 'Multiply';\n\nexport type MultiplyInputs =
BinaryInputs;\n\nexport const Neg = 'Neg';\n\nexport type
NegInputs = UnaryInputs;\n\nexport const NotEqual = 'NotEqual';\n\nexport type NotEqualInputs =
BinaryInputs;\n\nexport const NonMaxSuppressionV3 = 'NonMaxSuppressionV3';\n\nexport type
NonMaxSuppressionV3Inputs =\n Pick<NamedTensorInfoMap, 'boxes'|'scores'>;\n\nexport interface
NonMaxSuppressionV3Attrs {\n maxOutputSize: number;\n iouThreshold: number;\n scoreThreshold:
number;\n}\n\n\nexport const NonMaxSuppressionV4 = 'NonMaxSuppressionV4';\n\nexport type
NonMaxSuppressionV4Inputs =\n Pick<NamedTensorInfoMap, 'boxes'|'scores'>;\n\nexport interface
NonMaxSuppressionV4Attrs {\n maxOutputSize: number;\n iouThreshold: number;\n scoreThreshold: number;\n
padToMaxOutputSize: boolean;\n}\n\n\nexport const NonMaxSuppressionV5 = 'NonMaxSuppressionV5';\n\nexport
type NonMaxSuppressionV5Inputs =\n Pick<NamedTensorInfoMap, 'boxes'|'scores'>;\n\nexport interface
NonMaxSuppressionV5Attrs {\n maxOutputSize: number;\n iouThreshold: number;\n scoreThreshold: number;\n
softNmsSigma: number;\n}\n\n\nexport
const OnesLike = 'OnesLike';\n\nexport type OnesLikeInputs = UnaryInputs;\n\nexport const OneHot =
'OneHot';\n\nexport type OneHotInputs = Pick<NamedTensorInfoMap, 'indices'>;\n\nexport interface OneHotAttrs {\n
depth: number;\n onValue: number;\n offValue: number;\n}\n\n\nexport const Pack = 'Pack';\n\nexport type
PackInputs = TensorInfo[];\n\nexport interface PackAttrs {\n axis: number;\n}\n\n\nexport const PadV2 =
'PadV2';\n\nexport type PadV2Inputs = Pick<NamedTensorInfoMap, 'x'>;\n\nexport interface PadV2Attrs {\n
paddings: Array<[number, number]>;\n constantValue: number;\n}\n\n\nexport const Pool = 'Pool';\n\nexport type
PoolInputs = Pick<NamedTensorInfoMap, 'input'>;\n\nexport const Pow = 'Pow';\n\nexport type PowInputs =
BinaryInputs;\n\nexport const Prelu = 'Prelu';\n\nexport type PreluInputs = Pick<NamedTensorInfoMap,
'x'|'alpha'>;\n\nexport const Prod = 'Prod';\n\nexport type ProdInputs = Pick<NamedTensorInfoMap, 'x'>;\n\nexport
interface ProdAttrs {\n axis: number|number[];\n keepDims: boolean;\n}\n\n\nexport
const Range = 'Range';\n\nexport interface RangeAttrs {\n start: number;\n stop: number;\n step: number;\n dtype:
'float32'|'int32';\n}\n\n\nexport const Real = 'Real';\n\nexport type RealInputs = Pick<NamedTensorInfoMap,
'input'>;\n\nexport const Reciprocal = 'Reciprocal';\n\nexport type ReciprocalInputs = UnaryInputs;\n\nexport const
Relu = 'Relu';\n\nexport type ReluInputs = Pick<NamedTensorInfoMap, 'x'>;\n\nexport const Reshape =
'Reshape';\n\nexport type ReshapeInputs = Pick<NamedTensorInfoMap, 'x'>;\n\nexport interface ReshapeAttrs {\n

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shape: number[];\n}\n\nexport const ResizeNearestNeighbor = 'ResizeNearestNeighbor';\nexport type
ResizeNearestNeighborInputs = Pick<NamedTensorInfoMap, 'images'>;\nexport interface
ResizeNearestNeighborAttrs {\n  alignCorners: boolean;\n  halfPixelCenters: boolean;\n  size: [number,
number];\n}\n\nexport const ResizeNearestNeighborGrad = 'ResizeNearestNeighborGrad';\nexport type
ResizeNearestNeighborGradInputs =\n  Pick<NamedTensorInfoMap,
  'images'|'dy'>;\nexport type ResizeNearestNeighborGradAttrs = ResizeNearestNeighborAttrs;\n\nexport const
ResizeBilinear = 'ResizeBilinear';\nexport type ResizeBilinearInputs = Pick<NamedTensorInfoMap,
'images'>;\nexport interface ResizeBilinearAttrs {\n  alignCorners: boolean;\n  halfPixelCenters: boolean;\n  size:
[number, number];\n}\n\nexport const ResizeBilinearGrad = 'ResizeBilinearGrad';\nexport type
ResizeBilinearGradInputs = Pick<NamedTensorInfoMap, 'images'|'dy'>;\nexport type ResizeBilinearGradAttrs =
ResizeBilinearAttrs;\n\nexport const Relu6 = 'Relu6';\nexport type Relu6Inputs = Pick<NamedTensorInfoMap,
'x'>;\n\nexport const Reverse = 'Reverse';\nexport type ReverseInputs = Pick<NamedTensorInfoMap, 'x'>;\nexport
interface ReverseAttrs {\n  dims: number|number[];\n}\n\nexport const Round = 'Round';\nexport type RoundInputs
= UnaryInputs;\n\nexport const Rsqrt = 'Rsqrt';\nexport type RsqrtInputs = UnaryInputs;\n\nexport const ScatterNd
= 'ScatterNd';\nexport type ScatterNdInputs
= Pick<NamedTensorInfoMap, 'indices'|'updates'>;\nexport interface ScatterNdAttrs {\n  shape:
number[];\n}\n\nexport const Select = 'Select';\nexport type SelectInputs = Pick<NamedTensorInfoMap,
'condition'|'t'|'e'>;\n\nexport const Selu = 'Selu';\nexport type SeluInputs = Pick<NamedTensorInfoMap,
'x'>;\n\nexport const Slice = 'Slice';\nexport type SliceInputs = Pick<NamedTensorInfoMap, 'x'>;\nexport interface
SliceAttrs {\n  begin: number|number[];\n  size: number|number[];\n}\n\nexport const Sin = 'Sin';\nexport type
SinInputs = UnaryInputs;\n\nexport const Sinh = 'Sinh';\nexport type SinhInputs = UnaryInputs;\n\nexport const
Sign = 'Sign';\nexport type SignInputs = UnaryInputs;\n\nexport const Sigmoid = 'Sigmoid';\nexport type
SigmoidInputs = UnaryInputs;\n\nexport const Softplus = 'Softplus';\nexport type SoftplusInputs =
UnaryInputs;\n\nexport const Sqrt = 'Sqrt';\nexport type SqrtInputs = UnaryInputs;\n\nexport const Sum =
'Sum';\nexport type SumInputs = Pick<NamedTensorInfoMap,
'x'>;\nexport interface SumAttrs {\n  axis: number|number[];\n  keepDims: boolean;\n}\n\nexport const
SpaceToBatchND = 'SpaceToBatchND';\nexport type SpaceToBatchNDInputs = Pick<NamedTensorInfoMap,
'x'>;\nexport interface SpaceToBatchNDAttrs {\n  blockShape: number[];\n  paddings: number[][];\n}\n\nexport
const SplitV = 'SplitV';\nexport type SplitVInputs = Pick<NamedTensorInfoMap, 'x'>;\nexport interface SplitVAttrs
{\n  numOrSizeSplits: number[]|number;\n  axis: number;\n}\n\nexport const Softmax = 'Softmax';\nexport type
SoftmaxInputs = Pick<NamedTensorInfoMap, 'logits'>;\nexport interface SoftmaxAttrs {\n  dim:
number;\n}\n\nexport const SquaredDifference = 'SquaredDifference';\nexport type SquaredDifferenceInputs =
BinaryInputs;\n\nexport const Square = 'Square';\nexport type SquareInputs = Pick<NamedTensorInfoMap,
'x'>;\n\nexport const Sub = 'Sub';\nexport type SubInputs = BinaryInputs;\n\nexport const SparseToDense =
'SparseToDense';\nexport type SparseToDenseInputs =\n  Pick<NamedTensorInfoMap, 'sparseIndices'|'sparseValues'|'defaultValue'>;\nexport interface SparseToDenseAttrs
{\n  outputShape: number[];\n}\n\nexport const StridedSlice = 'StridedSlice';\nexport type StridedSliceInputs =
Pick<NamedTensorInfoMap, 'x'>;\nexport interface StridedSliceAttrs {\n  begin: number[];\n  end: number[];\n
strides: number[];\n  beginMask: number;\n  endMask: number;\n  ellipsisMask: number;\n  newAxisMask:
number;\n  shrinkAxisMask: number;\n}\n\nexport const Tan = 'Tan';\nexport type TanInputs =
UnaryInputs;\n\nexport const Tanh = 'Tanh';\nexport type TanhInputs = UnaryInputs;\n\nexport const Tile =
'Tile';\nexport type TileInputs = Pick<NamedTensorInfoMap, 'x'>;\nexport interface TileAttrs {\n  reps:
number[];\n}\n\nexport const TopK = 'TopK';\nexport type TopKInputs = Pick<NamedTensorInfoMap,
'x'>;\nexport interface TopKAttrs {\n  k: number;\n  sorted: boolean;\n}\n\nexport const Transpose =
'Transpose';\nexport type TransposeInputs = Pick<NamedTensorInfoMap,
'x'>;\nexport interface TransposeAttrs {\n  perm: number[];\n}\n\nexport const Unique = 'Unique';\nexport type
UniqueInputs = Pick<NamedTensorInfoMap, 'x'>;\nexport interface UniqueAttrs {\n  axis: number;\n}\n\nexport
type UnaryInputs = Pick<NamedTensorInfoMap, 'x'>;\n\nexport const Unpack = 'Unpack';\nexport type

```

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UnpackInputs = Pick<NamedTensorInfoMap, 'value'>;\nexport interface UnpackAttrs {\n axis:
number;\n}\n\nexport const UnsortedSegmentSum = 'UnsortedSegmentSum';\nexport type
UnsortedSegmentSumInputs =\n Pick<NamedTensorInfoMap, 'x'|'segmentIds'>;\nexport interface
UnsortedSegmentSumAttrs {\n numSegments: number;\n}\n\nexport const ZerosLike = 'ZerosLike';\nexport type
ZerosLikeInputs = UnaryInputs;\n\n/**\n * TensorFlow.js-only kernels\n */\nexport const Step = 'Step';\nexport
type StepInputs = UnaryInputs;\nexport interface StepAttrs {\n alpha: number;\n}\n\nexport const FromPixels =
'FromPixels';\nexport interface FromPixelsInputs {\n pixels:
PixelData|ImageData|HTMLImageElement|HTMLCanvasElement|\n
HTMLVideoElement|ImageBitmap;\n}\n\nexport interface FromPixelsAttrs {\n numChannels:
number;\n}\n\nexport const RotateWithOffset = 'RotateWithOffset';\nexport type RotateWithOffsetInputs =
Pick<NamedTensorInfoMap, 'image'>;\nexport interface RotateWithOffsetAttrs {\n radians: number;\n fillValue:
number|[number, number, number];\n center: number|[number, number];\n}\n\nexport const _FusedMatMul =
'_FusedMatMul';\n\n// tslint:disable-next-line: class-name\nexport interface _FusedMatMulInputs extends
NamedTensorInfoMap {\n a: TensorInfo;\n b: TensorInfo;\n bias?: TensorInfo;\n preluActivationWeights?:
TensorInfo;\n}\n\n// tslint:disable-next-line: class-name\nexport interface _FusedMatMulAttrs {\n transposeA:
boolean;\n transposeB: boolean;\n activation: Activation;\n leakyreluAlpha?: number;\n}\n\nexport const
FusedConv2D = 'FusedConv2D';\nexport interface FusedConv2DInputs extends NamedTensorInfoMap {\n x:
TensorInfo;\n filter: TensorInfo;\n
bias?: TensorInfo;\n preluActivationWeights?: TensorInfo;\n}\n\nexport interface FusedConv2DAttrs {\n strides:
[number, number]|number;\n pad: 'valid'|'same'|number|ExplicitPadding;\n dataFormat: 'NHWC'|'NCHW';\n
dilations: [number, number]|number;\n dimRoundingMode: 'floor'|'round'|'ceil';\n activation: Activation;\n
leakyreluAlpha?: number;\n}\n\nexport const FusedDepthwiseConv2D = 'FusedDepthwiseConv2D';\nexport
interface FusedDepthwiseConv2DInputs extends NamedTensorInfoMap {\n x: TensorInfo;\n filter: TensorInfo;\n
bias?: TensorInfo;\n preluActivationWeights?: TensorInfo;\n}\n\nexport interface FusedDepthwiseConv2DAttrs {\n
strides: [number, number]|number;\n pad: 'valid'|'same'|number;\n dataFormat: 'NHWC'|'NCHW';\n dilations:
[number, number]|number;\n dimRoundingMode: 'floor'|'round'|'ceil';\n activation: Activation;\n leakyreluAlpha?:
number;\n}\n\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License,
Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may
obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by
applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS"
BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the
License for the specific language governing permissions and\n * limitations under the License.\n *
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\n
*\nimport {env} from './environment';\nimport {getGlobal} from './global_util';\nimport {NamedGradientMap}
from './tape';\nimport {Tensor} from './tensor';\nimport {DataType, RecursiveArray} from './types';\n\nconst
kernelRegistry =\n getGlobal('kernelRegistry', () => new Map<string, KernelConfig>());\nconst gradRegistry =\n getGlobal('gradRegistry', () => new Map<string,
GradConfig>());\n\nexport type DataId = object;\n\nexport type AttributeValue =\n
number|number[]|boolean|boolean[]|string|string[]|NamedAttrMap;\n\n/** These are extra non-tensor/primitive
params passed to kernel functions. */\nexport type Attribute =
AttributeValue|RecursiveArray<AttributeValue>;\n\n/** Specifies the code to run when executing a kernel.
*\nexport type KernelFunc = (params: {\n inputs: NamedTensorInfoMap,\n backend: {},\n attrs?:
NamedAttrMap,\n}) => TensorInfo|TensorInfo[];\n\n/** The function to run when computing a gradient during
backprop. */\nexport type GradFunc =\n (dy: Tensor|Tensor[], saved: Tensor[], attrs: NamedAttrMap) =>\n
NamedGradientMap;\n\n/** Function that gets called after the backend initializes. */\nexport type KernelSetupFunc
= (backend: {}) => void;\n\n/** Function that gets called right before the backend is disposed. */\nexport type
KernelDisposeFunc = KernelSetupFunc;\n\n/** Config object for registering a kernel in the global registry.

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*/\nexport interface KernelConfig {\n  kernelName: string;\n  backendName: string;\n  kernelFunc: KernelFunc;\n  setupFunc?: KernelSetupFunc;\n  disposeFunc?: KernelDisposeFunc;\n}\n\n/** Config object for registering a
gradient in the global registry. */\nexport interface GradConfig {\n  kernelName: string;\n  inputsToSave?:
string[];\n  // When saveAllInputs is true, all inputs will be saved. Only use this flag\n  // if inputs is an array of
Tensors.\n  saveAllInputs?: boolean;\n  outputsToSave?: boolean[];\n  gradFunc: GradFunc;\n}\n\n/** Holds
metadata for a given tensor. */\nexport interface TensorInfo {\n  dataId: DataId;\n  shape: number[];\n  dtype:
DataType;\n}\n\nexport interface NamedTensorInfoMap {\n  [name: string]: TensorInfo;\n}\n\nexport interface
NamedAttrMap {\n  [name: string]: Attribute;\n}\n\n/**\n * Returns the kernel function (code) associated with the
provided names.\n * @param kernelName The official name of the kernel.\n * @param backendName The
official
name of the backend.\n */\nexport function getKernel(\n  kernelName: string, backendName: string):
KernelConfig {\n  const key = makeKey(kernelName, backendName);\n  return kernelRegistry.get(key);\n}\n\n/**\n * Returns the registered gradient info associated with the provided kernel.\n * @param kernelName The official TF
kernel name.\n */\nexport function getGradient(kernelName: string): GradConfig {\n  return
gradRegistry.get(kernelName);\n}\n\nexport function getKernelsForBackend(backendName: string): KernelConfig[]
{\n  const it = kernelRegistry.entries();\n  const result: KernelConfig[] = [];\n\n  while (true) {\n    const {done,
value} = it.next();\n    if (done) {\n      break;\n    }\n    const [key, config] = value;\n    const [backend, ] =
key.split('_');\n    if (backend === backendName) {\n      result.push(config);\n    }\n  }\n  return result;\n}\n\n/**\n * Registers the function (forward pass) for the kernel in a global registry.\n * @param config A config object
with the following properties:\n * - `kernelName` The official name of the kernel.\n * - `backendName` The official
name of the backend.\n * - `kernelFunc` The function to run during the forward pass of the kernel.\n * - `setupFunc`
Optional. Gets called once, after the backend initializes.\n * - `disposeFunc` Optional. Gets called once, right before
the backend is\n * disposed.\n */\nexport function registerKernel(config: KernelConfig) {\n  const {kernelName,
backendName} = config;\n  const key = makeKey(kernelName, backendName);\n  if (kernelRegistry.has(key)) {\n    console.warn(\n      `The kernel '${kernelName}' for backend ` +\n      `${backendName}' is already
registered`);\n  }\n  kernelRegistry.set(key, config);\n}\n\n/**\n * Registers a gradient function for a given kernel in
the global registry,\n * to be used during the back-propagation of that kernel.\n * @param config An object with
the following properties:\n * - `kernelName` The name of the kernel that the gradient
function is for.\n * - `gradFunc` The function to run during back-propagation.\n */\nexport function
registerGradient(config: GradConfig) {\n  const {kernelName} = config;\n\n  if (gradRegistry.has(kernelName)) {\n    // TODO (yassogba) after 3.0 assess whether we need to keep this gated\n    // to debug mode.\n    if
(env().getBool('DEBUG')) {\n      console.warn(`Overriding the gradient for '${kernelName}'`);\n    }\n  }\n  gradRegistry.set(kernelName, config);\n}\n\n/**\n * Removes the kernel function from the registry.\n * @param
kernelName The official name of the kernel.\n * @param backendName The official name of the backend.\n */\n\nexport function unregisterKernel(\n  kernelName: string, backendName: string): void {\n  const key =
makeKey(kernelName, backendName);\n  if (!kernelRegistry.has(key)) {\n    throw new Error(\n      `The kernel
'${kernelName}' for backend ` +\n      `${backendName}' is not registered`);\n  }\n  kernelRegistry.delete(key);\n}\n\n/**
Removes the registered gradient from the global registry. */\nexport function unregisterGradient(kernelName:
string): void {\n  if (!gradRegistry.has(kernelName)) {\n    throw new Error(\n      `The gradient '${kernelName}'
for backend is not registered`);\n  }\n  gradRegistry.delete(kernelName);\n}\n\n/**\n * Finds kernels that have
already been registered to a backend and re-registers\n * them for a new backend. Useful for registering custom
backends.\n * @param registeredBackendName Already registered backend.\n * @param newBackendName New
backend.\n */\nexport function copyRegisteredKernels(\n  registeredBackendName: string, newBackendName:
string): void {\n  const kernels = getKernelsForBackend(registeredBackendName);\n  kernels.forEach(kernelConfig
=> {\n    const newKernelConfig =\n      Object.assign({}, kernelConfig, {backendName: newBackendName});\n    registerKernel(newKernelConfig);\n  });\n}\n\nfunction makeKey(kernelName: string, backendName: string) {\n
return `${backendName}_${kernelName}`;\n}\n\n", "/*\n

```

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*\n\nimport {env} from './environment';\nimport {BackendValues, DataType, TensorLike, TypedArray} from
 './types';\nimport * as base from './util_base';\nexport * from './util_base';\n\n/**\n * Create typed array for scalar
 value. Used for storing
 in `DataStorage`.\n */\nexport function createScalarValue(\n  value: DataType, dtype: DataType): BackendValues
 {\n  if (dtype === 'string') {\n    return encodeString(value);\n  }\n\n  return toTypedArray([value],
 dtype);\n}\n\nfunction noConversionNeeded(a: TensorLike, dtype: DataType): boolean {\n  return (a instanceof
 Float32Array && dtype === 'float32') ||\n    (a instanceof Int32Array && dtype === 'int32') ||\n    (a instanceof
 Uint8Array && dtype === 'bool');\n}\n\nexport function toTypedArray(a: TensorLike, dtype: DataType):
 TypedArray {\n  if (dtype === 'string') {\n    throw new Error('Cannot convert a string[] to a TypedArray');\n  }\n  if
 (Array.isArray(a)) {\n    a = base.flatten(a);\n  }\n\n  if (env().getBool('DEBUG')) {\n
    base.checkConversionForErrors(a as number[], dtype);\n  }\n\n  if (noConversionNeeded(a, dtype)) {\n    return a as
 TypedArray;\n  }\n\n  if (dtype == null || dtype === 'float32' || dtype === 'complex64') {\n    return new
 Float32Array(a as number[]);\n  }\n\n  } else if (dtype === 'int32') {\n    return new Int32Array(a as number[]);\n  } else if (dtype === 'bool') {\n    const
 bool = new Uint8Array((a as number[]).length);\n    for (let i = 0; i < bool.length; ++i) {\n      if (Math.round((a as
 number[])[i]) !== 0) {\n        bool[i] = 1;\n      }\n    }\n    return bool;\n  } else {\n    throw new Error('Unknown
 data type ${dtype}');\n  }\n}\n\n/**\n * Returns the current high-resolution time in milliseconds relative to an\n *
 arbitrary time in the past. It works across different platforms (node.js,\n * browsers).\n */\n\n```\n *
 console.log(tf.util.now());\n * ```\n */\n * @doc {heading: 'Util', namespace: 'util'}\n */\nexport function now():
 number {\n  return env().platform.now();\n}\n\n/**\n * Returns a platform-specific implementation of\n *
 [fetch](https://developer.mozilla.org/en-US/docs/Web/API/Fetch_API).\n */\n * If `fetch` is defined on the global
 object (`window`, `process`, etc.),\n * `tf.util.fetch` returns that
 function.\n */\n * If not, `tf.util.fetch` returns a platform-specific solution.\n */\n\n```\n *
 const resource = await
 tf.util.fetch('https://unpkg.com/@tensorflow/tfjs');\n * // handle response\n * ```\n */\n * @doc {heading: 'Util'}\n */\n
export function fetch(\n  path: string, requestInits?: RequestInit): Promise<Response> {\n  return
 env().platform.fetch(path, requestInits);\n}\n\n/**\n * Encodes the provided string into bytes using the provided
 encoding scheme.\n */\n * @param s The string to encode.\n * @param encoding The encoding scheme. Defaults to
 utf-8.\n */\n * @doc {heading: 'Util'}\n */\nexport function encodeString(s: string, encoding = 'utf-8'): Uint8Array
 {\n  encoding = encoding || 'utf-8';\n  return env().platform.encode(s, encoding);\n}\n\n/**\n * Decodes the provided
 bytes into a string using the provided encoding scheme.\n */\n * @param bytes The bytes to decode.\n */\n * @param
 encoding The encoding scheme. Defaults to utf-8.\n */\n * @doc {heading: 'Util'}\n */\nexport
 function decodeString(bytes: Uint8Array, encoding = 'utf-8'): string {\n  encoding = encoding || 'utf-8';\n  return
 env().platform.decode(bytes, encoding);\n}\n\n"/**\n * @license\n * Copyright 2018 Google LLC. All Rights
 Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file
 except in compliance with the License.\n * You may obtain a copy of the License at\n *
 http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
 software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
 OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
 governing permissions and\n * limitations under the License.\n */\n
=====
*\n\nimport {BackendTimer, BackendTimingInfo} from './backends/backend';\nimport {env} from
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/environment';\nimport {\nTensor} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {DataType, DataTypeMap,\nTypedArray} from './types';\nimport * as util from './util';\n\nexport type KernelProfile = {\n kernelName: string;\n outputs: Tensor[];\n inputs: NamedTensorMap;\n timeMs: Promise<number>|{error: string}>;\n extraInfo:\nPromise<string>>};\n\nexport class Profiler {\n constructor(private backendTimer: BackendTimer, private logger?:\nLogger) {\n if (logger == null) {\n this.logger = new Logger();\n }\n }\n\n profileKernel(kernelName: string,\ninputs: NamedTensorMap, f: () => Tensor[]):\nKernelProfile {\n let outputs: Tensor[];\n const\nholdResultWrapperFn = () => {\n outputs = f();\n }; \n let timer: Promise<BackendTimingInfo>;\n const\nstart = util.now();\n if (this.backendTimer.timerAvailable()) {\n timer =\nthi.s.backendTimer.time(holdResultWrapperFn);\n } else {\n holdResultWrapperFn();\n outputs.map(output\n=> output.dataSync());\n\n\ttimer = Promise.resolve({kernelMs: util.now() - start});\n}\n\nif\n(env().getBool('CHECK_COMPUTATION_FOR_ERRORS')) {\nfor (let i = 0; i < outputs.length; i++) {\nconst output = outputs[i];\n// Dangling promise here because we don't want to propagate up\n//\nasynchronicity.\noutput.data().then(tensorVals => {\ncheckComputationForErrors(tensorVals,\noutput.dtype, kernelName);\n});\n}\n}\n\nconst kernelProfile = {\nkernelName,\noutputs,\ninputs,\ntimeMs: timer.then(timing => timing.kernelMs),\nexttraInfo: timer.then(\ntiming =>\ntiming.getExtraProfileInfo != null ?\ntiming.getExtraProfileInfo():\n'')\n};\nreturn\nkernelProfile;\n}\n\nlogKernelProfile(kernelProfile: KernelProfile): void {\nconst {kernelName, outputs,\ntimeMs, inputs, extraInfo} = kernelProfile;\noutputs.forEach(result => {\nPromise.all([result.data(),\ntimeMs, extraInfo]).then(valueContainer => {\nthis.logger.logKernelProfile(\nkernelName, result,\nvalueContainer[0], valueContainer[1], inputs,\nvalueContainer[2]);\n});\n});\n}\n\nexport\nfunction checkComputationForErrors<D extends DataType>(vals: DataTypeMap[D], dtype: D, kernelName:\nstring): boolean {\nif (dtype !== 'float32') {\n// Only floating point computations will generate NaN values\nreturn false;\n}\n\nfor (let i = 0; i < vals.length; i++) {\nconst num = vals[i] as number;\nif (isNaN(num) ||\n!isFinite(num)) {\n// Throwing custom exception so behavior is testable.\nconsole.warn(`Found ${num} in\nthe result of "${kernelName}"`);\nreturn true;\n}\n}\n\nreturn false;\n}\n\nexport class Logger {\nlogKernelProfile(\nname: string, result: Tensor, vals: TypedArray,\ntimeMs: number|{error: string}, inputs:\nNamedTensorMap,\nexttraInfo?: string) {\nconst time\n= typeof timeMs === 'number' ? util.rightPad(`${timeMs}ms`, 9):\ntimeMs['error'];\n\nconst paddedName = util.rightPad(name, 25);\nconst rank = result.rank;\nconst size = result.size;\nconst\nshape = util.rightPad(result.shape.toString(), 14);\nlet inputShapesDescription = ";\n\nfor (const name in\ninputs) {\nconst input = inputs[name];\nif (input != null) {\n// The input might be a non-tensor (e.g\nHTMLImageElement), in which case\n// we claim the output shape as input shape.\nconst inputShape =\ninput.shape || result.shape;\nconst inputRank = inputShape.length;\ninputShapesDescription +=`\n${name}: ${inputRank}D ${inputRank > 0 ? inputShape : ""}`;\n}\n}\n\nconsole.log(\n`${c$${paddedName}}\\t%c${time}\\t%c${rank}D ${{shape}}\\t%c${size}\\t%c${\ninputShapesDescription}\\t%c${extraInfo}`, \nfont-weight:bold', 'color:red',\n'color:blue', 'color: orange',\n'color: green', 'color: steelblue');\n}\n\n"/**\n * @license\n * Copyright 2017\nGoogle LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you\nmay not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\nhhttp://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,\nssoftware\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES\nOR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\ngoverning permissions and\n * limitations under the License.\n */\n\n\n=====\n*\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport * as util from\n './util';\n\nexport interface TapeNode {\n id: number;\n kernelName: string;\n
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    outputs: Tensor[];\n    inputs: NamedTensorMap;\n    // Optional params, defined only for ops with gradient impl.\n    gradient?: (dys: Tensor[]) => NamedGradientMap;\n    saved?: Tensor[];\n}\n\n\nexport type NamedGradientMap = {\n    [inputName: string]: () => Tensor;\n};\n\n/**\n * Computes a list of TapeNodes that connect x to y, filtering everything else\n * out and preserving the order of the original tape elements.\n */\n * @param tape The tape elements to filter.\n * @param xs The input Tensors.\n * @param y The output Tensor.\n */\nexport function\ngetFilteredNodesXToY(\n    tape: TapeNode[], xs: Tensor[], y: Tensor): TapeNode[] {\n    // Forward pass to compute all the nodes and Tensors that are transitively a\n    // function of x.\n    const tensorsFromX: {[tensorId: number]: boolean} = {};\n    const nodesFromX: {[nodeId: number]: boolean} = {};\n    for (let i = 0; i < xs.length; i++) {\n        tensorsFromX[xs[i].id] = true;\n    }\n    for (let i = 0; i < tape.length; i++) {\n        const node = tape[i];\n        const nodeInputs = node.inputs;\n        for (const inputName in nodeInputs) {\n            const input =\nnodeInputs[inputName];\n            let anyInputFromX = false;\n            for (let j = 0; j < xs.length; j++) {\n                if\n(tensorsFromX[input.id]) {\n                    node.outputs.forEach(output => tensorsFromX[output.id] = true);\n                    anyInputFromX = true;\n                    nodesFromX[node.id] = true;\n                    break;\n                }\n            }\n            if\n(anyInputFromX) {\n                break;\n            }\n        }\n    }\n    // Backward pass to find all of the nodes and Tensors that lead to y.\n    const tensorsLeadToY: {[tensorId: number]: boolean} = {};\n    tensorsLeadToY[y.id] = true;\n    const nodesToY: {[nodeId: number]: boolean} = {};\n    for (let i = tape.length - 1; i >= 0; i--) {\n        const node =\ntape[i];\n        const nodeInputs = node.inputs;\n        // If any of the outputs lead to y, mark all of the inputs as leading to y.\n        for (let j = 0; j < node.outputs.length; j++) {\n            if (tensorsLeadToY[node.outputs[j].id])\n{\n                for (const inputName in nodeInputs) {\n                    tensorsLeadToY[nodeInputs[inputName].id] = true;\n                    nodesToY[node.id] = true;\n                }\n                break;\n            }\n        }\n    }\n    // Return the paths that come from x and lead to y.\n    const filteredTape: TapeNode[] = [];\n    for (let i = 0; i < tape.length; i++) {\n        const node = tape[i];\n        if\n(nodesFromX[node.id] && nodesToY[node.id]) {\n            // Prune the inputs from the node that aren't a function of x.\n            const prunedInputs: {[inputName: string]: Tensor} = {};\n            for (const inputName in node.inputs) {\n                const nodeInput = node.inputs[inputName];\n                if (tensorsFromX[nodeInput.id]) {\n                    prunedInputs[inputName] = nodeInput;\n                }\n            }\n            // Copy the node and overwrite inputsAndArgs to the pruned version.\n            const prunedNode = Object.assign({}, node);\n            prunedNode.inputs = prunedInputs;\n            prunedNode.outputs = node.outputs;\n            filteredTape.push(prunedNode);\n        }\n    }\n    return filteredTape;\n}\n\n/**\n * Backpropagate gradients through the filtered TapeNodes.\n */\n * @param tensorAccumulatedGradientMap A map of Tensor to its gradient. This map\n * is mutated by this method.\n * @param filteredTape The filtered TapeNodes to backprop through.\n */\nexport function\nbackpropagateGradients(\n    tensorAccumulatedGradientMap: {[tensorId: number]: Tensor},\n    filteredTape: TapeNode[], tidy: (f: Function) => Tensor,\n    add: (a: Tensor, b: Tensor) => Tensor) {\n    // Walk the tape backward and keep a map of Tensor to its gradient.\n    for (let i = filteredTape.length - 1; i >= 0; i--) {\n        const node\n= filteredTape[i];\n        const dys: Tensor[] = [];\n        node.outputs.forEach(o => {\n            const gradTensor =\ntensorAccumulatedGradientMap[o.id];\n            if (gradTensor != null) {\n                dys.push(gradTensor);\n            } else {\n                // This particular output is not in the back-propagation subgraph, so it\n                // does not affect the final output, thus we put null for its dy.\n                dys.push(null);\n            }\n        });\n        if\n(node.gradient == null) {\n            throw new Error(\n                `Cannot compute gradient: gradient function not found`\n            );\n        }\n        // Backprop dy through this node and accumulate gradients over the inputs.\n        const inputGradients = node.gradient(dys);\n        for (const inputName in node.inputs) {\n            if\n(! (inputName in inputGradients)) {\n                throw new Error(\n                    `Cannot backprop through input\n${inputName}`\n                );\n            }\n            // Call the gradient function.\n            const dx = tidy(() => inputGradients[inputName]());\n            if (dx.dtype !== 'float32') {\n                throw new Error(\n                    `Error in gradient for op ${\nnode.kernelName\n}. The gradient of input\n`${inputName\n}` must have 'float32' dtype, but\nhas\n`${dx.dtype\n}`\n                );\n            }\n            const x = node.inputs[inputName];\n            if (!util.arraysEqual(dx.shape, x.shape)) {\n                throw new Error(\n                    `Error in gradient for op ${\nnode.kernelName\n}. The gradient of input\n`${inputName\n}` has shape\n`${dx.shape\n}`, which does not match\n`${\nnode.kernelName\n}` the shape of the input\n`

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'${x.shape}");\n    }\n    if (tensorAccumulatedGradientMap[x.id] == null) {\n
tensorAccumulatedGradientMap[x.id] = dx;\n    } else {\n        const curGradient =
tensorAccumulatedGradientMap[x.id];\n        tensorAccumulatedGradientMap[x.id] = add(curGradient, dx);\n
curGradient.dispose();\n    }\n    }\n    }\n    }"/**\n * @license\n * Copyright 2018 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n
*\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is
distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n *
=====
*\n\nimport {DataType, TypedArray} from './types';\nimport {computeStrides, isString, rightPad, sizeFromShape}
from './util';\n\n// Maximum number of values before we decide to show ellipsis.\nconst
FORMAT_LIMIT_NUM_VALS = 20;\n// Number of first and last values to show when displaying a, b,...,y,
z.\nconst FORMAT_NUM_FIRST_LAST_VALS = 3;\n// Number of significant digits to show.\nconst
FORMAT_NUM_SIG_DIGITS = 7;\n\nexport function tensorToString(\n    vals: TypedArray|string[], shape:
number[], dtype: DataType,\n    verbose: boolean) {\n    const strides = computeStrides(shape);\n
    const padPerCol = computeMaxSizePerColumn(vals, shape, dtype, strides);\n    const rank = shape.length;\n    const
valsLines = subTensorToString(vals, shape, dtype, strides, padPerCol);\n    const lines = ["Tensor"];\n    if (verbose) {\n
        lines.push(` dtype: ${dtype}`);\n        lines.push(` rank: ${rank}`);\n        lines.push(` shape: [${shape}]`);\n
        lines.push(` values:`);\n    }\n    lines.push(valsLines.map(l => ' ' + l).join("\n"));\n    return
lines.join("\n");\n}\n\nfunction computeMaxSizePerColumn(\n    vals: TypedArray|string[], shape: number[], dtype:
DataType,\n    strides: number[]): number[] {\n    const n = sizeFromShape(shape);\n    const numCols =
strides[strides.length - 1];\n    const padPerCol = new Array(numCols).fill(0);\n    const rank = shape.length;\n    const
valuesOrTuples =\n        dtype === 'complex64' ? createComplexTuples(vals) : vals;\n    if (rank > 1) {\n        for (let
row = 0; row < n / numCols; row++) {\n            const offset = row * numCols;\n            for
                (let j = 0; j < numCols; j++) {\n                padPerCol[j] = Math.max(\n                    padPerCol[j],\n
                    valToString(valuesOrTuples[offset + j], 0, dtype).length);\n            }\n        }\n    }\n    return padPerCol;\n}\n\nfunction
valToString(\n    val: number|string|[number, number], pad: number, dtype: DataType) {\n    let valStr: string;\n    if
(Array.isArray(val)) {\n        valStr = `${parseFloat(val[0].toFixed(FORMAT_NUM_SIG_DIGITS))} + ` +\n
`${parseFloat(val[1].toFixed(FORMAT_NUM_SIG_DIGITS))}j`;\n    } else if (isString(val)) {\n        valStr =
`${val}`;\n    } else if (dtype === 'bool') {\n        valStr = boolNumToString(val);\n    } else {\n        valStr =
parseFloat(val.toFixed(FORMAT_NUM_SIG_DIGITS)).toString();\n    }\n    return rightPad(valStr,
pad);\n}\n\nfunction boolNumToString(v: number): string {\n    return v === 0 ? 'false' : 'true';\n}\n\nfunction
subTensorToString(\n    vals: TypedArray|string[], shape: number[], dtype: DataType,\n    strides: number[],
padPerCol: number[], isLast = true):
string[] {\n    const storagePerElement = dtype === 'complex64' ? 2 : 1;\n    const size = shape[0];\n    const rank =
shape.length;\n    if (rank === 0) {\n        if (dtype === 'complex64') {\n            const complexTuple =
createComplexTuples(vals);\n            return [valToString(complexTuple[0], 0, dtype)];\n        }\n        if (dtype === 'bool')
{\n            return [boolNumToString(vals[0] as number)];\n        }\n        return [vals[0].toString()];\n    }\n    if (rank === 1)
{\n        if (size > FORMAT_LIMIT_NUM_VALS) {\n            const firstValsSize =
FORMAT_NUM_FIRST_LAST_VALS * storagePerElement;\n            let firstVals =
Array.from<number|string|[number, number]>(\n                vals.slice(0, firstValsSize));\n            let lastVals =
Array.from<number|string|[number, number]>(\n                vals.slice(\n                    (size - FORMAT_NUM_FIRST_LAST_VALS) *
storagePerElement,\n                    size * storagePerElement));\n            if (dtype === 'complex64') {\n                firstVals =
createComplexTuples(firstVals);\n                lastVals = createComplexTuples(lastVals);\n            }\n        }\n    }\n}\n}

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    }\n    return [\n        '[' +\n            firstVals.map((x, i) => valToString(x, padPerCol[i], dtype))\n                .join(', ')\n        +\n            ', ..., ' +\n            lastVals\n                .map(\n                    (x, i) => valToString(\n                        x, padPerCol[size -\n                        FORMAT_NUM_FIRST_LAST_VALS + i], dtype)\n                )\n                .join(', ')\n            +\n            ']\n    ];\n    }\n    const\n    displayVals: Array<number|string>[<number, number>] =\n        dtype === 'complex64' ? createComplexTuples(vals)\n        :\n            Array.from<number|string>(vals);\n    return [\n        '[' +\n            displayVals.map((x, i) =>\n                valToString(x, padPerCol[i], dtype))\n                .join(', ')\n            +\n            ']\n    ];\n    }\n    // The array is rank 2 or more.\n    const\n    subshape = shape.slice(1);\n    const substrides = strides.slice(1);\n    const stride = strides[0] * storagePerElement;\n    const lines: string[] = [];\n    if (size > FORMAT_LIMIT_NUM_VALS) {\n        for (let i = 0; i <\n        FORMAT_NUM_FIRST_LAST_VALS;\n        i++) {\n            const start = i * stride;\n            const end = start + stride;\n            lines.push(...subTensorToString(\n                vals.slice(start, end), subshape, dtype, substrides, padPerCol,\n                false /* isLast */));\n        }\n        lines.push('...');\n        for (let i = size - FORMAT_NUM_FIRST_LAST_VALS; i < size; i++) {\n            const start = i * stride;\n            const end\n            = start + stride;\n            lines.push(...subTensorToString(\n                vals.slice(start, end), subshape, dtype, substrides,\n                padPerCol,\n                i === size - 1 /* isLast */));\n        }\n    } else {\n        for (let i = 0; i < size; i++) {\n            const start = i *\n            stride;\n            const end = start + stride;\n            lines.push(...subTensorToString(\n                vals.slice(start, end), subshape,\n                dtype, substrides, padPerCol,\n                i === size - 1 /* isLast */));\n        }\n    }\n    const sep = rank === 2 ? ' ' : ' ';\n    lines[0] = '[' + lines[0] + sep;\n    for (let i = 1; i < lines.length - 1; i++) {\n        lines[i] = ' ' + lines[i]\n        + sep;\n    }\n    let newLineSep = ',\n';\n    for (let i = 2; i < rank; i++) {\n        newLineSep += '\n';\n    }\n    lines[lines.length - 1] =\n        ' ' + lines[lines.length - 1] + ']' + (isLast ? '' : newLineSep);\n    return\n    lines;\n    }\n    }\n    function createComplexTuples(vals: Array<{\n        TypedArray>): Array<[number,\n    number]> {\n        const complexTuples: Array<[number, number]> = [];\n        for (let i = 0; i < vals.length; i += 2) {\n            complexTuples.push([vals[i], vals[i + 1]] as [number, number]);\n        }\n        return complexTuples;\n    }\n    }\n    /**\n     * @license\n     * Copyright 2017 Google LLC. All Rights Reserved.\n     * Licensed under the Apache License, Version\n     * 2.0 (the "License");\n     * you may not use this file except in compliance with the License.\n     * You may obtain a\n     * copy of the License at\n     * http://www.apache.org/licenses/LICENSE-2.0\n     * Unless required by applicable\n     * law or agreed to in writing, software\n     * distributed under the License is distributed on an "AS IS"\n     * BASIS,\n     * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n     * See the\n     * License for the specific language governing permissions and\n     * limitations under the License.\n     */\n    =====\n    *\n    import {getGlobal} from './global_util';\n    import {tensorToString} from './tensor_format';\n    import {ArrayMap,\n    BackendValues, DataType, DataTypeMap, DataValues, NumericDataType, Rank, ShapeMap, SingleValueMap,\n    TypedArray} from './types';\n    import * as util from './util';\n    import {computeStrides, toNestedArray} from\n    './util';\n    export interface TensorData<D extends DataType> {\n        dataId?: DataId;\n        values?:\n        DataTypeMap[D];\n    }\n    // This interface mimics KernelBackend (in backend.ts), which would create a\n    // circular\n    dependency if imported.\n    export interface Backend {\n    }\n    /**\n     * A mutable object, similar to `tf.Tensor`, that\n     * allows users to set values\n     * at locations before converting to an immutable `tf.Tensor`.\n     *\n     * See `tf.buffer` for creating a tensor buffer.\n     */\n    @doc {heading: 'Tensors', subheading: 'Classes'}\n    export class TensorBuffer<R extends Rank, D extends DataType = 'float32'> {\n        size: number;\n        shape:\n        ShapeMap[R];\n        strides: number[];\n        values: DataTypeMap[D];\n        constructor(shape: ShapeMap[R], public\n        dtype: D, values?: DataTypeMap[D]) {\n            this.shape = shape.slice() as ShapeMap[R];\n            this.size =\n            util.sizeFromShape(shape);\n            if (values != null) {\n                const n = values.length;\n                util.assert(\n                    n ===\n                    this.size,\n                    () => `Length of values '${n}' does not match the size ` +\n                        `inferred by the shape\n                        '${this.shape}'`);\n            }\n            if (dtype === 'complex64') {\n                throw new Error(\n                    `complex64 dtype\n                    TensorBuffers are not supported. Please create ` +\n                        `a TensorBuffer for the real and imaginary parts\n                    separately and ` +\n                        `call tf.complex(real, imag).`);\n            }\n            this.values = values ||\n            util.getArrayFromDType(dtype, this.size);\n            this.strides = computeStrides(shape);\n        }\n        /**\n         * Sets a value\n         * in the buffer at a given location.\n         * @param value The value to set.\n         * @param locs The location\n         * indices.\n         */\n        @doc {heading: 'Tensors', subheading: 'Creation'}\n        set(value: SingleValueMap[D], ...locs:

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number[]): void {\n  if (locs.length === 0) {\n    locs = [0];\n  }\n  util.assert(\n    locs.length === this.rank,\n    () => `The number of provided coordinates (${locs.length}) must ` +\n      `match the rank\n      (${this.rank})`);\n  const index = this.locToIndex(locs);\n  this.values[index] = value as number;\n }\n\n /**\n  * Returns the value in the buffer at the provided location.\n  * @param locs The location indices.\n  * @doc {heading: 'Tensors', subheading: 'Creation'}\n  */\n  get(...locs: number[]): SingleValueMap[D] {\n    if\n      (locs.length === 0) {\n        locs = [0];\n      }\n    let i = 0;\n\n    for (const loc of locs) {\n      if (loc < 0 || loc >= this.shape[i]) {\n        const msg = `Requested out of range\n        element at ${locs}. ` +\n          ` Buffer shape=${this.shape}`;\n        throw new Error(msg);\n      }\n      i++;\n    }\n    let index = locs[locs.length - 1];\n    for (let i = 0; i < locs.length - 1; ++i) {\n      index += this.strides[i] *\n        locs[i];\n    }\n    return this.values[index] as SingleValueMap[D];\n }\n\n  locToIndex(locs: number[]): number {\n    if (this.rank === 0) {\n      return 0;\n    } else if (this.rank === 1) {\n      return locs[0];\n    }\n    let index =\n      locs[locs.length - 1];\n    for (let i = 0; i < locs.length - 1; ++i) {\n      index += this.strides[i] * locs[i];\n    }\n    return index;\n }\n\n  indexToLoc(index: number): number[] {\n    if (this.rank === 0) {\n      return [];\n    } else if\n      (this.rank === 1) {\n        return [index];\n      }\n    const locs: number[] = new Array(this.shape.length);\n    for (let i =\n      0; i < locs.length\n      - 1; ++i) {\n      locs[i] = Math.floor(index / this.strides[i]);\n      index -= locs[i] * this.strides[i];\n    }\n    locs[locs.length - 1] = index;\n    return locs;\n }\n\n  get rank() {\n    return this.shape.length;\n }\n\n /**\n  * Creates an immutable `tf.Tensor` object from the buffer.\n  * @doc {heading: 'Tensors', subheading:\n  'Creation'}\n  */\n  toTensor(): Tensor<R> {\n    return trackerFn().makeTensor(this.values, this.shape, this.dtype)\n    as\n      Tensor<R>;\n }\n\n  export interface TensorTracker {\n    makeTensor(\n      values: DataValues, shape:\n      number[], dtype: DataType,\n      backend?: Backend): Tensor;\n    makeVariable(\n      initialValue: Tensor,\n      trainable?: boolean, name?: string,\n      dtype?: DataType): Variable;\n    incRef(a: Tensor, backend: Backend):\n    void;\n    disposeTensor(t: Tensor): void;\n    disposeVariable(v: Variable): void;\n    read(dataId: DataId):\n    Promise<BackendValues>;\n    readSync(dataId: DataId): BackendValues;\n }\n\n /**\n  * The Tensor class calls into this handler to delegate chaining operations.\n  */\n  export interface OpHandler {\n    cast<T extends Tensor>(x: T, dtype: DataType): T;\n    buffer<R extends Rank, D extends DataType>(\n      shape:\n      ShapeMap[R], dtype: D,\n      values?: DataTypeMap[D]): TensorBuffer<R, D>;\n    print<T extends Tensor>(x: T,\n      verbose: boolean): void;\n    clone<T extends Tensor>(x: T): T;\n    // TODO(yassogba) bring reshape back?\n }\n\n  // For tracking tensor creation and disposal.\n  let trackerFn: () => TensorTracker = null;\n  // Used by chaining methods\n  to call into ops.\n  let opHandler: OpHandler = null;\n  // Used to warn about deprecated methods.\n  let\n    deprecationWarningFn: (msg: string) => void = null;\n  // This here so that we can use this method on dev branches\n  and keep the\n  // functionality at master.\n  // tslint:disable-next-line:no-unused-\n  expression\n  [deprecationWarningFn];\n\n /**\n  * An external consumer can register itself as the tensor tracker. This\n  way\n  * the Tensor class can\n  notify the tracker for every tensor created and\n  * disposed.\n  */\n  export function setTensorTracker(fn: () =>\n    TensorTracker) {\n    trackerFn = fn;\n }\n\n /**\n  * An external consumer can register itself as the op handler. This\n  way the\n  * Tensor class can have chaining methods that call into ops via the op\n  * handler.\n  */\n  export function\n    setOpHandler(handler: OpHandler) {\n    opHandler = handler;\n }\n\n /**\n  * Sets the deprecation warning function\n  to be used by this file. This way the\n  * Tensor class can be a leaf but still use the environment.\n  */\n  export\n    function setDeprecationWarningFn(fn: (msg: string) => void) {\n    deprecationWarningFn = fn;\n }\n\n /**\n  * We\n  wrap data id since we use weak map to avoid memory leaks.\n  * Since we have our own memory management, we\n  have a reference counter\n  * mapping a tensor to its data, so there is always a pointer (even if that\n  * data is\n  otherwise garbage collectable).\n  * See https://developer.mozilla.org/en-US/docs/Web/JavaScript/Reference/\n  * Global_Objects/WeakMap\n  */\n  export type DataId = object; // object instead of {} to force non-primitive.\n\n  // Declare this namespace to make Tensor class augmentation work in google3.\n  export declare namespace Tensor\n    {\n      /**\n      * A `tf.Tensor` object represents an immutable, multidimensional array of\n      * numbers that has a shape\n      and a data type.\n      * See `tf.tensor` for details on how to create a `tf.Tensor`.\n      */\n      /**\n      * @doc {heading: 'Tensors',\n      subheading: 'Classes'}\n      */\n      export class Tensor<R extends Rank = Rank> {\n        /** Unique id of this tensor. */

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readonly id: number;\n /**\n * Id of the bucket holding the data for this tensor. Multiple arrays can\n * point to
the same bucket (e.g. when calling array.reshape()).\n */\n dataId: DataId;\n /** The shape of the tensor. */\n
readonly shape: ShapeMap[R];\n /** Number of elements in the tensor. */\n readonly size: number;\n /** The data
type for the array. */\n readonly dtype: DataType;\n /** The rank type for
the array (see `Rank` enum). */\n readonly rankType: R;\n\n /** Whether this tensor has been globally kept. */\n
kept = false;\n /** The id of the scope this tensor is being tracked in. */\n scopeId: number;\n\n /**\n * Number
of elements to skip in each dimension when indexing. See\n *
https://docs.scipy.org/doc/numpy/reference/generated/numpy.ndarray.strides.html\n */\n readonly strides:
number[];\n\n constructor(shape: ShapeMap[R], dtype: DataType, dataId: DataId, id: number) {\n this.shape =
shape.slice() as ShapeMap[R];\n this.dtype = dtype || 'float32';\n this.size = util.sizeFromShape(shape);\n
this.strides = computeStrides(shape);\n this.dataId = dataId;\n this.id = id;\n this.rankType = (this.rank < 5 ?
this.rank.toString() : 'higher') as R;\n }\n\n get rank(): number {\n return this.shape.length;\n }\n\n /**\n *
Returns a promise of `tf.TensorBuffer` that holds the underlying data.\n */\n * @doc {heading: 'Tensors',
subheading:
'Classes'}\n */\n async buffer<D extends DataType = 'float32'>(): Promise<TensorBuffer<R, D>> {\n const vals
= await this.data<D>();\n return opHandler.buffer(this.shape, this.dtype as D, vals);\n }\n\n /**\n * Returns a
`tf.TensorBuffer` that holds the underlying data.\n */\n * @doc {heading: 'Tensors', subheading: 'Classes'}\n */\n
bufferSync<D extends DataType = 'float32'>(): TensorBuffer<R, D> {\n return opHandler.buffer(this.shape,
this.dtype as D, this.dataSync());\n }\n\n /**\n * Returns the tensor data as a nested array. The transfer of data is
done\n * asynchronously.\n */\n * @doc {heading: 'Tensors', subheading: 'Classes'}\n */\n async array():
Promise<ArrayMap[R]> {\n const vals = await this.data();\n return toNestedArray(this.shape, vals) as
ArrayMap[R];\n }\n\n /**\n * Returns the tensor data as a nested array. The transfer of data is done\n *
synchronously.\n */\n * @doc {heading: 'Tensors', subheading: 'Classes'}\n */\n arraySync(): ArrayMap[R] {\n
return toNestedArray(this.shape, this.dataSync()) as ArrayMap[R];\n }\n\n /**\n * Asynchronously downloads the
values from the `tf.Tensor`. Returns a\n * promise of `TypedArray` that resolves
when the computation has finished.\n */\n * @doc {heading: 'Tensors', subheading: 'Classes'}\n */\n async
data<D extends DataType = NumericDataType>(): Promise<DataTypeMap[D]> {\n this.throwIfDisposed();\n
const data = trackerFn().read(this.dataId);\n if (this.dtype === 'string') {\n const bytes = await data as
Uint8Array[];\n try {\n return bytes.map(b => util.decodeString(b)) as DataTypeMap[D];\n } catch {\n
throw new Error(\n 'Failed to decode the string bytes into utf-8. ' +\n 'To get the original bytes, call
tensor.bytes().');\n }\n }\n return data as Promise<DataTypeMap[D]>;\n }\n\n /**\n * Synchronously
downloads the values from the `tf.Tensor`. This blocks the\n * UI
thread until the values are ready, which can cause performance issues.\n */\n * @doc {heading: 'Tensors',
subheading: 'Classes'}\n */\n dataSync<D extends DataType = NumericDataType>(): DataTypeMap[D] {\n
this.throwIfDisposed();\n const data = trackerFn().readSync(this.dataId);\n if (this.dtype === 'string') {\n try
{\n return (data as Uint8Array[]).map(b => util.decodeString(b)) as\n DataTypeMap[D];\n } catch {\n
throw new Error(\n 'Failed to decode the string bytes into utf-8. ' +\n 'To get the original bytes, call
tensor.bytes().');\n }\n }\n return data as DataTypeMap[D];\n }\n\n /**\n * Returns the underlying bytes of the
tensor's data. */\n async bytes(): Promise<Uint8Array[]|Uint8Array> {\n this.throwIfDisposed();\n const data =
await trackerFn().read(this.dataId);\n if (this.dtype === 'string') {\n return data as Uint8Array[];\n } else {\n
return new Uint8Array((data as TypedArray).buffer);\n }\n }\n\n /**\n * Disposes `tf.Tensor` from memory.\n */\n * @doc {heading: 'Tensors', subheading:
'Classes'}\n */\n dispose(): void {\n if (this.isDisposed) {\n return;\n }\n
trackerFn().disposeTensor(this);\n this.isDisposedInternal = true;\n }\n\n protected isDisposedInternal = false;\n
get isDisposed(): boolean {\n return this.isDisposedInternal;\n }\n\n throwIfDisposed() {\n if (this.isDisposed)
{\n throw new Error('Tensor is disposed.);\n }\n }\n\n /**\n * Prints the `tf.Tensor`. See `tf.print` for
details.\n */\n * @param verbose Whether to print verbose information about the tensor,\n * including dtype
and size.\n */\n * @doc {heading: 'Tensors', subheading: 'Classes'}\n */\n print(verbose = false): void {\n

```

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return opHandler.print(this, verbose);\n }\n\n /**\n  * Returns a copy of the tensor. See `tf.clone` for details.\n  *\n  * @doc {heading: 'Tensors', subheading: 'Classes'}\n  */\n clone<T\n  extends Tensor>(this: T): T {\n   this.throwIfDisposed();\n   return opHandler.clone(this);\n }\n\n /**\n  * Returns a human-readable description of the tensor. Useful for logging.\n  *\n  * @doc {heading: 'Tensors',\n  subheading: 'Classes'}\n  */\n toString(verbose = false): string {\n   const vals = this.dataSync();\n   return\n   tensorToString(vals, this.shape, this.dtype, verbose);\n }\n\n cast<T extends this>(dtype: DataType): T {\n   this.throwIfDisposed();\n   return opHandler.cast(this as T, dtype);\n }\n\n variable(trainable = true, name?: string,\n  dtype?: DataType): Variable<R> {\n   this.throwIfDisposed();\n   return trackerFn().makeVariable(this, trainable,\n   name, dtype) as\n   Variable<R>;\n }\n\n Object.defineProperty(Tensor, Symbol.hasInstance, {\n   value:\n   (instance: Tensor) => {\n     // Implementation note: we should use properties of the object that will be\n     // defined\n     before the constructor body has finished executing (methods).\n     // This\n     is because when this code is transpiled by babel, babel will call\n     // classCallCheck before the constructor body is\n     run.\n     // See https://github.com/tensorflow/tfjs/issues/3384 for backstory.\n     return !!instance && instance.data !=\n     null && instance.dataSync != null &&\n     instance.throwIfDisposed != null;\n   });\n }\n\n export function\n  getGlobalTensorClass() {\n   // Use getGlobal so that we can augment the Tensor class across package\n   // boundaries because the node resolution alg may result in different modules\n   // being returned for this file depending\n   on the path they are loaded from.\n   return getGlobal('Tensor', () => {\n     return Tensor;\n   });\n }\n\n // Global side\n  effect. Cache global reference to Tensor class\n  getGlobalTensorClass();\n\n export interface NumericTensor<R\n  extends Rank = Rank> extends Tensor<R> {\n   dtype: NumericDataType;\n   dataSync<D extends DataType =\n   NumericDataType>(): DataTypeMap[D];\n   data<D extends DataType = NumericDataType>():\n   Promise<DataTypeMap[D]>;\n }\n\n export\n  interface StringTensor<R extends Rank = Rank> extends Tensor<R> {\n   dtype: 'string';\n   dataSync<D extends\n   DataType = 'string'>(): DataTypeMap[D];\n   data<D extends DataType = 'string'>():\n   Promise<DataTypeMap[D]>;\n }\n\n /**\n  * @doclink Tensor\n  */\n export type Scalar = Tensor<Rank.R0>;\n\n /**\n  * @doclink Tensor\n  */\n export type Tensor1D = Tensor<Rank.R1>;\n\n /**\n  * @doclink Tensor\n  */\n export type Tensor2D = Tensor<Rank.R2>;\n\n /**\n  * @doclink Tensor\n  */\n export type Tensor3D = Tensor<Rank.R3>;\n\n /**\n  * @doclink Tensor\n  */\n export type Tensor4D = Tensor<Rank.R4>;\n\n /**\n  * @doclink Tensor\n  */\n export type Tensor5D =\n  Tensor<Rank.R5>;\n\n /**\n  * @doclink Tensor\n  */\n export type Tensor6D = Tensor<Rank.R6>;\n\n /**\n  * A mutable\n  `tf.Tensor`, useful for persisting state, e.g. for training.\n  *\n  * @doc {heading: 'Tensors', subheading: 'Classes'}\n  */\n export class Variable<R extends Rank = Rank> extends Tensor<R> {\n   name: string;\n   constructor(\n   initialValue: Tensor<R>, public trainable: boolean,\n   name: string,\n   tensorId: number) {\n     super(\n       initialValue.shape, initialValue.dtype, initialValue.dataId,\n       tensorId);\n     this.name = name;\n   }\n\n   /**\n    * Assign a new `tf.Tensor` to this variable. The new `tf.Tensor`\n    * must have\n    * the same shape and dtype as the old `tf.Tensor`.\n    *\n    * @param newValue New tensor to be\n    assigned to this variable.\n    *\n    * @doc {heading: 'Tensors', subheading: 'Classes'}\n    */\n   assign(newValue:\n   Tensor<R>): void {\n     if (newValue.dtype !== this.dtype) {\n       throw new Error(\n         `dtype of the new value\n         (${newValue.dtype}) and ` +\n         `previous value (${this.dtype}) must match`);\n     }\n     if\n     (!util.arraysEqual(newValue.shape, this.shape)) {\n       throw new Error(\n         `shape of the new value\n         (${newValue.shape}) and ` +\n         `previous value (${this.shape}) must match`);\n     }\n     trackerFn().disposeTensor(this);\n     this.dataId = newValue.dataId;\n     trackerFn().incRef(this, null\n     /* backend */);\n   }\n\n   dispose(): void {\n     trackerFn().disposeVariable(this);\n     this.isDisposedInternal = true;\n   }\n\n   Object.defineProperty(Variable, Symbol.hasInstance, {\n     value: (instance: Variable) => {\n       return\n       instance instanceof Tensor && instance.assign != null &&\n       instance.assign instanceof Function;\n     }\n   });\n }\n\n /**\n  * @license\n  * Copyright 2017 Google LLC. All Rights Reserved.\n  * Licensed under the Apache\n  License, Version 2.0 (the "License");\n  * you may not use this file except in compliance with the License.\n  * You\n  may obtain a copy of the License at\n  * http://www.apache.org/licenses/LICENSE-2.0\n  * Unless required\n  by applicable law or agreed to in writing, software\n  * distributed under the License is distributed on an "AS IS"\n  BASIS,\n  * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n  * See the

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CONDITIONS OF ANY KIND, either express or implied. See the License for the specific language governing permissions and limitations under the License.

```
=====
* \n \n import { Tensor } from './tensor'; \n import { TensorContainer, TensorContainerArray } from
 './tensor_types'; \n import { upcastType } from './types'; \n import { assert } from './util'; \n \n export function
 makeTypesMatch<T extends Tensor>(a: T, b: T): [T, T] { \n   if (a.dtype === b.dtype) { \n     return [a, b]; \n   } \n
   const dtype = upcastType(a.dtype, b.dtype); \n   return [a.cast(dtype), b.cast(dtype)]; \n } \n \n export function
 assertTypesMatch(a: Tensor, b: Tensor): void { \n   assert( \n     a.dtype === b.dtype, \n     () => `The dtypes of the
   first(${a.dtype}) and` + \n       `second(${b.dtype}) input must match` \n   ); \n } \n \n export function
 isTensorInList(tensor: Tensor, tensorList: Tensor[]): boolean { \n   return tensorList.some(x => x.id ===
   tensor.id); \n } \n \n /** \n
   * Extracts any `Tensor`s found within the provided object. \n * \n * @param container an object that may be a
   `Tensor` or may directly contain \n * `Tensor`s, such as a `Tensor[]` or `{key: Tensor, ...}`. In general it \n * is safe
   to pass any object here, except that `Promise`s are not \n * supported. \n * @returns An array of `Tensors` found
   within the passed object. If the \n * argument is simply a `Tensor`, a list containing that `Tensor` is \n * returned. If
   the object is not a `Tensor` or does not \n * contain `Tensors`, an empty list is returned. \n */ \n export function
 getTensorsInContainer(result: TensorContainer): Tensor[] { \n   const list: Tensor[] = []; \n   const seen = new
   Set<{}>(); \n   void walkTensorContainer(result, list, seen); \n   return list; \n } \n \n function walkTensorContainer( \n
   container: TensorContainer, list: Tensor[], seen: Set<{}>): void { \n   if (container === null) { \n     return; \n   } \n
   if (container instanceof Tensor) { \n     list.push(container); \n
     return; \n   } \n   if (!Iterable(container)) { \n     return; \n   } \n   // Iteration over keys works also for arrays. \n
   const iterable = container as TensorContainerArray; \n   for (const k in iterable) { \n     const val = iterable[k]; \n
     if (!seen.has(val)) { \n       seen.add(val); \n       walkTensorContainer(val, list, seen); \n     } \n   } \n } \n \n // tslint:disable-
next-line:no-any \n function isIterable(obj: any): boolean { \n   return Array.isArray(obj) || typeof obj ===
   'object'; \n } \n \n /** \n * \n * @license \n * Copyright 2018 Google LLC. All Rights Reserved. \n * Licensed under the
   Apache License, Version 2.0 (the "License"); \n * you may not use this file except in compliance with the
   License. \n * You may obtain a copy of the License at \n * \n * http://www.apache.org/licenses/LICENSE-2.0 \n * \n *
   Unless required by applicable law or agreed to in writing, software \n * distributed under the License is distributed
   on an "AS IS" BASIS, \n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express
   or implied. \n * See the License for the specific language governing permissions and \n * limitations under the
   License. \n */
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=====
* \n \n import { BackendTimingInfo, DataMover, KernelBackend } from './backends/backend'; \n import { Environment,
   setEnvironmentGlobal } from './environment'; \n import { getGlobalNamespace } from './global_util'; \n import { Add,
   Cast, Identity } from './kernel_names'; \n import { getGradient, getKernel, getKernelsForBackend, GradFunc,
   NamedAttrMap, TensorInfo } from './kernel_registry'; \n import { KernelProfile, Profiler } from './profiler'; \n import
   { backpropagateGradients, getFilteredNodesXToY, TapeNode } from './tape'; \n import { DataId, setTensorTracker,
   Tensor, TensorTracker, Variable } from './tensor'; \n import { GradSaveFunc, NamedTensorMap, NamedVariableMap,
   TensorContainer } from './tensor_types'; \n import { getTensorsInContainer } from './tensor_util'; \n import
   { BackendValues, DataType, DataValues } from './types'; \n import
   * as util from './util'; \n import { bytesFromStringArray, makeOnesTypedArray, now, sizeFromShape } from
   './util'; \n \n /** \n * \n * A function that computes an output. The save function is for saving tensors \n * computed in the
   forward pass, that we need in the backward pass. \n */ \n export type ForwardFunc<T> = (backend: KernelBackend,
   save?: GradSaveFunc) => T; \n \n /** \n * \n * @docalias (a: Tensor, b: Tensor, ..., save?: Function) => { \n *   value:
   =====
```

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Tensor, \n * gradFunc: (dy: Tensor, saved?: NamedTensorMap) => Tensor | Tensor[] \n * } \n * \nexport type
CustomGradientFunc<T extends Tensor> = \n (...inputs: Array<Tensor|GradSaveFunc>) => { \n value: T; \n
gradFunc: (dy: T, saved: Tensor[]) => Tensor | Tensor[]; \n }; \n \nexport type MemoryInfo = { \n numTensors:
number; numDataBuffers: number; numBytes: number; \n unreliable?: boolean; reasons: string[]; \n }; \n \ninterface
KernelInfo = { \n name: string; bytesAdded: number; totalBytesSnapshot: number; \n tensorsAdded: number; \n
totalTensorsSnapshot:
number; \n inputShapes: number[][]; \n outputShapes: number[][]; \n kernelTimeMs: number | { error: string } |
Promise<number|{error: string}>; \n extraInfo: string | Promise<string>; \n }; \n \nexport type ProfileInfo = { \n
newBytes: number; newTensors: number; peakBytes: number; \n kernels: KernelInfo[]; \n result:
TensorContainer; \n kernelNames: string[]; \n }; \n \nexport interface TimingInfo extends BackendTimingInfo { \n
wallMs: number; \n } \n \n/** @docalias Function */ \nexport type ScopeFn<T extends TensorContainer> = () =>
T; \n \ninterface ScopeState { \n track: Tensor[]; \n name: string; \n id: number; \n } \n \ninterface
RegisteredKernelInvocation<I extends NamedTensorMap> { \n kernelName: string; \n inputs: I; \n attrs?:
NamedAttrMap; \n } \n \ninterface CustomGradKernelInvocation<T extends Tensor|Tensor[], \n
I extends NamedTensorMap> { \n forwardFunc: ForwardFunc<T>; \n backwardsFunc: (dy: T, saved: Tensor[])
=> \n [P in keyof
I]: () => I[P] \n ]; \n inputs: I; \n attrs?: NamedAttrMap; \n } \n \nfunction isRegisteredKernelInvocation<T extends
Tensor|Tensor[], \n
I extends NamedTensorMap>(\n kernelInvocation:
RegisteredKernelInvocation<I> \n CustomGradKernelInvocation<T, I>): \n kernelInvocation is
RegisteredKernelInvocation<I> { \n return (kernelInvocation as RegisteredKernelInvocation<I>).kernelName !=
null; \n } \n \n \nclass EngineState { \n // Public since optimizers will use it. \n registeredVariables: NamedVariableMap
= {}; \n \n nextTapeNodeId = 0; \n numBytes = 0; \n numTensors = 0; \n numStringTensors = 0; \n numDataBuffers
= 0; \n \n activeTape: TapeNode[]; \n // Number of nested tf.grad() statements when computing higher-order \n //
gradients. E.g. `1` for first-order gradients and `2` for second-order \n // gradients. Used to track if the tape should be
removed after a backprop. \n gradientDepth = 0; \n // Number of nested kernel calls. When kernel depth
is greater than 1, we turn \n // off the tape. \n kernelDepth = 0; \n // Keep Tensors that parallel the tapes. \n
activeScope: ScopeState; \n scopeStack: ScopeState[] = []; \n /** \n * Keeps track of the number of data moves
during a kernel execution. We \n * maintain a stack since kernels can call other kernels, recursively. \n */ \n
numDataMovesStack: number[] = []; \n nextScopeId = 0; \n \n tensorInfo = new WeakMap<DataId, { \n backend:
KernelBackend, \n bytes: number, \n dtype: DataType, \n shape: number[] \n }>; \n \n profiling = false; \n
activeProfile: ProfileInfo = { \n newBytes: 0, \n newTensors: 0, \n peakBytes: 0, \n kernels: [], \n result:
null, \n get kernelNames(): \n string[] { \n return Array.from(new Set(this.kernels.map(k => k.name))); \n
} \n }; \n \n dispose() { \n for (const variableName in this.registeredVariables) { \n
this.registeredVariables[variableName].dispose(); \n } \n } \n } \n \nexport class Engine implements
TensorTracker, DataMover { \n state: EngineState; \n backendName: string; \n registry: {[id: string]:
KernelBackend} = {}; \n registryFactory: { \n [id: string]: \n factory: () => KernelBackend |
Promise<KernelBackend>, \n priority: number \n } \n } = {}; \n \n private profiler: Profiler; \n private
backendInstance: KernelBackend; \n private pendingBackendInit: Promise<boolean>; \n private
pendingBackendInitId = 0; \n \n constructor(public ENV: Environment) { \n this.state = new EngineState(); \n } \n \n
async ready(): Promise<void> { \n if (this.pendingBackendInit != null) { \n return
this.pendingBackendInit.then(() => {}); \n } \n if (this.backendInstance != null) { \n return; \n } \n const
sortedBackends = this.getSortedBackends(); \n for (let i = 0; i < sortedBackends.length; i++) { \n const
backendName = sortedBackends[i]; \n const success = await this.initializeBackend(backendName).success; \n
if (success) { \n await this.setBackend(backendName); \n
return; \n } \n } \n \n throw new Error(\n `Could not initialize any backends, all backend initializations
` + \n `failed.`); \n } \n \n get backend(): KernelBackend { \n if (this.pendingBackendInit != null) { \n throw
new Error(\n `Backend '${this.backendName}' has not yet been initialized. Make ` + \n `sure to await
tf.ready() or await tf.setBackend() before calling ` + \n `other methods`); \n } \n if (this.backendInstance ==

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null) {\n    const { name, asyncInit } = this.initializeBackendsAndReturnBest();\n    if (asyncInit) {\n        throw\n        new Error(\n            `The highest priority backend '${name}' has not yet been ` +\n            `initialized. Make sure to\n            await tf.ready() or ` +\n            `await tf.setBackend() before calling other methods`);\n    }\n    this.setBackend(name);\n} \n\n return this.backendInstance;\n}\n\n backendNames(): string[] {\n    return\n    Object.keys(this.registryFactory);\n}\n\n findBackend(backendName: string): KernelBackend {\n    if (!(backendName in this.registry)) {\n        // If\n        the backend hasn't been initialized but we have a registry entry for\n        // it, initialize it and return it.\n        if\n        (backendName in this.registryFactory) {\n            const { asyncInit } = this.initializeBackend(backendName);\n            if\n            (asyncInit) {\n                // Backend is not ready yet.\n                return null;\n            }\n        } else {\n            return null;\n        }\n    }\n    return this.registry[backendName];\n}\n\n findBackendFactory(backendName: string):\n    () =>\n    KernelBackend | Promise<KernelBackend> {\n    if (!(backendName in this.registryFactory)) {\n        return null;\n    }\n    return this.registryFactory[backendName].factory;\n}\n\n registerBackend(\n    backendName: string,\n    factory: () => KernelBackend | Promise<KernelBackend>,\n    priority = 1): boolean {\n    if (backendName in\n    this.registryFactory) {\n        console.warn(\n            `${backendName} backend was already registered.` +\n            `Reusing existing backend\n            factory.`);\n        return false;\n    }\n    this.registryFactory[backendName] = {factory, priority};\n    return true;\n}\n\n async setBackend(backendName: string): Promise<boolean> {\n    if (this.registryFactory[backendName] ==\n    null) {\n        throw new Error(`Backend name '${backendName}' not found in registry`);\n    }\n    this.backendName\n    = backendName;\n    if (this.registry[backendName] == null) {\n        this.backendInstance = null;\n        const\n        {success, asyncInit} = this.initializeBackend(backendName);\n        const result = asyncInit ? await success :\n        success;\n        if (!result) {\n            return false;\n        }\n    }\n    this.backendInstance = this.registry[backendName];\n    this.setupRegisteredKernels();\n    // Reset the profiler.\n    this.profiler = new Profiler(this.backendInstance);\n    return true;\n}\n\n private setupRegisteredKernels():\n    void {\n    const kernels = getKernelsForBackend(this.backendName);\n    kernels.forEach(kernel => {\n        if\n        (kernel.setupFunc != null) {\n            kernel.setupFunc(this.backendInstance);\n        }\n    });\n}\n\n private\n    disposeRegisteredKernels(backendName: string): void {\n    const kernels =\n    getKernelsForBackend(backendName);\n    kernels.forEach(kernel => {\n        if (kernel.disposeFunc != null) {\n            kernel.disposeFunc(this.registry[backendName]);\n        }\n    });\n}\n\n /**\n    * Initializes a backend by looking\n    up the backend name in the factory\n    * registry and calling the factory method. Returns a boolean representing\n    * whether the initialization of the backend succeeded. Throws an error if\n    * there is no backend in the factory\n    registry.\n    */\n private initializeBackend(backendName: string):\n    {success: boolean|Promise<boolean>,\n    asyncInit: boolean} {\n    const registryFactoryEntry = this.registryFactory[backendName];\n    if\n    (registryFactoryEntry\n    == null) {\n        throw new Error(\n            `Cannot initialize backend ${backendName}, no registration found.`);\n    }\n    try {\n        const backend = registryFactoryEntry.factory();\n        /* Test if the factory returns a promise.\n        Done in a more liberal way than\n        previous 'Promise.resolve(backend)===backend'\n        as we needed to account\n        for custom Promise\n        implementations (e.g. Angular) */\n        if (backend && !(backend instanceof\n        KernelBackend) &&\n        typeof backend.then === 'function') {\n            const promiseId =\n            ++this.pendingBackendInitId;\n            const success =\n            backend\n            .then(backendInstance => {\n                // Outdated promise. Another backend was set in the meantime.\n                if (promiseId <\n                this.pendingBackendInitId) {\n                    return false;\n                }\n                this.registry[backendName] =\n                backendInstance;\n                this.pendingBackendInit = null;\n                return true;\n            })\n            .catch(err => {\n                // Outdated promise. Another backend\n                was set in the meantime.\n                if (promiseId < this.pendingBackendInitId) {\n                    return false;\n                }\n                this.pendingBackendInit = null;\n                console.warn(\n                    `Initialization of\n                    backend ${backendName} failed`);\n                console.warn(err.stack || err.message);\n                return false;\n            });\n            this.pendingBackendInit = success;\n            return {success, asyncInit: true};\n        } else {\n            this.registry[backendName] = backend as KernelBackend;\n            return {success: true, asyncInit: false};\n        }\n    }\n}

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catch (err) {\n  console.warn(`Initialization of backend ${backendName} failed`);\n  console.warn(err.stack ||
err.message);\n  return {success: false, asyncInit: false};\n  }\n }\n\n removeBackend(backendName:
string): void {\n  if (!(backendName in this.registryFactory)) {\n    throw new Error(`${backendName} backend
not found in registry`);\n  }\n  if (this.backendName === backendName && this.pendingBackendInit != null) {\n
  // There is a pending promise of the backend we want to remove. Make it\n  // obsolete.\n
this.pendingBackendInitId++;\n  }\n  if (backendName in this.registry) {\n
this.disposeRegisteredKernels(backendName);\n  this.registry[backendName].dispose();\n  delete
this.registry[backendName];\n  }\n  delete this.registryFactory[backendName];\n  // Unset the backend if it is
active.\n  if (this.backendName === backendName) {\n    this.pendingBackendInit = null;\n    this.backendName
= null;\n    this.backendInstance = null;\n  }\n  }\n  private getSortedBackends(): string[] {\n  if
(Object.keys(this.registryFactory).length === 0) {\n    throw new Error('No backend found in registry.);\n  }\n
  return Object.keys(this.registryFactory).sort((a: string, b: string) => {\n    // Highest priority comes first.\n
return this.registryFactory[b].priority -\n    this.registryFactory[a].priority;\n  });\n  }\n  private
initializeBackendsAndReturnBest():\n  {name: string, asyncInit: boolean} {\n    const sortedBackends =
this.getSortedBackends();\n    for (let i = 0; i < sortedBackends.length; i++) {\n    const backendName =
sortedBackends[i];\n    const {success, asyncInit} = this.initializeBackend(backendName);\n    if (asyncInit ||
success) {\n    return {name: backendName, asyncInit};\n    }\n    }\n    throw new Error(\n    `Could not
initialize any backends, all backend initializations ` +\n    `failed.`);\n  }\n  }\n  moveData(backend: KernelBackend,
dataId: DataId) {\n    const info = this.state.tensorInfo.get(dataId);\n    const srcBackend = info.backend;\n    const
values = this.readSync(dataId);\n    const refCount = srcBackend.refCount(dataId);\n
  // Delete the tensor from the old backend and move it to the new\n  // backend.\n
srcBackend.disposeData(dataId, true);\n    info.backend = backend;\n    backend.move(dataId, values, info.shape,
info.dtype, refCount);\n    if (this.shouldCheckForMemLeaks()) {\n    // Track the number of moves during a kernel
execution to correctly\n    // detect memory leaks.\n
this.state.numDataMovesStack[this.state.numDataMovesStack.length - 1]++;\n    }\n    }\n    tidy<T extends
TensorContainer>(nameOrFn: string|ScopeFn<T>, fn?: ScopeFn<T>):\n    T {\n    let name: string = null;\n    if (fn
== null) {\n    // Called with only 1 argument.\n    if (typeof nameOrFn !== 'function') {\n    throw new
Error('Please provide a function to tidy());\n    }\n    fn = nameOrFn;\n    } else {\n    // Called with 2
arguments.\n    if (typeof nameOrFn !== 'string' && !(nameOrFn instanceof String)) {\n    throw new Error(\n
'When calling with two arguments,
the first argument ' +\n    'to tidy() must be a string');\n    }\n    if (typeof fn !== 'function') {\n    throw
new Error(\n    'When calling with two arguments, the 2nd argument ' +\n    'to tidy() must be a
function');\n    }\n    name = nameOrFn as string;\n    // TODO(nsthorat,smilkov): Do operation logging and
performance\n    // profiling.\n    }\n    let result: T;\n    return this.scopedRun(\n    () => this.startScope(name), ()
=> this.endScope(result), () => {\n    result = fn();\n    if (result instanceof Promise) {\n
console.error('Cannot return a Promise inside of tidy.);\n    }\n    return result;\n    });\n    }\n    private
scopedRun<T>(start: () => void, end: () => void, f: () => T): T {\n    start();\n    try {\n    const res = f();\n
end();\n    return res;\n    } catch (ex) {\n    end();\n    throw ex;\n    }\n    }\n    private static nextTensorId = 0;\n
private nextTensorId():
number {\n    return Engine.nextTensorId++;\n    }\n    private static nextVariableId = 0;\n    private nextVariableId():
number {\n    return Engine.nextVariableId++;\n    }\n    /**\n    * This method is called instead of the public-facing
tensor.clone() when\n    * saving a tensor for backwards pass. It makes sure to add the clone\n    * operation to the
tape regardless of being called inside a kernel\n    * execution.\n    */\n    private clone(x: Tensor): Tensor {\n    const
y: Tensor = ENGINE.runKernel(Identity, {x} as {} as NamedTensorMap);\n    const inputs = {x};\n    const grad =
(dy: Tensor) => ({\n    x: () => {\n    const dtype = 'float32';\n    const gradInputs = {x: dy};\n    const attrs
= {dtype};\n    return ENGINE.runKernel(\n    Cast, gradInputs as {} as NamedTensorMap,\n    // tslint:disable-next-line: no-unnecessary-type-assertion\n    attrs as {} as NamedAttrMap) as Tensor;\n    }\n    });\n    const

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    saved: Tensor[] = [];\n    this.addTapeNode(this.state.activeScope.name, inputs, [y], grad, saved, {});\n    return y;\n  }\n\n  /**\n   * Execute a kernel with the given name and return the output tensor.\n   * @param kernelName The name of the kernel to execute.\n   * @param inputs A map of input names to tensors.\n   * @param attrs A map of attribute names to their values. An attribute is a\n   * primitive (non-tensor) input to the kernel.\n   * @param inputsToSave A list of tensors, inputs to save for the backprop\n   * computation.\n   * @param outputsToSave A list of booleans, specifying which output to save\n   * for the backprop computation. These are booleans since the\n   * output tensors are not visible to the user.\n   */\n  runKernel<T extends Tensor|Tensor[]>(\n    kernelName: string, inputs: NamedTensorMap, attrs?: NamedAttrMap): T {\n    const hasKernel = getKernel(kernelName, this.backendName) != null;\n    if (!hasKernel) {\n      throw new Error(`Kernel '${kernelName}' not registered for backend '${this.backendName}'`);\n    }\n    return this.runKernelFunc({kernelName, inputs, attrs});\n  }\n\n  private shouldCheckForMemLeaks(): boolean {\n    return this.ENV.getBool('IS_TEST');\n  }\n\n  private checkKernelForMemLeak(\n    kernelName: string, numDataIdsBefore: number,\n    outInfos: TensorInfo[]): void {\n    const numDataIdsAfter = this.backend.numDataIds();\n    // Count the number of data ids associated with the result of the kernel.\n    let numOutputDataIds = 0;\n    outInfos.forEach(info => {\n      // Complex numbers allocate 3 data ids, one for 'real', one for\n      // 'imaginary', and one for the container that holds the former two.\n      numOutputDataIds += (info.dtype === 'complex64' ? 3 : 1);\n    });\n    // Account for the number of moves during kernel execution. A\n    // "data move" can happen in the middle of a kernel execution, placing a new (key,value)\n    // pair in the data storage.\n\n    Since data moves have net zero effect (we always remove the data from the old backend), we have to cancel them out\n    // when detecting memory leaks.\n    const numMoves =\n      this.state.numDataMovesStack[this.state.numDataMovesStack.length - 1];\n    const dataIdsLeaked =\n      numDataIdsAfter - numDataIdsBefore - numOutputDataIds - numMoves;\n    if (dataIdsLeaked > 0) {\n      throw new Error(`Backend '${this.backendName}' has an internal memory leak ` +\n        `(${dataIdsLeaked} data ids) after running '${kernelName}'`);\n    }\n  }\n\n  /**\n   * Internal helper method to execute a kernel\n   * Use `runKernel` to execute kernels from outside of engine.\n   */\n  private runKernelFunc<T extends Tensor|Tensor[], I extends NamedTensorMap>(\n    kernelParams: RegisteredKernelInvocation<I>)\n    CustomGradKernelInvocation<T, I>): T {\n    let outputs: Tensor[];\n    let saved: Tensor[] = [];\n    const isTapeOn = this.isTapeOn();\n\n    const startingBytecount = this.state.numBytes;\n    const startingNumTensors = this.state.numTensors;\n    if (this.shouldCheckForMemLeaks()) {\n      this.state.numDataMovesStack.push(0);\n    }\n    let kernelFunc: () => Tensor[];\n    if (this.backendName == null) {\n      // backend has not been initialized yet (backend initialization is lazy\n      // can be deferred until an op/ kernel is run).\n      // The below getter has side effects that will try to initialize the\n      // backend and set properties like this.backendName\n      // tslint:disable-next-line: no-unused-expression\n      this.backend;\n    }\n    let out: TensorInfo|TensorInfo[];\n    const kernelOrScopeName = isRegisteredKernelInvocation(kernelParams) ?\n      kernelParams.kernelName : this.state.activeScope != null ?\n      this.state.activeScope.name : '';\n    // Create the kernelFunc from either a registered kernel OR passed in\n    // forward/backward functions (used by custom grad). In this context a\n    // kernelFunc wraps a kernel implementation with some bookkeeping.\n    if (isRegisteredKernelInvocation(kernelParams)) {\n      const {kernelName, inputs, attrs} = kernelParams;\n      if (this.backendName == null) {\n        // backend has not been initialized yet (backend initialization is lazy\n        // can be deferred until an op/ kernel is run).\n        // The below getter has side effects that will try to initialize the\n        // backend and set properties like this.backendName\n        // tslint:disable-next-line: no-unused-expression\n        this.backend;\n      }\n      const kernel = getKernel(kernelName, this.backendName);\n      util.assert(kernel != null,\n        () => `Cannot find registered kernel '${kernelName}' for backend '${this.backendName}'`);\n      kernelFunc = () => {\n        const numDataIdsBefore = this.backend.numDataIds();\n        out = kernel.kernelFunc({inputs, attrs, backend: this.backend});\n      }\n    }\n  }

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const outInfos = Array.isArray(out) ? out : [out];\n    if (this.shouldCheckForMemLeaks()) {\n
this.checkKernelForMemLeak(kernelName, numDataIdsBefore, outInfos);\n    }\n    const outTensors =
outInfos.map((outInfo: TensorInfo|Tensor) => {\n        // todo (yassogba) remove this option (Tensor) when node
backend\n        // methods have been modularized and they all return tensorInfo.\n        // TensorInfos do not have
a rank attribute.\n        if ((outInfo as Tensor).rank != null) {\n            return outInfo as Tensor;\n        }\n
const {dataId, shape, dtype} = outInfo as TensorInfo;\n        return this.makeTensorFromDataId(dataId, shape,
dtype);\n    });\n    // Save any required inputs and outputs.\n    // Do not save unless we are recording to
the tape. Otherwise it would\n    // cause a mem leak since there would be no backprop for these tensors\n    //
(which would otherwise dispose them).\n
    if (isTapeOn) {\n        const tensorsToSave =\n            this.getTensorsForGradient(kernelName, inputs,
outTensors);\n        saved = this.saveTensorsForBackwardMode(tensorsToSave);\n    }\n    return
outTensors;\n    };\n    } else {\n        const {forwardFunc} = kernelParams;\n        // Running a customGrad op.\n
const saveFunc: GradSaveFunc = (tensors) => {\n        // Do not save unless we are recording to the tape. Otherwise
it would\n        // cause a mem leak since we would never run backprop, which disposes\n        // the kept tensors.\n
        if (!isTapeOn) {\n            return;\n        }\n        saved = tensors.map(tensor => this.keep(this.clone(tensor)));\n
    };\n    kernelFunc = () => {\n        const numDataIdsBefore = this.backend.numDataIds();\n        out = this.tidy(()
=> forwardFunc(this.backend, saveFunc));\n        const outs = (Array.isArray(out) ? out : [out]) as Tensor[];\n        if
(this.shouldCheckForMemLeaks()) {\n
        // Scope name is used to print a more helpful error message if needed.\n
this.checkKernelForMemLeak(kernelOrScopeName, numDataIdsBefore, outs);\n        }\n        return outs;\n    };\n
}\n\n    // Run the kernelFunc. Optionally profiling it.\n    // const {inputs, attrs} = kernelParams;\n    const
backwardsFunc = isRegisteredKernelInvocation(kernelParams) ?\n        null :\n        kernelParams.backwardsFunc;\n    let kernelProfile: KernelProfile;\n    this.scopedRun(\n        // Stop recording to
a tape when running a kernel.\n        () => this.state.kernelDepth++, () => this.state.kernelDepth--, () => {\n            if
(!this.ENV.getBool('DEBUG') && !this.state.profiling) {\n                outputs = kernelFunc();\n            } else {\n
kernelProfile = this.profiler.profileKernel(\n                kernelOrScopeName, inputs, () => kernelFunc());\n            if
(this.ENV.getBool('DEBUG')) {\n                this.profiler.logKernelProfile(kernelProfile);\n
            }\n            outputs = kernelProfile.outputs;\n        });\n    if (isTapeOn) {\n
this.addTapeNode(\n        kernelOrScopeName, inputs, outputs, backwardsFunc, saved, attrs);\n    }\n    if
(this.state.profiling) {\n        this.state.activeProfile.kernels.push({\n            name: kernelOrScopeName,\n
bytesAdded: this.state.numBytes - startingBytecount,\n            totalBytesSnapshot: this.state.numBytes,\n
tensorsAdded: this.state.numTensors - startingNumTensors,\n            totalTensorsSnapshot: this.state.numTensors,\n
inputShapes: Object.keys(inputs).map(\n                key => inputs[key] != null ? inputs[key].shape : null),\n
outputShapes: outputs.map(item => item.shape),\n            kernelTimeMs: kernelProfile.timeMs,\n            extraInfo:
kernelProfile.extraInfo\n        });\n    }\n    return (Array.isArray(out) ? outputs : outputs[0]) as T;\n    }\n\n    /**\n     *
Saves tensors used in forward mode for use in backward mode.\n     */\n
    * @param tensors the list of tensors to save.\n     */\n    private saveTensorsForBackwardMode(tensors: Tensor[]):
Tensor[] {\n        const saved = tensors.map(tensor => this.keep(this.clone(tensor)));\n        return saved;\n    }\n\n    /**\n     *
Returns a list of tensors to save for a given gradient calculation.\n     */\n    * @param kernelName name of kernel to
look up gradient for.\n     * @param inputs a map of input tensors.\n     * @param outputs an array of output tensors
from forward mode of kernel.\n     */\n    private getTensorsForGradient(\n        kernelName: string, inputs:
NamedTensorMap,\n        outputs: Tensor[]): Tensor[]|null {\n        const gradConfig = getGradient(kernelName);\n        if
(gradConfig != null) {\n            const inputsToSave: string[] = gradConfig.inputsToSave || [];\n            const outputsToSave:
boolean[] = gradConfig.outputsToSave || [];\n            // If saveAllInputs is true, all inputs will be saved. Otherwise,
inputs\n            // specified in inputsToSave will be saved.\n            let inputTensorsToSave:
Tensor[];\n            if (gradConfig.saveAllInputs) {\n                util.assert(\n                    Array.isArray(inputs),\n                    () =>
'saveAllInputs is true, expected inputs to be an array.);\n                inputTensorsToSave =
Object.keys(inputs).map((key) => inputs[key]);\n            } else {\n                inputTensorsToSave =

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inputsToSave.map((inputName) => inputs[inputName]);\n    }\n\n    const outputTensorsToSave: Tensor[] =\n      outputs.filter((_, i) => outputsToSave[i]);\n\n    return inputTensorsToSave.concat(outputTensorsToSave);\n  }\n\n  // We return an empty list rather than throw an error because the kernel we\n  // are looking up may not actually be\n  // relevant to backproping through the\n  // overall function\n  // See 'does not error if irrelevant (pruned) ops\n  // are missing grads' test\n  // in gradients_test.ts for an example.\n  return [];\n}\n\n/**\n * Internal method used\n * by public APIs for tensor creation. Makes a new\n * tensor with\n * the provided shape, dtype and values. It always\n * creates a new data id and writes the values to the underlying\n * backend.\n */\nmakeTensor(\n  values: DataValues, shape: number[], dtype: DataType,\n  backend?:\n  KernelBackend): Tensor {\n  if (values == null) {\n    throw new Error('Values passed to engine.makeTensor() are\n    null');\n  }\n  dtype = dtype || 'float32';\n  backend = backend || this.backend;\n  let backendVals = values as\n  BackendValues;\n  if (dtype === 'string' && util.isString(values[0])) {\n    backendVals = (values as\n    string[]).map(d => util.encodeString(d));\n  }\n  const dataId = backend.write(backendVals, shape, dtype);\n  const t = new Tensor(shape, dtype, dataId, this.nextTensorId());\n  this.trackTensor(t, backend);\n\n  // Count\n  // bytes for string tensors.\n  if (dtype === 'string') {\n    const info = this.state.tensorInfo.get(dataId);\n    const\n    newBytes = bytesFromStringArray(backendVals as Uint8Array[]);\n    this.state.numBytes\n    += newBytes - info.bytes;\n    info.bytes = newBytes;\n  }\n  return t;\n}\n\n/**\n * Internal method used by\n * backends. Makes a new tensor\n * that is a wrapper around an existing data id. It doesn't create\n * a new data id,\n * only increments the ref count used in memory tracking.\n */\nmakeTensorFromDataId(\n  dataId: DataId,\n  shape: number[], dtype: DataType,\n  backend?: KernelBackend): Tensor {\n  dtype = dtype || 'float32';\n  const\n  t = new Tensor(shape, dtype, dataId, this.nextTensorId());\n  this.trackTensor(t, backend);\n  return t;\n}\n\nmakeVariable(\n  initialValue: Tensor, trainable = true, name?: string,\n  dtype?: DataType): Variable {\n  name = name || this.nextVariableId().toString();\n  if (dtype != null && dtype !== initialValue.dtype) {\n    initialValue = initialValue.cast(dtype);\n  }\n  const v = new Variable(initialValue, trainable, name,\n  this.nextTensorId());\n  if (this.state.registeredVariables[v.name]\n  != null) {\n    throw new Error(`Variable with name ${v.name} was already registered`);\n  }\n  this.state.registeredVariables[v.name] = v;\n  this.incRef(v, this.backend);\n  return v;\n}\n\ntrackTensor(a:\n  Tensor, backend: KernelBackend): void {\n  this.state.numTensors++;\n  if (a.dtype === 'string') {\n    this.state.numStringTensors++;\n  }\n  // Bytes for complex numbers are counted by their components. Bytes for\n  // string tensors are counted when writing values.\n  let bytes = 0;\n  if (a.dtype !== 'complex64' && a.dtype !==\n  'string') {\n    bytes = a.size * util.bytesPerElement(a.dtype);\n  }\n  this.state.numBytes += bytes;\n\n  if\n  (!this.state.tensorInfo.has(a.dataId)) {\n    this.state.numDataBuffers++;\n    this.state.tensorInfo.set(a.dataId, {\n      backend: backend || this.backend,\n      dtype: a.dtype,\n      shape: a.shape,\n      bytes\n    });\n  }\n  if\n  (!(a instanceof Variable)) {\n    this.track(a);\n  }\n}\n\n// Track the tensor by dataId and increase the refCount for the dataId in the\n// backend.\n//\n// TODO(pyu10055): This is currently used by makeVariable method, to increase\n// refCount on the backend for the\n// dataId. It can potentially be replaced with\n// Identity op instead of calling backend directly.\nincRef(a: Tensor,\n  backend: KernelBackend): void {\n  this.trackTensor(a, backend);\n  this.backend.incRef(a.dataId);\n}\n\nremoveDataId(dataId: DataId, backend: KernelBackend) {\n  if (this.state.tensorInfo.has(dataId) &&\n  this.state.tensorInfo.get(dataId).backend === backend) {\n    this.state.tensorInfo.delete(dataId);\n    this.state.numDataBuffers--;\n  }\n}\n\ndisposeTensor(a: Tensor): void {\n  if\n  (!this.state.tensorInfo.has(a.dataId)) {\n    return;\n  }\n  const info = this.state.tensorInfo.get(a.dataId);\n  this.state.numTensors--;\n  if (a.dtype === 'string') {\n    this.state.numStringTensors--;\n    this.state.numBytes -= info.bytes;\n  }\n  // Don't count bytes for complex numbers as they are counted by\n  // their\n  // components.\n  if (a.dtype !== 'complex64' && a.dtype !== 'string') {\n    const bytes = a.size *\n    util.bytesPerElement(a.dtype);\n    this.state.numBytes -= bytes;\n  }\n  // Remove the reference to dataId if\n  // backend dispose the data successfully\n  if (info.backend.disposeData(a.dataId)) {\n    this.removeDataId(a.dataId, info.backend);\n  }\n\n  // TODO(nsthorat): Construct an error and save the stack\n  // trace for\n  // debugging when in debug mode. Creating a stack trace is too expensive\n  // to do unconditionally.\n
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}\n\n disposeVariables(): void {\n  for (const varName in this.state.registeredVariables) {\n    const v =
this.state.registeredVariables[varName];\n    this.disposeVariable(v);\n  }\n}\n\n disposeVariable(v: Variable):
void {\n  this.disposeTensor(v);\n  if (this.state.registeredVariables[v.name] != null)
{\n    delete this.state.registeredVariables[v.name];\n  }\n}\n\n memory(): MemoryInfo {\n  const info =
this.backend.memory() as MemoryInfo;\n  info.numTensors = this.state.numTensors;\n  info.numDataBuffers =
this.state.numDataBuffers;\n  info.numBytes = this.state.numBytes;\n  if (this.state.numStringTensors > 0) {\n
info.unreliable = true;\n  if (info.reasons == null) {\n    info.reasons = [];\n  }\n  info.reasons.push(\n
'Memory usage by string tensors is approximate ' +\n    '(2 bytes per character)');\n  }\n  return info;\n}\n\n
async profile(query: () => (TensorContainer | Promise<TensorContainer>)):\n  Promise<ProfileInfo> {\n
this.state.profiling = true;\n\n  const startBytes = this.state.numBytes;\n  const startNumTensors =
this.state.numTensors;\n\n  this.state.activeProfile.kernels = [];\n  this.state.activeProfile.result = await
query();\n\n  this.state.profiling = false;\n\n  this.state.activeProfile.peakBytes
= Math.max(\n    ...this.state.activeProfile.kernels.map(d => d.totalBytesSnapshot));\n
this.state.activeProfile.newBytes = this.state.numBytes - startBytes;\n  this.state.activeProfile.newTensors =\n
this.state.numTensors - startNumTensors;\n  for (const kernel of this.state.activeProfile.kernels) {\n
kernel.kernelTimeMs = await kernel.kernelTimeMs;\n  kernel.extraInfo = await kernel.extraInfo;\n  }\n  return
this.state.activeProfile;\n}\n\n isTapeOn(): boolean {\n  return this.state.gradientDepth > 0 &&
this.state.kernelDepth === 0;\n}\n\n private addTapeNode(\n  kernelName: string, inputs: NamedTensorMap,
outputs: Tensor[],\n  gradientsFunc: GradFunc, saved: Tensor[], attrs: NamedAttrMap): void {\n  const
tapeNode: TapeNode =\n    {id: this.state.nextTapeNodeId++, kernelName, inputs, outputs, saved};\n  const
gradConfig = getGradient(kernelName);\n  if (gradConfig != null) {\n    gradientsFunc = gradConfig.gradFunc;\n
  }\n  if (gradientsFunc != null) {\n    tapeNode.gradient = (dys: Tensor[]) => {\n      // TODO(smilkov): To
optimize back-prop, pass dys that are not used in\n      // the backprop graph to the user as null instead of zeros\n
dys = dys.map((dy, i) => {\n        if (dy == null) {\n          const output = outputs[i];\n          const vals =
util.makeZerosTypedArray(output.size, output.dtype);\n          return this.makeTensor(vals, output.shape,
output.dtype);\n        }\n        return dy;\n      });\n      // Grad functions of ops with single outputs expect a dy,
while ops\n      // with multiple outputs expect dys (array of dy).\n      return gradientsFunc(dys.length > 1 ? dys :
dys[0], saved, attrs);\n    };\n  }\n  this.state.activeTape.push(tapeNode);\n}\n\n keep<T extends
Tensor>(result: T): T {\n  result.kept = true;\n  return result;\n}\n\n private startTape() {\n  if
(this.state.gradientDepth === 0) {\n
  this.state.activeTape = [];\n  }\n  this.state.gradientDepth++;\n}\n\n private endTape() {\n
this.state.gradientDepth--;\n}\n\n /**\n * Start a scope. Use this with endScope() to achieve the same
functionality\n * as scope() without the need for a function closure.\n */\n startScope(name?: string) {\n  const
scopeInfo: ScopeState = {\n    track: [],\n    name: 'unnamed scope',\n    id: this.state.nextScopeId++\n  };\n  if
(name) {\n    scopeInfo.name = name;\n  }\n  this.state.scopeStack.push(scopeInfo);\n  this.state.activeScope =
scopeInfo;\n}\n\n /**\n * End a scope. Use this with startScope() to achieve the same functionality\n * as
scope() without the need for a function closure.\n */\n endScope(result?: TensorContainer) {\n  const
tensorsToTrackInParent = getTensorsInContainer(result);\n  const tensorsToTrackInParentSet =\n    new
Set(tensorsToTrackInParent.map(t => t.id));\n  // Dispose the arrays tracked in this
scope.\n  for (let i = 0; i < this.state.activeScope.track.length; i++) {\n    const tensor =
this.state.activeScope.track[i];\n    if (!tensor.kept && !tensorsToTrackInParentSet.has(tensor.id)) {\n
tensor.dispose();\n    }\n  }\n  const oldScope = this.state.scopeStack.pop();\n  this.state.activeScope =
this.state.scopeStack.length === 0 ?\n    null :\n    this.state.scopeStack[this.state.scopeStack.length - 1];\n  //
Track the current result in the parent scope.\n  tensorsToTrackInParent.forEach(tensor => {\n    // Only track the
tensor if was allocated in the inner scope and is not\n    // globally kept.\n    if (!tensor.kept && tensor.scopeId
=== oldScope.id) {\n      this.track(tensor);\n    }\n  });\n}\n\n /**\n * Returns gradients of `f` with respect to
each of the `xs`. The gradients\n * returned are of the same length as `xs`, but some might be null if `f`\n * was
not a function of that `x`. It also takes optional dy

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to multiply the\n * gradient, which defaults to 1.\n * \n gradients<T extends Tensor>(\n f: () => T, xs:
Tensor[], dy?: T,\n allowNoGradients = false): { value: T, grads: Tensor[] } {\n util.assert(\n xs.length > 0,
() => 'gradients() received an empty list of xs.);\n if (dy != null && dy.dtype !== 'float32') {\n throw new
Error('dy must have 'float32' dtype, but has '${dy.dtype}');\n }\n\n const y = this.scopedRun(\n () =>
this.startTape(), () => this.endTape(),\n () => this.tidy('forward', f));\n\n util.assert(\n y instanceof
Tensor,\n () => 'The result y returned by f() must be a tensor.);\n // Filter out the nodes that don't connect x =>
y.\n const filteredTape = getFilteredNodesXToY(this.state.activeTape, xs, y);\n if (!allowNoGradients &&
filteredTape.length === 0 && xs.length > 0) {\n throw new Error(\n 'Cannot compute gradient of y=f(x)
with respect to x. Make sure ' +\n 'that
the f you passed encloses all operations that lead from x ' +\n 'to y.);\n }\n\n return this.tidy('backward', ()
=> {\n const accumulatedGradientMap: {[tensorId: number]: Tensor} = {};\n accumulatedGradientMap[y.id]
= (dy == null) ? ones(y.shape) : dy;\n\n // Backprop gradients through the filtered nodes.\n
backpropagateGradients(\n accumulatedGradientMap, filteredTape,\n // Pass the tidy function to avoid
circular dep with `tape.ts`.\n f => this.tidy(f as ScopeFn<Tensor>),\n // Pass an add function to avoid a
circular dep with `tape.ts`.\n add);\n const grads = xs.map(x => accumulatedGradientMap[x.id]);\n\n if
(this.state.gradientDepth === 0) {\n // This means that we are not computing higher-order gradients\n // and
can clean up the tape.\n this.state.activeTape.forEach(node => {\n for (const tensor of node.saved) {\n
tensor.dispose();\n }\n
});\n this.state.activeTape = null;\n }\n return { value: y, grads};\n });\n }\n\n customGrad<T
extends Tensor>(f: CustomGradientFunc<T>):\n (...args: Array<Tensor|GradSaveFunc>) => T {\n util.assert(\n
util.isFunction(f),\n () => 'The f passed in customGrad(f) must be a function.);\n return (...inputs:
Tensor[]): T => {\n util.assert(\n inputs.every(t => t instanceof Tensor),\n () => 'The args passed in
customGrad(f)(x1, x2,...) must all be ' +\n 'tensors');\n\n let res: {\n value: T,\n gradFunc: (dy: T,
saved: Tensor[]) => Tensor | Tensor[],\n }; \n const inputMap: NamedTensorMap = {};\n
inputs.forEach((input, i) => {\n inputMap[i] = input;\n });\n\n const forwardFunc: ForwardFunc<T> = (_,
save) => {\n res = f(...inputs, save);\n util.assert(\n res.value instanceof Tensor,\n () =>
'The function f passed in
customGrad(f) must return an ' +\n 'object where `obj.value` is a tensor');\n\n util.assert(\n
util.isFunction(res.gradFunc),\n () => 'The function f passed in customGrad(f) must return an ' +\n
'object where `obj.gradFunc` is a function.);\n return res.value;\n });\n\n const backwardsFunc = (dy: T,
saved: Tensor[]) => {\n const gradRes = res.gradFunc(dy, saved);\n const grads: Tensor[] =
Array.isArray(gradRes) ? gradRes : [gradRes];\n\n util.assert(\n grads.length === inputs.length,\n ()
=> 'The function f passed in customGrad(f) must return an ' +\n 'object where `obj.gradFunc` is a function
that returns ' +\n 'the same number of tensors as inputs passed to f(...).);\n\n util.assert(\n
grads.every(t => t instanceof Tensor),\n () => 'The function f passed in customGrad(f) must return an ' +\n
'object
where `obj.gradFunc` is a function that returns ' +\n 'a list of only tensors.);\n\n const gradMap: {[key:
string]: () => Tensor} = {};\n grads.forEach((grad, i) => {\n gradMap[i] = () => grad;\n });\n\n
return gradMap;\n });\n\n return this.runKernelFunc({\n forwardFunc,\n backwardsFunc,\n
inputs: inputMap,\n });\n });\n\n readSync(dataId: DataId): BackendValues {\n // Route the read to the
correct backend.\n const info = this.state.tensorInfo.get(dataId);\n return info.backend.readSync(dataId);\n }\n\n
read(dataId: DataId): Promise<BackendValues> {\n // Route the read to the correct backend.\n const info =
this.state.tensorInfo.get(dataId);\n return info.backend.read(dataId);\n }\n\n async time(query: () => void):
Promise<TimingInfo> {\n const start = now();\n const timingInfo = await this.backend.time(query) as
TimingInfo;\n timingInfo.wallMs = now() - start;\n
return timingInfo;\n }\n\n /**\n * Tracks a Tensor in the current scope to be automatically cleaned up\n *
when the current scope ends, and returns the value.\n * \n * @param result The Tensor to track in the current
scope.\n * \n * private track<T extends Tensor>(result: T): T {\n if (this.state.activeScope !== null) {\n

```

```
result.scopeId = this.state.activeScope.id;\n      this.state.activeScope.track.push(result);\n    }\n\n    return result;\n  }\n\n  get registeredVariables(): NamedVariableMap {\n    return this.state.registeredVariables;\n  }\n\n  /**\n   * Resets the engine state. Removes all backends but does not remove\n   * registered backend factories.\n   */\n  reset(): void {\n    // Make any pending promise obsolete.\n    this.pendingBackendInitId++;\n\n    this.state.dispose();\n    this.ENV.reset();\n    this.state = new EngineState();\n\n    for (const backendName in\nthis.registry) {\n      this.disposeRegisteredKernels(backendName);\n      this.registry[backendName].dispose();\n      delete this.registry[backendName];\n    }\n    this.backendName = null;\n    this.backendInstance = null;\n\n    this.pendingBackendInit = null;\n  }\n\n  function ones(shape: number[]): Tensor {\n    const values =\nmakeOnesTypedArray(sizeFromShape(shape), 'float32');\n    return ENGINE.makeTensor(values, shape,\n'float32');\n  }\n\n  nexport function getOrMakeEngine(): Engine {\n    const ns = getGlobalNamespace() as { }\n    as\n    { _tfengine: Engine};\n    if (ns._tfengine == null) {\n      const environment = new Environment(ns);\n      ns._tfengine =\nnew Engine(environment);\n    }\n    setEnvironmentGlobal(ns._tfengine.ENV);\n\n    // Tell the current tensor interface\n    that the global engine is responsible\n    // for tracking.\n    setTensorTracker() => ns._tfengine);\n    return\nns._tfengine;\n  }\n\n  nexport const ENGINE = getOrMakeEngine();\n\n  /**\n   * A implementation of the add op for use\n   within engine and tape.\n   */\n  * This allows us to avoid a circular dependency between add.ts and\n  engine.\n  * It is exported to be available in tape tests.\n  */\n  nexport function add(a: Tensor, b: Tensor): Tensor {\n    // We duplicate Add here to avoid a circular dependency with add.ts.\n    const inputs = {a, b};\n    return\nENGINE.runKernel(Add, inputs as { } as NamedTensorMap);\n  }\n\n  /**\n   * @license\n   * Copyright 2017 Google\n  LLC. All Rights Reserved.\n  * Licensed under the Apache License, Version 2.0 (the \"License\");\n  * you may not\n  use this file except in compliance with the License.\n  * You may obtain a copy of the License at\n  */\n  *  
http://www.apache.org/licenses/LICENSE-2.0\n  */\n  * Unless required by applicable law or agreed to in writing,\n  software\n  * distributed under the License is distributed on an \"AS IS\" BASIS,\n  * WITHOUT WARRANTIES\n  OR CONDITIONS OF ANY KIND, either express or implied.\n  * See the License for the specific language\n  governing permissions and\n  * limitations under the License.\n  */\n  =====\n  *\n  /**\n   * tslint:disable-next-line:no-any\n   function _isNavigatorDefined(): boolean {\n    return typeof navigator !==\n'undefined' && navigator != null;\n  }\n\n  nexport function isMobile(): boolean {\n    if (_isNavigatorDefined()) {\n      // tslint:disable-next-line:no-any\n      const a = navigator.userAgent || navigator.vendor || (window as any).opera;\n      // tslint:disable-next-line:max-line-length\n      return\n/(android|bb\\d+|meego).+mobile|avantgo|bada\\b|blackberry|blazer|compal|elaine|fennec|hiptop|iemo|ip(hone|od)|\niris|kindle|lge |maemo|midp|mmp|mobile.+firefox|netfront|opera m(ob|in)i|palm(\nos)?|phone|p(ixi|re)|v(plucker|pocket|psp|series(4|6)0|symbian|treo|up\\.(browser|link))|vodafone|wap|windows\nce|xda|xiino|i\n      .test(a) ||\n      // tslint:disable-next-line:max-line-length\n      /1207|6310|6590|3gso|4thp|50[1-6]i|770s|802s|a wa|abac|ac(er|oo|s\\-)\n)|ai(ko|rn)|al(av|ca|co)|amoi|an(ex|ny|yw)|aptu|ar(ch|go)|as(te|us)|attw|au(di|\\-m|r |s\n)|avan|be(ck|ll|nq)|bi(lb|rd)|bl(ac|az)|br(e|v)w|bumb|bw\\-(n|u)|c55\\|capi|ccwa|cdm\\-|cell|chtm|cl|cl|cmd\\-|\n|co(mp|nd)|craw|da(it|ll|ng)|dbte|dc\\-|s|devi|dica|dmob|do(c|p)o|ds(12\\-|d)|el(49|ai)|em(l2|ul)|er(ic|k0)|esl8|ez([4-7]0|os|wa|ze)|fetc|fly(\\-|_)g1\nu|g560|gene|gf\\-5|g\\-mo|go(\\.|w|od)|gr(ad|un)|haie|hcit|hd\\-(m|p|t)|hei\\-|hi(pt|ta)|hp( i|ip)|hs\\-|c|ht(c|\\-|\n|_|a|g|p|s|t|tp)|hu(aw|tc)|i\\-(20|go|ma)|i230|iac( \\-|\n|\\)|ibro|idea|ig01|ikom|im1k|inno|ipaq|iris|ja(t|v)a|jbro|jemu|jigs|kddi|keji|kgt( \\|\\)|klon|kpt |kwc\\-|\n|kyo(c|k)|le(no|xi)|lg( g|\\(k|l|u)|50|54\\-|[a-w])|libw|lynx|m1\\-w|m3ga|m50\\|ma(te|ui|xo)|mc(01|21|ca)|m\\-|\n|cr|me(rc|ri)|mi(o8|oa|ts)|mmef|mo(01|02|bi|de|do|t\\-| |o|v)|zz)|mt(50|p1|v )|mwbpm|mywa|n10[0-2]|n20[2-3]|n30[0|2]|n50[0|2|5]|n7[0|0|1]|10)|ne((c|m)\\-|\n|on|tf|wf|wg|wt)|nok(6|i)|nzph|o2im|op(ti|wv)|oran|owg1|p800|pan(a|d|t)|pdxg|pg(13\\-|\\-([1-8]|c))|phil|pire|pl(ay|uc)|pn\\-2|po(c|k|rt|se)|prox|psio|pt\\-|g|qa\\-|a|qc(07|12|21|32|60|\\-|\\-2-7)|i\\-|\n)|qtek|r380|r600|raks|rim9|ro(ve|zo)|s55\\|sa(ge|ma|mm|ms|ny|va)|sc(01|h\\-|oo|p\\-)|sdk\\|se(c|\\-|\n|0|1)|47|mc(nd|ri)|sgh\\-|shar|sie(\\-|m)|sk\\-0|sl(45|id)|sm(al|ar|b3|it|t5)|so(ft|ny)|sp(01|h\\-|v\\-|v
```

```

|sy(01|mb)|t2(18|50)|t6(00|10|18)|ta(gt|lk)|tcl|-|tdg|-|tel(i|m)|tim|-|t|-mo|to(pl|sh)|ts(70|m|-|m3|m5)|tx|-
9|up(\\b|gl|si)|utst|v400|v750|veri|vi(rg|te)|vk(40|5[0-3])|-
v)|vm40|voda|vulc|vx(52|53|60|61|70|80|81|83|85|98)|w3c(\\-| )|webc|whit|wi(g|nc|nw)|wmlb|wonu|x700|yas|-
|your|zeto|zte|-/i)n .test(a.substr(0, 4));n }n return false;n }n\nexport function isBrowser(): boolean {n
return (typeof window !== 'undefined' && window.document !== null) ||n //@ts-ignoren (typeof
WorkerGlobalScope !== 'undefined');n }n"/**n * @licensen * Copyright 2019 Google LLC. All Rights
Reserved.n * Licensed under the Apache License, Version 2.0 (the "License");n * you may not use this file
except in compliance with the License.n * You may obtain a copy of the License atn *n *
http://www.apache.org/licenses/LICENSE-2.0n
*n * Unless required by applicable law or agreed to in writing, softwaren * distributed under the License is
distributed on an "AS IS" BASIS,n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
express or implied.n * See the License for the specific language governing permissions andn * limitations under
the License.n *
=====n
*/nimport './engine';nimport * as device_util from './device_util';nimport {env} from './environment';nconst
ENV = env();n/**n * This file contains environment-related flag registrations.n */n/** Whether to enable
debug mode. */nENV.registerFlag('DEBUG', () => false, debugValue => {n if (debugValue) {n
console.warn(n 'Debugging mode is ON. The output of every math call will ' +n 'be downloaded to CPU
and checked for NaNs. ' +n 'This significantly impacts performance.');
```



```

shape, []);\n } \n\n return shape;\n}\n\nfunction deepAssertShapeConsistency(\n    val: TensorLike, shape: number[], indices: number[]) {\n    indices = indices || [];\n    if (!(Array.isArray(val)) && !isTypedArray(val)) {\n        assert(\n            shape.length === 0,\n            () => `Element arr[${indices.join('[]')}] is a primitive,` +\n                `but should be an array/TypedArray of ${shape[0]} elements`);\n        return;\n    }\n    assert(\n        shape.length > 0,\n        () => `Element arr[${indices.join('[]')}] should be a primitive,` +\n            `but is an array of ${val.length} elements`);\n    assert(\n        val.length === shape[0],\n        () => `Element arr[${indices.join('[]')}] should have ${shape[0]}` +\n            `elements, but has ${val.length} elements`);\n    const subShape = shape.slice(1);\n    for (let i = 0; i < val.length; ++i) {\n        deepAssertShapeConsistency(val[i], subShape, indices.concat(i));\n    }\n}\n\nfunction assertDType(\n    expectedDType: DataType|'numeric'|'string_or_numeric',\n    actualDType: DataType, argName: string, functionName: string)\n{\n    if (expectedDType === 'string_or_numeric') {\n        return;\n    }\n    if (expectedDType == null) {\n        throw new Error(`Expected dtype cannot be null.`);\n    }\n    if (expectedDType !== 'numeric' && expectedDType !== actualDType ||\n        expectedDType === 'numeric' && actualDType === 'string') {\n        throw new Error(\n            `Argument '${argName}' passed to '${functionName}' must` +\n                `be ${expectedDType} tensor, but got ${actualDType} tensor`);\n    }\n}\n\nexport function convertToTensor<T extends Tensor>(\n    x: T|TensorLike, argName: string, functionName: string,\n    parseAsDType: DataType|'numeric'|'string_or_numeric' = 'numeric'): T {\n    if (x instanceof Tensor) {\n        assertDType(parseAsDType, x.dtype, argName, functionName);\n        return x;\n    }\n    let inferredDType = inferDType(x);\n    // If the user expects a bool/int/float, use that info to update the\n    // inferredDType when it is not a string.\n    if (inferredDType !== 'string' && [\n        'bool', 'int32', 'float32'].indexOf(parseAsDType)\n    ]\n    ) {\n        inferredDType = parseAsDType as DataType;\n    }\n    assertDType(parseAsDType, inferredDType, argName, functionName);\n    if ((x == null) || (!isTypedArray(x) && !Array.isArray(x) && typeof x !== 'number' && typeof x !== 'boolean' && typeof x !== 'string')) {\n        const type = x == null ? 'null' : (x as {}).constructor.name;\n        throw new Error(\n            `Argument '${argName}' passed to '${functionName}' must be a` +\n                `Tensor or TensorLike, but got '${type}'`);\n    }\n    const inferredShape = inferShape(x, inferredDType);\n    if (!isTypedArray(x) && !Array.isArray(x)) {\n        x = [x] as number[];\n    }\n    const skipTypedArray = true;\n    const values = inferredDType !== 'string' ?\n        toTypedArray(x, inferredDType as DataType):\n        flatten(x as string[], [], skipTypedArray) as string[];\n    return ENGINE.makeTensor(values, inferredShape, inferredDType) as T;\n}\n\nexport function convertToTensorArray<T extends Tensor>(\n    arg:\n        Array<T|TensorLike>, argName: string, functionName: string,\n        parseAsDType: DataType|'numeric'|'string_or_numeric' = 'numeric'): T[] {\n    if (!Array.isArray(arg)) {\n        throw new Error(\n            `Argument ${argName} passed to ${functionName} must be a` +\n                `Tensor[] or TensorLike[]`);\n    }\n    const tensors = arg as T[];\n    return tensors.map(\n        (t, i) =>\n            convertToTensor(t, `${argName}[${i}]`,\n                functionName, parseAsDType);\n    );\n}\n\n"/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n\nimport {ENGINE} from '../engine';\nimport {isPromise} from '../util';\n\nexport const OP_SCOPE_SUFFIX = '_op';\n\n/**\n * Used for wrapping functions that perform math operations on\n * Tensors. The function will be wrapped in a named scope that cleans all\n * memory usage after the function is done.\n */\nexport function op<T extends Function>(f: {[name: string]: T}): T {\n    const keys = Object.keys(f);\n    if (keys.length !== 1) {\n        throw new Error(\n            `Please provide an object with a single key` +\n                `(operation name) mapping to a function. Got an object with` +\n                `${keys.length} keys.`);\n    }\n    let opName = keys[0];\n    const fn = f[opName];\n    // Strip the underscore from the end of the function name.\n    if (opName.endsWith('_')) {\n        opName =

```

```

opName.substring(0,
  opName.length - 1);
}
// add an __op suffix to distinguish ops from kernels in tf.profile
opName =
opName + OP_SCOPE_SUFFIX;
// tslint:disable-next-line:no-any
const f2 = (...args: any[]) => {
  ENGINE.startScope(opName);
  try {
    const result = fn(...args);
    if (isPromise(result)) {
      console.error('Cannot return a Promise inside of tidy.');
```

}
 ENGINE.endScope(result);
 return result;
 } catch (ex) {
 ENGINE.endScope(null);
 throw ex;
 }
};
Object.defineProperty(f2, 'name', { value:
opName, configurable: true });
// tslint:disable-next-line:no-any
return f2 as any as T;
}
"/**
 *
 * @license
 * Copyright 2020 Google LLC. All Rights Reserved.
 * Licensed under the Apache License, Version
 2.0 (the "License");
 * you may not use this file except in compliance with the License.
 * You may obtain a
 copy of the License at
 * http://www.apache.org/licenses/LICENSE-2.0
 * Unless required
 by applicable law or agreed to in writing, software
 * distributed under the License is distributed on an "AS IS"
 BASIS,
 * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.
 * See the
 License for the specific language governing permissions and
 * limitations under the License.
 */
=====
*/
import {ENGINE} from '../engine';
import {Complex, ComplexInputs} from '../kernel_names';
import
{Tensor} from '../tensor';
import {NamedTensorMap} from '../tensor_types';
import {convertToTensor} from
 '../tensor_util_env';
import {TensorLike} from '../types';
import * as util from '../util';
import {op} from
 '../operation';
/n/**
 * Converts two real numbers to a complex number.
 *
 * Given a tensor `real` representing
 the real part of a complex number, and a
 * tensor `imag` representing the imaginary part of a complex number,
 this
 * operation returns complex numbers elementwise
 of the form [r0, i0, r1, i1],
 * where r represents the real part and i represents the imag part.
 *
 * The input
 tensors real and imag must have the same shape.
 */
const real = tf.tensor1d([2.25, 3.25]);
const
imag = tf.tensor1d([4.75, 5.75]);
const complex = tf.complex(real, imag);
complex.print();
/n
 * @doc {heading: 'Tensors', subheading: 'Creation'}
 */
function complex_<T extends Tensor>(real: T|TensorLike,
 imag: T|TensorLike): T {
 const \$real = convertToTensor(real, 'real', 'complex');
 const \$imag =
 convertToTensor(imag, 'imag', 'complex');
 util.assertShapesMatch(
 \$real.shape, \$imag.shape,
 `real and
 imag shapes, \${\$real.shape} and \${\$imag.shape}, ` +
 `must match in call to tf.complex().`);
 const
 inputs: ComplexInputs = {real: \$real, imag: \$imag};
 return ENGINE.runKernel(Complex, inputs as { }) as
 NamedTensorMap;
}
export const complex = op({complex_});
"/**
 *
 * @license
 * Copyright
 2018 Google LLC. All Rights Reserved.
 * Licensed under the Apache License, Version 2.0 (the "License");
 * you may not use this file except in compliance with the License.
 * You may obtain a copy of the License at
 * http://www.apache.org/licenses/LICENSE-2.0
 * Unless required by applicable law or agreed to in writing,
 software
 * distributed under the License is distributed on an "AS IS" BASIS,
 * WITHOUT WARRANTIES
 OR CONDITIONS OF ANY KIND, either express or implied.
 * See the License for the specific language
 governing permissions and
 * limitations under the License.
 */
=====
*/
import {ENGINE} from '../engine';
import {Tensor} from '../tensor';
import {TensorLike, TypedArray}
from '../types';
import {DataType} from '../types';
import {assert, assertNonNegativeIntegerDimensions, flatten,
inferDtype, isTypedArray, sizeFromShape, toTypedArray} from '../util';
/n/** This is
 shared code across all tensor creation methods.
 */
export function makeTensor(
 values: TensorLike, shape:
 number[], inferredShape: number[],
 dtype?: DataType): Tensor {
 if (dtype == null) {
 dtype =
 inferDtype(values);
 }
 if (dtype === 'complex64') {
 throw new Error(
 `Cannot construct a complex64
 tensor directly. ` +
 `Please use tf.complex(real, imag).`);
 }
 if (!isTypedArray(values) &&
!Array.isArray(values) &&
typeof values !== 'number' &&
typeof values !== 'boolean' &&
typeof values
 !== 'string') {
 throw new Error(
 `values passed to tensor(values) must be a number/boolean/string or ` +
 `an array of numbers/booleans/strings, or a TypedArray`);
 }
 if (shape != null) {
 assertNonNegativeIntegerDimensions(shape);
 const providedSize = sizeFromShape(shape);
 const
 inferredSize = sizeFromShape(inferredShape);
 assert(
 providedSize === inferredSize,
 () => {

```

Based on the provided shape, [${shape}], the tensor should have `+`n` ` ${providedSize} values but has
${inferredSize}`);`n` for (let i = 0; i < inferredShape.length; ++i) {`n` const inferred = inferredShape[i];`n`
const flatDimsDontMatch = i === inferredShape.length - 1 ?`n` inferred !== sizeFromShape(shape.slice(i)) :`n`
true;`n` assert(`n` inferredShape[i] === shape[i] || !flatDimsDontMatch,`n` () => `Error creating a
new Tensor. Inferred shape `+`n` ` (${inferredShape}) does not match the provided `+`n` `shape
(${shape}).`);`n` }`n` }`n` if (!isTypedArray(values) && !Array.isArray(values)) {`n` values = [values] as
number[];`n` }`n` shape = shape || inferredShape;`n` values = dtype !== 'string' ?`n` toTypedArray(values, dtype)
:`n` flatten(values as string[], [], true) as string[];`n` return ENGINE.makeTensor(values as TypedArray, shape,
dtype);`n`}`n`", "/*`n` * @license`n` * Copyright

```

```

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you may not use this file except in compliance with the License.`n` * You may obtain a copy of the License at`n` *`n` *
http://www.apache.org/licenses/LICENSE-2.0`n` *`n` * Unless required by applicable law or agreed to in writing,
software`n` * distributed under the License is distributed on an "AS IS" BASIS,`n` * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.`n` * See the License for the specific language
governing permissions and`n` * limitations under the License.`n` *

```

```

=====`n`
*/`n`nimport {Tensor} from './tensor';`n`nimport {inferShape} from './tensor_util_env';`n`nimport {TensorLike} from
'./types';`n`nimport {DataType, Rank, ShapeMap} from './types';`n`nimport {makeTensor} from
'./tensor_ops_util';`n`n/**`n` * Creates a `tf.Tensor` with the provided values, shape and dtype.`n`
*`n` * ``js`n` * // Pass an array of values to create a vector.`n` * tf.tensor([1, 2, 3, 4]).print();`n` * ```n` * ``js`n` * //
Pass a nested array of values to make a matrix or a higher`n` * // dimensional tensor.`n` * tf.tensor([[1, 2], [3,
4]]).print();`n` * ```n` * ``js`n` * // Pass a flat array and specify a shape yourself.`n` * tf.tensor([1, 2, 3, 4], [2,
2]).print();`n` * ```n` * ```n` * @param values The values of the tensor. Can be nested array of numbers,`n` * or a flat
array, or a `TypedArray`. If the values are strings,`n` * they will be encoded as utf-8 and kept as `Uint8Array[]`.`n`
* @param shape The shape of the tensor. Optional. If not provided,`n` * it is inferred from `values`.`n` * @param
dtype The data type.`n` *`n` * @doc {heading: 'Tensors', subheading: 'Creation'}`n` */`n`nexport function tensor<R
extends Rank>(`n` values: TensorLike, shape?: ShapeMap[R], dtype?: DataType): Tensor<R> {`n` const
inferredShape = inferShape(values, dtype);`n` return makeTensor(values,
shape, inferredShape, dtype) as Tensor<R>;`n`}`n`", "/*`n` * @license`n` * Copyright 2018 Google LLC. All Rights
Reserved.`n` * Licensed under the Apache License, Version 2.0 (the "License");`n` * you may not use this file
except in compliance with the License.`n` * You may obtain a copy of the License at`n` *`n` *
http://www.apache.org/licenses/LICENSE-2.0`n` *`n` * Unless required by applicable law or agreed to in writing,
software`n` * distributed under the License is distributed on an "AS IS" BASIS,`n` * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.`n` * See the License for the specific language
governing permissions and`n` * limitations under the License.`n` *

```

```

=====`n`
*/`n`n/* Type definitions for exporting and importing of models. */`n`n/**`n` * A map from Tensor dtype to number
of bytes per element of the Tensor.`n` */`n`nexport const DTYPE_VALUE_SIZE_MAP: {[dtype: string]: number} =
{`n` `float32`:
4,`n` `float16`: 2,`n` `int32`: 4,`n` `uint16`: 2,`n` `uint8`: 1,`n` `bool`: 1,`n` `complex64`: 8`n`};`n`n/**`n` * A weight
manifest.`n` *`n` * The weight manifest consists of an ordered list of weight-manifest groups.`n` * Each weight-
manifest group ("group" for short hereafter) consists of a`n` * number of weight values stored in a number of
paths.`n` * See the documentation of `WeightManifestGroupConfig` below for more details.`n` */`n`nexport declare
type WeightManifestConfig = WeightManifestGroupConfig[];`n`n/**`n` * A weight-manifest group.`n` *`n` * Consists of an ordered list of weight values encoded in binary format,`n` * stored in an ordered list of paths.`n`
*/`n`nexport declare interface WeightManifestGroupConfig {`n` /**`n` * An ordered list of paths.`n` *`n` * Paths are
intentionally abstract in order to be general. For example, they`n` * can be relative URL paths or relative paths on
the file system.`n` */`n` paths: string[];`n` /**`n` * Specifications of the weights

```

stored in the paths.
 * weights: WeightsManifestEntry[];
 * - 'optimizer': Weight from a stateful optimizer.
 * export type WeightGroup = 'model'|'optimizer';
 An entry in the weight manifest.
 * The entry contains specification of a weight.
 * export declare interface WeightsManifestEntry {
 * Name of the weight, e.g., 'Dense_1/bias'
 * name: string;
 * Shape of the weight.
 * shape: number[];
 * Data type of the weight.
 * dtype: 'float32'|'int32'|'bool'|'string'|'complex64';
 * Type of the weight.
 * Optional.
 * The value 'optimizer' indicates the weight belongs to an optimizer
 * (i.e., used only during model training and not during inference).
 * group?: WeightGroup;
 * Information for dequantization of the weight.
 * quantization?: {
 * scale?: number, // The scaling constant to multiply by.
 * min?: number, // The (possibly nudged) minimum weight to add.
 * dtype: 'uint16'|'uint8'|'float16' // The dtype of the quantized weights.
 * };
 * Options for saving a model.
 * @namespace io
 * export interface SaveConfig {
 * Whether to save only the trainable weights of the model, ignoring the
 * non-trainable ones.
 * trainableOnly?: boolean;
 * Whether the optimizer will be saved (if exists).
 * Default: `false`.
 * includeOptimizer?: boolean;
 * Result of a saving operation.
 * export interface SaveResult {
 * Information about the model artifacts saved.
 * modelArtifactsInfo: ModelArtifactsInfo;
 * HTTP responses from the server that handled the model-saving request (if any). This is applicable only to server-based saving routes.
 * responses?: Response[];
 * Error messages and related data (if any).
 * errors?: Array<{}|string>;
 * export declare interface ModelArtifactsInfo {
 * Timestamp for when the model is saved.
 * dateSaved: Date;
 * TODO(cais,yassogba) consider removing GraphDef as GraphDefs now
 * come in a JSON format and none of our IOHandlers support a non json
 * format. We could consider replacing this with 'Binary' if we want to
 * allow future handlers to save to non json formats (though they will
 * probably want more information than 'Binary').
 * Type of the model topology
 * Type of the model topology
 * Possible values:
 * - JSON: JSON config (human-readable, e.g., Keras JSON).
 * - GraphDef: TensorFlow
 * [GraphDef](https://www.tensorflow.org/extend/tool_developers/#graphdef)
 * protocol buffer (binary).
 * modelTopologyType: 'JSON'|'GraphDef';
 * Size of model topology (Keras JSON or GraphDef), in bytes.
 * modelTopologyBytes?: number;
 * Size of weight specification or manifest, in bytes.
 * weightSpecsBytes?: number;
 * Size of weight value data, in bytes.
 * weightDataBytes?: number;
 * Model training configuration.
 * export declare interface TrainingConfig {
 * // TODO(cais): Tighten the typing once keras spec is available to tfjs-core.
 * // See
 * tslint:disable-next-line:max-line-length
 * // https://github.com/tensorflow/tfjs-layers/blob/master/src/keras_format/training_config.ts
 * Optimizer used for the model training.
 * optimizer_config: {};
 * // TODO(cais): Tighten the typing once keras spec is available to tfjs-core.
 * Loss function(s) for the model's output(s).
 * loss: string|string[]|{[key: string]: string};
 * // TODO(cais): Tighten the typing once keras spec is available to tfjs-core.
 * Metric function(s) for the model's output(s).
 * metrics?: string[]|{[key: string]: string};
 * // TODO(cais): Tighten the typing once keras spec is available to tfjs-core.
 * weighted_metrics?: string[];
 * // TODO(cais): Tighten the typing once keras spec is available to tfjs-core.
 * sample_weight_mode?: string;
 * loss_weights?: number[]|{[key: string]: number};
 * The serialized artifacts of a model, including topology and weights.
 * The `modelTopology`, `trainingConfig`, `weightSpecs` and `weightData` fields
 * of this interface are optional, in order to support topology- or weights-only
 * saving and loading.
 * Note this interface is used internally in IOHandlers. For the file format
 * written to disk as `model.json`, see `ModelJSON`.
 * export declare interface ModelArtifacts {
 * Model topology.
 * For Keras-style `tf.Model`s, this is a JSON object.
 * For TensorFlow-style models (e.g., `SavedModel`), this is the JSON
 * encoding of the `GraphDef` protocol buffer.
 * modelTopology?: {}|ArrayBuffer;
 * Serialized configuration for the model's training.
 * trainingConfig?: TrainingConfig;
 * Weight specifications.
 * This corresponds to the weightsData below.
 * weightSpecs?: WeightsManifestEntry[];
 * Binary buffer for all weight values concatenated in the order specified
 * by `weightSpecs`.
 * weightData?: ArrayBuffer;
 *

Hard-coded format name for models saved from TensorFlow.js or converted by TensorFlow.js Converter.

format?: string; What library is responsible for originally generating this artifact. Used for debugging purposes. E.g., 'TensorFlow.js v1.0.0'.

generatedBy?: string; What library or tool is responsible for converting the original model to this format, applicable only if the model is output by a converter. Used for debugging purposes. E.g., 'TensorFlow.js Converter v1.0.0'.

A value of `null` means the model artifacts are generated without any conversion process (e.g., saved directly from a TensorFlow.js `tf.LayersModel` instance).

convertedBy?: string|null; Inputs and outputs signature for saved model. signature?: {};

User-defined metadata about the model. userDefinedMetadata?: {[key: string]: {}};

Initializer for the model. modelInitializer?: {};

The on-disk format of the `model.json` file. TF.js 1.0 always populates the optional fields when writing model.json. Prior versions did not provide those fields.

export declare interface ModelJSON { Model topology. For Keras-style `tf.Model`s, this is a JSON object. For TensorFlow-style models (e.g., `SavedModel`), this is the JSON encoding of the `GraphDef` protocol buffer. modelTopology: {};

Model training configuration. trainingConfig?: TrainingConfig;

Weights manifest. The weights manifest consists of an ordered list of weight-manifest groups. Each weight-manifest group consists of a number of weight values stored in a number of paths. See the documentation of `WeightsManifestConfig` for more details. weightsManifest: WeightsManifestConfig;

Hard-coded format name for models saved from TensorFlow.js or converted by TensorFlow.js Converter. format?: string;

What library is responsible for originally generating this artifact. Used for debugging purposes. E.g., 'TensorFlow.js v1.0.0'.

generatedBy?: string; What library or tool is responsible for converting the original model to this format, applicable only if the model is output by a converter. Used for debugging purposes. E.g., 'TensorFlow.js Converter v1.0.0'.

A value of `null` means the model artifacts are generated without any conversion process (e.g., saved directly from a TensorFlow.js `tf.LayersModel` instance).

convertedBy?: string|null; Inputs and outputs signature for saved model. signature?: {};

User-defined metadata about the model. userDefinedMetadata?: {[key: string]: {}};

Initializer for the model. modelInitializer?: {};

Type definition for handlers of loading operations. export type LoadHandler = () => Promise<ModelArtifacts>;

Type definition for handlers of saving operations. export type SaveHandler = (modelArtifact: ModelArtifacts) => Promise<SaveResult>;

Interface for a model import/export handler. The `save` and `load` handlers are both optional, in order to allow handlers that support only saving or loading. tslint:disable-next-line:interface-name export interface IOHandler { save?: SaveHandler; load?: LoadHandler; }

An interface for the manager of a model store. A model store is defined as a storage medium on which multiple models can be stored. Each stored model has a unique `path` as its identifier. A `ModelStoreManager` for the store allows actions including

- Listing the models stored in the store.
- Deleting a model from the store.

export interface ModelStoreManager { List all models in the model store. @returns A dictionary mapping paths of existing models to their model artifacts info. Model artifacts info include type of the model's topology, byte sizes of the topology, weights, etc. listModels(): Promise<{[path: string]: ModelArtifactsInfo}>;

Remove a model specified by `path`. @param path @returns ModelArtifactsInfo of the deleted model (if and only if deletion is successful). @throws Error if deletion fails, e.g., if no model exists at `path`. removeModel(path: string): Promise<ModelArtifactsInfo>; }

Callback for the progress of a long-running action such as an HTTP request for a large binary object. `fraction` should be a number in the [0, 1] interval, indicating how much of the action has completed.

export type OnProgressCallback = (fraction: number) => void;

@innamespace io export interface LoadOptions { RequestInit (options) for HTTP requests. For detailed information on the supported fields, see https://developer.mozilla.org/en-US/docs/Web/API/Request/Request

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https://developer.mozilla.org/en-US/docs/Web/API/Request/Request)\n * /\n requestInit?: RequestInit;\n\n /**\n * Progress callback.\n * /\n onProgress?: OnProgressCallback;\n\n /**\n * A function used to override the\n `window.fetch` function.\n * /\n fetchFunc?: Function;\n\n /**\n * Strict loading model: whether extraneous\n weights or missing\n * weights should trigger an `Error`.\n * /\n *\n If `true`, require that the provided weights exactly match those\n * required by the layers. `false` means that both\n extra weights\n * and missing weights will be silently ignored.\n * /\n * Default: `true`.\n * /\n strict?:\n boolean;\n\n /**\n * Path prefix for weight files, by default this is calculated from the\n * path of the model\n JSON file.\n * /\n * For instance, if the path to the model JSON file is\n * `http://localhost/foo/model.json`, then\n the default path prefix will be\n * `http://localhost/foo/`. If a weight file has the path value\n * `group1-shard1of2`\n in the weight manifest, then the weight file will be\n * loaded from `http://localhost/foo/group1-shard1of2` by\n default. However,\n * if you provide a `weightPathPrefix` value of\n * `http://localhost/foo/alt-weights`, then the\n weight file will be loaded\n * from the path `http://localhost/foo/alt-weights/group1-shard1of2` instead.\n * /\n weightPathPrefix?: string;\n\n /**\n * Whether the\n module or model is to be loaded from TF Hub.\n * /\n * Setting this to `true` allows passing a TF-Hub module\n URL, omitting the\n * standard model file name and the query parameters.\n * /\n * Default: `false`.\n * /\n fromTFHub?: boolean;\n\n /**\n * An async function to convert weight file name to URL. The weight file\n * names are stored in model.json's weightsManifest.paths field. By default we\n * consider weight files are colocated\n with the model.json file. For example:\n * model.json URL: https://www.google.com/models/1/model.json\n * group1-shard1of1.bin url:\n * https://www.google.com/models/1/group1-shard1of1.bin\n * /\n * With this\n func you can convert the weight file name to any URL.\n * /\n weightUrlConverter?: (weightFileName: string) =>\n Promise<string>;\n\n /**\n * Additional options for Platform.fetch\n * /\nexport interface RequestDetails {\n\n /**\n * Is this request for a binary file (as opposed to a json file)\n * /\n isBinary?:\n boolean;\n\n },\n\n "use strict"\n\n\nexports.byteLength = byteLength\n\nexports.toByteArray =\n toByteArray\n\nexports.fromByteArray = fromByteArray\n\n\nvar lookup = []\n\nvar revLookup = []\n\nvar Arr = typeof\n Uint8Array !== 'undefined' ? Uint8Array : Array\n\n\nvar code =\n 'ABCDEFGHIJKLMNOPQRSTUVWXYZabcdefghijklmnopqrstuvwxyz0123456789+/'\n\nfor (var i = 0, len =\n code.length; i < len; ++i) {\n lookup[i] = code[i]\n revLookup[code.charCodeAt(i)] = i\n}\n\n// Support decoding\n URL-safe base64 strings, as Node.js does.\n// See:\n https://en.wikipedia.org/wiki/Base64#URL_applications\n\nrevLookup['-'.charCodeAt(0)] =\n 62\n\nrevLookup['_'.charCodeAt(0)] = 63\n\nfunction getLens(b64) {\n var len = b64.length\n\n if (len % 4 > 0) {\n throw new Error('Invalid string. Length must be a multiple of 4')\n }\n\n // Trim off extra bytes after placeholder\n bytes are found\n // See: https://github.com/beatgammit/base64-js/issues/42\n var validLen = b64.indexOf('=')\n\n if\n (validLen === -1) validLen = len\n\n var\n placeHoldersLen = validLen === len\n ? 0\n : 4 - (validLen % 4)\n\n return [validLen,\n placeHoldersLen]\n}\n\n// base64 is 4/3 + up to two characters of the original data\nfunction byteLength(b64) {\n var lens = getLens(b64)\n var validLen = lens[0]\n var placeHoldersLen = lens[1]\n\n return ((validLen +\n placeHoldersLen) * 3 / 4) - placeHoldersLen\n}\n\nfunction _byteLength(b64, validLen, placeHoldersLen) {\n return ((validLen + placeHoldersLen) * 3 / 4) - placeHoldersLen\n}\n\nfunction toByteArray(b64) {\n var tmp\n var lens = getLens(b64)\n var validLen = lens[0]\n var placeHoldersLen = lens[1]\n\n var arr = new\n Arr(_byteLength(b64, validLen, placeHoldersLen))\n\n var curByte = 0\n\n // if there are placeholders, only get up\n to the last complete 4 chars\n var len = placeHoldersLen > 0\n ? validLen - 4\n : validLen\n\n var i\n for (i = 0;\n i < len; i += 4) {\n tmp =\n (revLookup[b64.charCodeAt(i)] << 18) |\n (revLookup[b64.charCodeAt(i + 1)]\n << 12) |\n (revLookup[b64.charCodeAt(i + 2)] << 6) |\n revLookup[b64.charCodeAt(i + 3)]\n\n arr[curByte++] = (tmp >> 16) & 0xFF\n arr[curByte++] = (tmp >> 8) & 0xFF\n arr[curByte++] = tmp & 0xFF\n }\n\n if (placeHoldersLen === 2) {\n tmp =\n (revLookup[b64.charCodeAt(i)] << 2) |\n (revLookup[b64.charCodeAt(i + 1)] >> 4)\n\n arr[curByte++] = tmp & 0xFF\n }\n\n if (placeHoldersLen === 1)\n {\n tmp =\n (revLookup[b64.charCodeAt(i)] << 10) |\n (revLookup[b64.charCodeAt(i + 1)] << 4) |\n (revLookup[b64.charCodeAt(i + 2)] >> 2)\n\n arr[curByte++] = (tmp >> 8) & 0xFF\n arr[curByte++] = tmp &

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0xFF\n }\n\n return arr\n}\n\nfunction tripletToBase64 (num) {\n return lookup[num >> 18 & 0x3F] +\n
lookup[num >> 12 & 0x3F] +\n lookup[num >> 6 & 0x3F] +\n lookup[num & 0x3F]\n}\n\nfunction
encodeChunk (uint8, start, end) {\n var tmp\n var output = []\n for (var i = start; i < end; i += 3) {\n tmp =\n
((uint8[i] << 16) & 0xFF0000)\n
+\n ((uint8[i + 1] << 8) & 0xFF00) +\n (uint8[i + 2] & 0xFF)\n output.push(tripletToBase64(tmp))\n }\n
return output.join(")\n}\n\nfunction fromByteArray (uint8) {\n var tmp\n var len = uint8.length\n var extraBytes =
len % 3 // if we have 1 byte left, pad 2 bytes\n var parts = []\n var maxChunkLength = 16383 // must be multiple of
3\n\n // go through the array every three bytes, we'll deal with trailing stuff later\n for (var i = 0, len2 = len -
extraBytes; i < len2; i += maxChunkLength) {\n parts.push(encodeChunk(\n uint8, i, (i + maxChunkLength) >
len2 ? len2 : (i + maxChunkLength)\n ))\n }\n\n // pad the end with zeros, but make sure to not forget the extra
bytes\n if (extraBytes === 1) {\n tmp = uint8[len - 1]\n parts.push(\n lookup[tmp >> 2] +\n lookup[(tmp
<< 4) & 0x3F] +\n '=='\n )\n } else if (extraBytes === 2) {\n tmp = (uint8[len - 2] << 8) + uint8[len - 1]\n
parts.push(\n lookup[tmp >> 10] +\n
lookup[(tmp >> 4) & 0x3F] +\n lookup[(tmp << 2) & 0x3F] +\n '='\n )\n }\n\n return
parts.join(")\n}\n\n", "exports.read = function (buffer, offset, isLE, mLen, nBytes) {\n var e, m\n var eLen = (nBytes
* 8) - mLen - 1\n var eMax = (1 << eLen) - 1\n var eBias = eMax >> 1\n var nBits = -7\n var i = isLE ? (nBytes -
1) : 0\n var d = isLE ? -1 : 1\n var s = buffer[offset + i]\n\n i += d\n e = s & ((1 << (-nBits)) - 1)\n s >>= (-
nBits)\n nBits += eLen\n for (; nBits > 0; e = (e * 256) + buffer[offset + i], i += d, nBits -= 8) {\n\n m = e & ((1
<< (-nBits)) - 1)\n e >>= (-nBits)\n nBits += mLen\n for (; nBits > 0; m = (m * 256) + buffer[offset + i], i += d,
nBits -= 8) {\n\n if (e === 0) {\n e = 1 - eBias\n } else if (e === eMax) {\n return m ? NaN : ((s ? -1 : 1) *
Infinity)\n } else {\n m = m + Math.pow(2, mLen)\n e = e - eBias\n }\n return (s ? -1 : 1) * m * Math.pow(2, e
- mLen)\n }\n\n\nexports.write = function (buffer, value, offset, isLE,
mLen, nBytes) {\n var e, m, c\n var eLen = (nBytes * 8) - mLen - 1\n var eMax = (1 << eLen) - 1\n var eBias =
eMax >> 1\n var rt = (mLen === 23 ? Math.pow(2, -24) - Math.pow(2, -77) : 0)\n var i = isLE ? 0 : (nBytes - 1)\n
var d = isLE ? 1 : -1\n var s = value < 0 || (value === 0 && 1 / value < 0) ? 1 : 0\n value = Math.abs(value)\n\n if
(isNaN(value) || value === Infinity) {\n m = isNaN(value) ? 1 : 0\n e = eMax\n } else {\n e =
Math.floor(Math.log(value) / Math.LN2)\n if (value * (c = Math.pow(2, -e)) < 1) {\n e--\n c *= 2\n }\n if
(e + eBias >= 1) {\n value += rt / c\n } else {\n value += rt * Math.pow(2, 1 - eBias)\n }\n if (value * c
>= 2) {\n e++\n c /= 2\n }\n\n if (e + eBias >= eMax) {\n m = 0\n e = eMax\n } else if (e + eBias
>= 1) {\n m = ((value * c) - 1) * Math.pow(2, mLen)\n e = e + eBias\n } else {\n m = value *
Math.pow(2, eBias - 1) * Math.pow(2, mLen)\n e
= 0\n }\n }\n\n for (; mLen >= 8; buffer[offset + i] = m & 0xff, i += d, m /= 256, mLen -= 8) {\n\n e = (e <<
mLen) | m\n eLen += mLen\n for (; eLen > 0; buffer[offset + i] = e & 0xff, i += d, e /= 256, eLen -= 8) {\n\n
buffer[offset + i - d] |= s * 128\n}\n\n", "var toString = {}.toString;\n\nmodule.exports = Array.isArray || function (arr)
{\n return toString.call(arr) == '[object Array]';\n};\n\n", "/*!\n * The buffer module from node.js, for the browser.\n
*\n * @author Feross Aboukhadijeh <feross@feross.org> <http://feross.org>\n * @license MIT\n */\n\n/* eslint-
disable no-proto */\n\n'use strict'\n\nvar base64 = require('base64-js')\n\nvar ieee754 = require('ieee754')\n\nvar isArray
= require('isArray')\n\nexports.Buffer = Buffer\n\nexports.SlowBuffer =
SlowBuffer\n\nexports.inspectMaxBytes = 50\n\n\n/*\n * If `Buffer.TYPED_ARRAY_SUPPORT`:\n * ===
true Use Uint8Array implementation (fastest)\n * === false Use Object implementation (most compatible, even
IE6)\n */\n\n * Browsers
that support typed arrays are IE 10+, Firefox 4+, Chrome 7+, Safari 5.1+,\n * Opera 11.6+, iOS 4.2+.\n *\n * Due to
various browser bugs, sometimes the Object implementation will be used even\n * when the browser supports typed
arrays.\n *\n * Note:\n *\n * - Firefox 4-29 lacks support for adding new properties to `Uint8Array` instances,\n *
See: https://bugzilla.mozilla.org/show_bug.cgi?id=695438.\n *\n * - Chrome 9-10 is missing the
`TypedArray.prototype.subarray` function.\n *\n * - IE10 has a broken `TypedArray.prototype.subarray` function
which returns arrays of\n * incorrect length in some situations.\n *\n * We detect these buggy browsers and set
`Buffer.TYPED_ARRAY_SUPPORT` to `false` so they\n * get the Object implementation, which is slower but

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behaves correctly.\n *\nBuffer.TYPED_ARRAY_SUPPORT = global.TYPED_ARRAY_SUPPORT !==
undefined\n ? global.TYPED_ARRAY_SUPPORT\n : typedArraySupport()\n\n/*\n * Export kMaxLength after
typed array support is determined.\n
*/\nexports.kMaxLength = kMaxLength()\n\nfunction typedArraySupport () {\n try {\n   var arr = new
Uint8Array(1)\n   arr.__proto__ = {__proto__: Uint8Array.prototype, foo: function () { return 42 }}\n   return
arr.foo() === 42 && // typed array instances can be augmented\n     typeof arr.subarray === 'function' && //
chrome 9-10 lack `subarray`\n     arr.subarray(1, 1).byteLength === 0 // ie10 has broken `subarray`\n } catch (e)
{\n   return false\n }\n}\n\nfunction kMaxLength () {\n return Buffer.TYPED_ARRAY_SUPPORT\n ?
0x7fffffff\n   : 0x3fffffff\n}\n\nfunction createBuffer (that, length) {\n if (kMaxLength() < length) {\n   throw new
RangeError('Invalid typed array length')\n }\n if (Buffer.TYPED_ARRAY_SUPPORT) {\n   // Return an
augmented `Uint8Array` instance, for best performance\n   that = new Uint8Array(length)\n   that.__proto__ =
Buffer.prototype\n } else {\n   // Fallback: Return an object instance of the Buffer class\n   if (that === null)
{\n     that = new Buffer(length)\n   }\n   that.length = length\n }\n\n return that\n}\n\n/*\n * The Buffer
constructor returns instances of `Uint8Array` that have their\n * prototype changed to `Buffer.prototype`.
Furthermore, `Buffer` is a subclass of\n * `Uint8Array`, so the returned instances will have all the node `Buffer`
methods\n * and the `Uint8Array` methods. Square bracket notation works as expected -- it\n * returns a single
octet.\n *\n * The `Uint8Array` prototype remains unmodified.\n */\n\nfunction Buffer (arg, encodingOrOffset,
length) {\n if (!Buffer.TYPED_ARRAY_SUPPORT && !(this instanceof Buffer)) {\n   return new Buffer(arg,
encodingOrOffset, length)\n }\n\n // Common case.\n if (typeof arg === 'number') {\n   if (typeof
encodingOrOffset === 'string') {\n     throw new Error(\n       'If encoding is specified then the first argument must
be a string'\n     )\n   }\n   return allocUnsafe(this, arg)\n }\n return from(this, arg, encodingOrOffset,
length)\n}\n\nBuffer.poolSize
= 8192 // not used by this implementation\n\n// TODO: Legacy, not needed anymore. Remove in next major
version.\nBuffer._augment = function (arr) {\n arr.__proto__ = Buffer.prototype\n return arr\n}\n\nfunction from
(that, value, encodingOrOffset, length) {\n if (typeof value === 'number') {\n   throw new TypeError('"value"\n
argument must not be a number')\n }\n\n if (typeof ArrayBuffer !== 'undefined' && value instanceof ArrayBuffer)
{\n   return fromArrayBuffer(that, value, encodingOrOffset, length)\n }\n\n if (typeof value === 'string') {\n
return fromString(that, value, encodingOrOffset)\n }\n\n return fromObject(that, value)\n}\n\n/*\n * Functionally
equivalent to Buffer(arg, encoding) but throws a TypeError\n * if value is a number.\n * Buffer.from(str[,
encoding])\n * Buffer.from(array)\n * Buffer.from(buffer)\n * Buffer.from(arrayBuffer[, byteOffset[, length]])\n
**/\n\nBuffer.from = function (value, encodingOrOffset, length) {\n return
from(null, value, encodingOrOffset, length)\n}\n\nif (Buffer.TYPED_ARRAY_SUPPORT) {\n
Buffer.prototype.__proto__ = Uint8Array.prototype\n Buffer.__proto__ = Uint8Array\n if (typeof Symbol !==
'undefined' && Symbol.species &&\n   Buffer[Symbol.species] === Buffer) {\n   // Fix subarray() in ES2016.
See: https://github.com/feross/buffer/pull/97\n   Object.defineProperty(Buffer, Symbol.species, {\n     value: null,\n
configurable: true\n   })\n }\n}\n\nfunction assertSize (size) {\n if (typeof size !== 'number') {\n   throw new
TypeError('"size"\n argument must be a number')\n } else if (size < 0) {\n   throw new RangeError('"size"\n
argument must not be negative')\n }\n}\n\nfunction alloc (that, size, fill, encoding) {\n assertSize(size)\n if (size
<= 0) {\n   return createBuffer(that, size)\n }\n if (fill !== undefined) {\n   // Only pay attention to encoding if it's
a string. This\n   // prevents accidentally sending in a number that would\n   // be interpreted
as a start offset.\n   return typeof encoding === 'string'\n     ? createBuffer(that, size).fill(fill, encoding)\n     :
createBuffer(that, size).fill(fill)\n }\n return createBuffer(that, size)\n}\n\n/*\n * Creates a new filled Buffer
instance.\n * alloc(size[, fill[, encoding]])\n */\n\nBuffer.alloc = function (size, fill, encoding) {\n return alloc(null,
size, fill, encoding)\n}\n\nfunction allocUnsafe (that, size) {\n assertSize(size)\n that = createBuffer(that, size < 0 ?
0 : checked(size) | 0)\n if (!Buffer.TYPED_ARRAY_SUPPORT) {\n   for (var i = 0; i < size; ++i) {\n     that[i] =
0\n   }\n }\n return that\n}\n\n/*\n * Equivalent to Buffer(num), by default creates a non-zero-filled Buffer
instance.\n * *\n * Buffer.allocUnsafe = function (size) {\n   return allocUnsafe(null, size)\n }\n\n/*\n * Equivalent to
SlowBuffer(num), by default creates a non-zero-filled Buffer instance.\n */\n\nBuffer.allocUnsafeSlow = function

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(size) {\n return allocUnsafe(null, size)\n}\n\nfunction
fromString(that, string, encoding) {\n if (typeof encoding !== 'string' || encoding === '') {\n encoding = 'utf8'\n
}\n\n if (!Buffer.isEncoding(encoding)) {\n throw new TypeError('"encoding" must be a valid string
encoding')\n }\n\n var length = byteLength(string, encoding) | 0\n that = createBuffer(that, length)\n\n var actual =
that.write(string, encoding)\n\n if (actual !== length) {\n // Writing a hex string, for example, that contains invalid
characters will\n // cause everything after the first invalid character to be ignored. (e.g.\n // 'abxxcd' will be
treated as 'ab')\n that = that.slice(0, actual)\n }\n\n return that\n}\n\nfunction fromArrayLike(that, array) {\n var
length = array.length < 0 ? 0 : checked(array.length) | 0\n that = createBuffer(that, length)\n for (var i = 0; i <
length; i += 1) {\n that[i] = array[i] & 255\n }\n return that\n}\n\nfunction fromArrayBuffer(that, array,
byteOffset, length) {\n array.byteLength
\n // this throws if `array` is not a valid ArrayBuffer\n\n if (byteOffset < 0 || array.byteLength < byteOffset) {\n
throw new RangeError('"offset" is out of bounds')\n }\n\n if (array.byteLength < byteOffset + (length || 0)) {\n
throw new RangeError('"length" is out of bounds')\n }\n\n if (byteOffset === undefined && length ===
undefined) {\n array = new Uint8Array(array)\n } else if (length === undefined) {\n array = new
Uint8Array(array, byteOffset)\n } else {\n array = new Uint8Array(array, byteOffset, length)\n }\n\n if
(Buffer.TYPED_ARRAY_SUPPORT) {\n // Return an augmented `Uint8Array` instance, for best performance\n
that = array\n that.__proto__ = Buffer.prototype\n } else {\n // Fallback: Return an object instance of the Buffer
class\n that = fromArrayLike(that, array)\n }\n return that\n}\n\nfunction fromObject(that, obj) {\n if
(Buffer.isBuffer(obj)) {\n var len = checked(obj.length) | 0\n that = createBuffer(that,
len)\n\n if (that.length === 0) {\n return that\n }\n\n obj.copy(that, 0, 0, len)\n return that\n }\n\n if (obj)
{\n if ((typeof ArrayBuffer !== 'undefined' && obj.buffer instanceof ArrayBuffer) || 'length' in obj) {\n if
(typeof obj.length !== 'number' || !isFinite(obj.length)) {\n return createBuffer(that, 0)\n }\n return
fromArrayLike(that, obj)\n }\n\n if (obj.type === 'Buffer' && isArray(obj.data)) {\n return
fromArrayLike(that, obj.data)\n }\n }\n\n throw new TypeError('First argument must be a string, Buffer,
ArrayBuffer, Array, or array-like object.')\n}\n\nfunction checked(length) {\n // Note: cannot use `length <
kMaxLength()` here because that fails when\n // length is NaN (which is otherwise coerced to zero.)\n if (length >=
kMaxLength()) {\n throw new RangeError('Attempt to allocate Buffer larger than maximum ' +\n
'size: 0x' + kMaxLength().toString(16) + ' bytes')\n }\n return
length | 0\n}\n\nfunction SlowBuffer(length) {\n if (+length !== length) { // eslint-disable-line eqeqeq\n length =
0\n }\n return Buffer.alloc(+length)\n}\n\nBuffer.isBuffer = function isBuffer(b) {\n return !!b !== null &&
b._isBuffer\n}\n\nBuffer.compare = function compare(a, b) {\n if (!Buffer.isBuffer(a) || !Buffer.isBuffer(b)) {\n
throw new TypeError('Arguments must be Buffers')\n }\n\n if (a === b) return 0\n\n var x = a.length\n var y =
b.length\n\n for (var i = 0, len = Math.min(x, y); i < len; ++i) {\n if (a[i] !== b[i]) {\n x = a[i]\n y = b[i]\n
break\n }\n }\n\n if (x < y) return -1\n if (y < x) return 1\n return 0\n}\n\nBuffer.isEncoding = function
isEncoding(encoding) {\n switch (String(encoding).toLowerCase()) {\n case 'hex':\n case 'utf8':\n case 'utf-
8':\n case 'ascii':\n case 'latin1':\n case 'binary':\n case 'base64':\n case 'ucs2':\n case 'ucs-2':\n case
'utf16le':\n case 'utf-16le':\n\n return true\n default:\n return false\n }\n}\n\nBuffer.concat = function concat(list, length) {\n if
(!isArray(list)) {\n throw new TypeError('"list" argument must be an Array of Buffers')\n }\n\n if (list.length
=== 0) {\n return Buffer.alloc(0)\n }\n\n var i\n if (length === undefined) {\n length = 0\n for (i = 0; i <
list.length; ++i) {\n length += list[i].length\n }\n }\n\n var buffer = Buffer.allocUnsafe(length)\n var pos = 0\n
for (i = 0; i < list.length; ++i) {\n var buf = list[i]\n if (!Buffer.isBuffer(buf)) {\n throw new
TypeError('"list" argument must be an Array of Buffers')\n }\n buf.copy(buffer, pos)\n pos += buf.length\n
}\n return buffer\n}\n\nfunction byteLength(string, encoding) {\n if (Buffer.isBuffer(string)) {\n return
string.length\n }\n\n if (typeof ArrayBuffer !== 'undefined' && typeof ArrayBuffer.isView === 'function' &&
(ArrayBuffer.isView(string) || string instanceof ArrayBuffer)) {\n\n return string.byteLength\n }\n\n if (typeof string !== 'string') {\n string = '' + string\n }\n\n var len =
string.length\n if (len === 0) return 0\n\n // Use a for loop to avoid recursion\n var loweredCase = false\n for (;;)

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{\n  switch (encoding) {\n    case 'ascii':\n      case 'latin1':\n      case 'binary':\n        return len\n      case 'utf8':\n      case 'utf-8':\n      case undefined:\n        return utf8ToBytes(string).length\n      case 'ucs2':\n      case 'ucs-2':\n      case 'utf16le':\n      case 'utf-16le':\n        return len * 2\n      case 'hex':\n        return len >>> 1\n      case 'base64':\n        return base64ToBytes(string).length\n      default:\n        if (loweredCase) return utf8ToBytes(string).length //
assume utf8\n        encoding = (" + encoding).toLowerCase()\n        loweredCase = true\n      }\n}\n\nBuffer.prototype.byteLength = byteLength\n\nfunction slowToString (encoding, start, end) {\n  var loweredCase =
false\n\n  // No need
  to verify that \"this.length <= MAX_UINT32\" since it's a read-only\n  // property of a typed array.\n\n  // This
behaves neither like String nor Uint8Array in that we set start/end\n  // to their upper/lower bounds if the value
passed is out of range.\n  // undefined is handled specially as per ECMA-262 6th Edition,\n  // Section 13.3.3.7
Runtime Semantics: KeyedBindingInitialization.\n  if (start === undefined || start < 0) {\n    start = 0\n  }\n  // Return
early if start > this.length. Done here to prevent potential uint32\n  // coercion fail below.\n  if (start > this.length)
{\n    return \"\n  }\n\n  if (end === undefined || end > this.length) {\n    end = this.length\n  }\n\n  if (end <= 0) {\n
return \"\n  }\n\n  // Force coercion to uint32. This will also coerce falsey/NaN values to 0.\n  end >>>= 0\n  start
>>>= 0\n\n  if (end <= start) {\n    return \"\n  }\n\n  if (!encoding) encoding = 'utf8'\n\n  while (true) {\n    switch
(encoding) {\n      case 'hex':\n        return
        hexSlice(this, start, end)\n      case 'utf8':\n      case 'utf-8':\n        return utf8Slice(this, start, end)\n      case
'ascii':\n        return asciiSlice(this, start, end)\n      case 'latin1':\n      case 'binary':\n        return latin1Slice(this,
start, end)\n      case 'base64':\n        return base64Slice(this, start, end)\n      case 'ucs2':\n      case 'ucs-2':\n      case
'utf16le':\n      case 'utf-16le':\n        return utf16leSlice(this, start, end)\n      default:\n        if (loweredCase)
throw new TypeError('Unknown encoding: ' + encoding)\n        encoding = (encoding + '').toLowerCase()\n        loweredCase =
true\n      }\n    }\n\n    // The property is used by `Buffer.isBuffer` and `is-buffer` (in Safari 5-7) to
detect\n    // Buffer instances.\n    Buffer.prototype._isBuffer = true\n\n    function swap (b, n, m) {\n      var i = b[n]\n      b[n] =
b[m]\n      b[m] = i\n    }\n\n    Buffer.prototype.swap16 = function swap16 () {\n      var len = this.length\n      if (len % 2 !== 0)
{\n        throw new RangeError('Buffer size must be a multiple of 16-bits')\n      }\n      for (var i = 0; i < len; i += 2) {\n
swap(this, i, i + 1)\n      }\n      return this\n    }\n\n    Buffer.prototype.swap32 = function swap32 () {\n      var len = this.length\n
if (len % 4 !== 0) {\n      throw new RangeError('Buffer size must be a multiple of 32-bits')\n      }\n      for (var i = 0; i <
len; i += 4) {\n        swap(this, i, i + 3)\n        swap(this, i + 1, i + 2)\n      }\n      return this\n    }\n\n    Buffer.prototype.swap64 =
function swap64 () {\n      var len = this.length\n      if (len % 8 !== 0) {\n        throw new RangeError('Buffer size must be a
multiple of 64-bits')\n      }\n      for (var i = 0; i < len; i += 8) {\n        swap(this, i, i + 7)\n        swap(this, i + 1, i + 6)\n
swap(this, i + 2, i + 5)\n        swap(this, i + 3, i + 4)\n      }\n      return this\n    }\n\n    Buffer.prototype.toString = function
toString () {\n      var length = this.length | 0\n      if (length === 0) return \"\n      if (arguments.length === 0) return
utf8Slice(this, 0, length)\n      return slowToString.apply(this,
arguments)\n    }\n\n    Buffer.prototype.equals = function equals (b) {\n      if (!Buffer.isBuffer(b)) throw new
TypeError('Argument must be a Buffer')\n      if (this === b) return true\n      return Buffer.compare(this, b) ===
0\n    }\n\n    Buffer.prototype.inspect = function inspect () {\n      var str = \"\n      var max =
exports.INSPECT_MAX_BYTES\n      if (this.length > 0) {\n        str = this.toString('hex', 0, max).match(/.{2}/g).join('
')\n        if (this.length > max) str += ' ... '\n      }\n      return '<Buffer ' + str + '>'\n    }\n\n    Buffer.prototype.compare = function
compare (target, start, end, thisStart, thisEnd) {\n      if (!Buffer.isBuffer(target)) {\n        throw new
TypeError('Argument must be a Buffer')\n      }\n      if (start === undefined) {\n        start = 0\n      }\n      if (end ===
undefined) {\n        end = target ? target.length : 0\n      }\n      if (thisStart === undefined) {\n        thisStart = 0\n      }\n      if
(thisEnd === undefined) {\n        thisEnd = this.length\n      }\n      if (start < 0 || end > target.length || thisStart
< 0 || thisEnd > this.length) {\n        throw new RangeError('out of range index')\n      }\n      if (thisStart >= thisEnd &&
start >= end) {\n        return 0\n      }\n      if (thisStart >= thisEnd) {\n        return -1\n      }\n      if (start >= end) {\n
return 1\n      }\n      start >>>= 0\n      end >>>= 0\n      thisStart >>>= 0\n      thisEnd >>>= 0\n      if (this === target) return 0\n      var x =
thisEnd - thisStart\n      var y = end - start\n      var len = Math.min(x, y)\n      var thisCopy = this.slice(thisStart,
thisEnd)\n      var targetCopy = target.slice(start, end)\n      for (var i = 0; i < len; ++i) {\n        if (thisCopy[i] !==

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targetCopy[i]) {\n    x = thisCopy[i]\n    y = targetCopy[i]\n    break\n    }\n}\n\n if (x < y) return -1\n if (y < x) return 1\n return 0\n}\n\n// Finds either the first index of `val` in `buffer` at offset >= `byteOffset`,\n// OR the last index of `val` in `buffer` at offset <= `byteOffset`.\n// Arguments:\n// - buffer - a Buffer to search\n// - val - a string, Buffer, or number\n// -
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byteOffset - an index into `buffer`; will be clamped to an int32\n// - encoding - an optional encoding, relevant is val is a string\n// - dir - true for indexOf, false for lastIndexOf\nfunction bidirectionalIndexOf (buffer, val, byteOffset, encoding, dir) {\n // Empty buffer means no match\n if (buffer.length === 0) return -1\n\n // Normalize byteOffset\n if (typeof byteOffset === 'string') {\n    encoding = byteOffset\n    byteOffset = 0\n  } else if (byteOffset > 0x7fffffff) {\n    byteOffset = 0x7fffffff\n  } else if (byteOffset < -0x80000000) {\n    byteOffset = -0x80000000\n  }\n  byteOffset = +byteOffset // Coerce to Number.\n  if (isNaN(byteOffset)) {\n    // byteOffset: it it's undefined, null, NaN, \"foo\", etc, search whole buffer\n    byteOffset = dir ? 0 : (buffer.length - 1)\n  }\n\n // Normalize byteOffset: negative offsets start from the end of the buffer\n if (byteOffset < 0) byteOffset = buffer.length + byteOffset\n if (byteOffset >= buffer.length) {\n    if (dir)\n      return -1\n    else byteOffset = buffer.length - 1\n  } else if (byteOffset < 0) {\n    if (dir) byteOffset = 0\n    else return -1\n  }\n\n // Normalize val\n if (typeof val === 'string') {\n    val = Buffer.from(val, encoding)\n  }\n\n // Finally, search either indexOf (if dir is true) or lastIndexOf\n if (Buffer.isBuffer(val)) {\n    // Special case: looking for empty string/buffer always fails\n    if (val.length === 0) {\n      return -1\n    }\n    return arrayIndexOf(buffer, val, byteOffset, encoding, dir)\n  } else if (typeof val === 'number') {\n    val = val & 0xFF // Search for a byte value [0-255]\n    if (Buffer.TYPED_ARRAY_SUPPORT && typeof Uint8Array.prototype.indexOf === 'function') {\n      if (dir) {\n        return Uint8Array.prototype.indexOf.call(buffer, val, byteOffset)\n      } else {\n        return Uint8Array.prototype.lastIndexOf.call(buffer, val, byteOffset)\n      }\n    }\n    return arrayIndexOf(buffer, [ val ], byteOffset, encoding, dir)\n  }\n}
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\n\n throw new TypeError('val must be string, number or Buffer')\n}\n\nfunction arrayIndexOf (arr, val, byteOffset, encoding, dir) {\n  var indexSize = 1\n  var arrLength = arr.length\n  var valLength = val.length\n\n  if (encoding !== undefined) {\n    encoding = String(encoding).toLowerCase()\n    if (encoding === 'ucs2' || encoding === 'ucs-2' || encoding === 'utf16le' || encoding === 'utf-16le') {\n      if (arr.length < 2 || val.length < 2) {\n        return -1\n      }\n      indexSize = 2\n      arrLength /= 2\n      valLength /= 2\n      byteOffset /= 2\n    }\n  }\n\n  function read (buf, i) {\n    if (indexSize === 1) {\n      return buf[i]\n    } else {\n      return buf.readUInt16BE(i * indexSize)\n    }\n  }\n\n  var i\n  if (dir) {\n    var foundIndex = -1\n    for (i = byteOffset; i < arrLength; i++) {\n      if (read(arr, i) === read(val, foundIndex === -1 ? 0 : i - foundIndex)) {\n        if (foundIndex === -1) foundIndex = i\n        if (i - foundIndex + 1 === valLength) return foundIndex * indexSize\n      }\n    }\n  } else {\n    if (foundIndex !== -1) i -= i - foundIndex\n    foundIndex = -1\n  }\n\n  if (byteOffset + valLength > arrLength) byteOffset = arrLength - valLength\n  for (i = byteOffset; i >= 0; i--) {\n    var found = true\n    for (var j = 0; j < valLength; j++) {\n      if (read(arr, i + j) !== read(val, j)) {\n        found = false\n        break\n      }\n    }\n    if (found) return i\n  }\n\n  return -1\n}\n\nBuffer.prototype.includes = function includes (val, byteOffset, encoding) {\n  return this.indexOf(val, byteOffset, encoding) !== -1\n}\n\nBuffer.prototype.indexOf = function indexOf (val, byteOffset, encoding) {\n  return bidirectionalIndexOf(this, val, byteOffset, encoding, true)\n}\n\nBuffer.prototype.lastIndexOf = function lastIndexOf (val, byteOffset, encoding) {\n  return bidirectionalIndexOf(this, val, byteOffset, encoding, false)\n}\n\nfunction hexWrite (buf, string, offset, length) {\n  offset = Number(offset) || 0\n  var remaining = buf.length - offset\n  if (!length) {\n    length = remaining\n  } else {\n    length = Number(length)\n    if (length > remaining) {\n      length = remaining\n    }\n  }\n\n // must be an even number of digits\n  var strLen = string.length\n  if (strLen % 2 !== 0) throw new TypeError('Invalid hex string')\n  if (length > strLen / 2) {\n    length = strLen / 2\n  }\n  for (var i = 0; i < length; ++i) {\n    var parsed = parseInt(string.substr(i * 2, 2), 16)\n    if (isNaN(parsed)) return i\n    buf[offset + i] = parsed\n  }\n  return i\n}\n\nfunction utf8Write (buf, string, offset, length) {\n  return blitBuffer(utf8ToBytes(string), buf, offset, length)\n}\n\nfunction asciiWrite (buf, string, offset, length) {\n  return blitBuffer(asciiToBytes(string), buf, offset, length)\n}\n\nfunction latin1Write (buf, string, offset, length) {\n  return
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asciiWrite(buf, string, offset, length)\n}\n\nfunction
base64Write (buf, string, offset, length) {\n return blitBuffer(base64ToBytes(string), buf, offset,
length)\n}\n\nfunction ucs2Write (buf, string, offset, length) {\n return blitBuffer(utf16leToBytes(string, buf.length
- offset), buf, offset, length)\n}\n\nBuffer.prototype.write = function write (string, offset, length, encoding) {\n //
Buffer#write(string)\n if (offset === undefined) {\n encoding = 'utf8'\n length = this.length\n offset = 0\n //
Buffer#write(string, encoding)\n } else if (length === undefined && typeof offset === 'string') {\n encoding =
offset\n length = this.length\n offset = 0\n // Buffer#write(string, offset[, length][, encoding])\n } else if
(isFinite(offset)) {\n offset = offset | 0\n if (isFinite(length)) {\n length = length | 0\n if (encoding ===
undefined) encoding = 'utf8'\n } else {\n encoding = length\n length = undefined\n }\n // legacy
write(string, encoding, offset, length) - remove
in v0.13\n } else {\n throw new Error(\n 'Buffer.write(string, encoding, offset[, length]) is no longer
supported'\n )\n }\n\n var remaining = this.length - offset\n if (length === undefined || length > remaining) length
= remaining\n\n if ((string.length > 0 && (length < 0 || offset < 0)) || offset > this.length) {\n throw new
RangeError('Attempt to write outside buffer bounds')\n }\n\n if (!encoding) encoding = 'utf8'\n\n var loweredCase
= false\n for (;;) {\n switch (encoding) {\n case 'hex':\n return hexWrite(this, string, offset, length)\n\n case 'utf8':\n case 'utf-8':\n return utf8Write(this, string, offset, length)\n\n case 'ascii':\n return
asciiWrite(this, string, offset, length)\n\n case 'latin1':\n case 'binary':\n return latin1Write(this, string,
offset, length)\n\n case 'base64':\n // Warning: maxLength not taken into account in base64Write\n
return base64Write(this, string,
offset, length)\n\n case 'ucs2':\n case 'ucs-2':\n case 'utf16le':\n case 'utf-16le':\n return
ucs2Write(this, string, offset, length)\n\n default:\n if (loweredCase) throw new TypeError('Unknown
encoding: ' + encoding)\n encoding = (' + encoding).toLowerCase()\n loweredCase = true\n }\n
}\n}\n\nBuffer.prototype.toJSON = function toJSON () {\n return {\n type: 'Buffer',\n data:
Array.prototype.slice.call(this._arr || this, 0)\n }\n}\n\nfunction base64Slice (buf, start, end) {\n if (start === 0 &&
end === buf.length) {\n return base64.fromByteArray(buf)\n } else {\n return
base64.fromByteArray(buf.slice(start, end))\n }\n}\n\nfunction utf8Slice (buf, start, end) {\n end =
Math.min(buf.length, end)\n var res = []\n\n var i = start\n while (i < end) {\n var firstByte = buf[i]\n var
codePoint = null\n var bytesPerSequence = (firstByte > 0xEF) ? 4\n : (firstByte > 0xDF) ? 3\n : (firstByte
> 0xBF) ? 2\n : 1\n\n if (i + bytesPerSequence <= end) {\n var secondByte, thirdByte, fourthByte,
tempCodePoint\n\n switch (bytesPerSequence) {\n case 1:\n if (firstByte < 0x80) {\n codePoint
= firstByte\n }\n break\n case 2:\n secondByte = buf[i + 1]\n if ((secondByte & 0xC0)
=== 0x80) {\n tempCodePoint = (firstByte & 0x1F) << 0x6 | (secondByte & 0x3F)\n if
(tempCodePoint > 0x7F) {\n codePoint = tempCodePoint\n }\n }\n break\n case 3:\n
secondByte = buf[i + 1]\n thirdByte = buf[i + 2]\n if ((secondByte & 0xC0) === 0x80 && (thirdByte
& 0xC0) === 0x80) {\n tempCodePoint = (firstByte & 0xF) << 0xC | (secondByte & 0x3F) << 0x6 |
(thirdByte & 0x3F)\n if (tempCodePoint > 0x7FFF && (tempCodePoint < 0xD800 || tempCodePoint >
0xDFFF)) {\n codePoint = tempCodePoint\n }\n }\n break\n case 4:\n secondByte = buf[i + 1]\n thirdByte = buf[i + 2]\n
fourthByte = buf[i + 3]\n if ((secondByte & 0xC0) === 0x80 && (thirdByte & 0xC0) === 0x80 &&
(fourthByte & 0xC0) === 0x80) {\n tempCodePoint = (firstByte & 0xF) << 0x12 | (secondByte & 0x3F) <<
0xC | (thirdByte & 0x3F) << 0x6 | (fourthByte & 0x3F)\n if (tempCodePoint > 0xFFFF && tempCodePoint
< 0x110000) {\n codePoint = tempCodePoint\n }\n }\n }\n }\n\n if (codePoint === null)
{\n // we did not generate a valid codePoint so insert a\n // replacement char (U+FFFD) and advance only 1
byte\n codePoint = 0xFFFF\n bytesPerSequence = 1\n } else if (codePoint > 0xFFFF) {\n // encode to
utf16 (surrogate pair dance)\n codePoint -= 0x10000\n res.push(codePoint >>> 10 & 0x3FF | 0xD800)\n
codePoint = 0xDC00 | codePoint & 0x3FF\n }\n\n res.push(codePoint)\n
i += bytesPerSequence\n }\n}\n\n return decodeCodePointsArray(res)\n}\n\n// Based on
http://stackoverflow.com/a/22747272/680742, the browser with\n// the lowest limit is Chrome, with 0x10000

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args.\n// We go 1 magnitude less, for safety\nvar MAX_ARGUMENTS_LENGTH = 0x1000\n\nfunction
decodeCodePointsArray (codePoints) {\n  var len = codePoints.length\n  if (len <=
MAX_ARGUMENTS_LENGTH) {\n    return String.fromCharCode.apply(String, codePoints) // avoid extra
slice()\n  }\n  // Decode in chunks to avoid "call stack size exceeded"\n  var res = ""\n  var i = 0\n  while (i < len)
{\n    res += String.fromCharCode.apply(\n      String,\n      codePoints.slice(i, i +=
MAX_ARGUMENTS_LENGTH)\n    )\n  }\n  return res\n}\n\nfunction asciiSlice (buf, start, end) {\n  var ret = ""\n
end = Math.min(buf.length, end)\n  for (var i = start; i < end; ++i) {\n    ret += String.fromCharCode(buf[i] &
0x7F)\n  }\n  return ret\n}\n\nfunction latin1Slice (buf, start, end) {\n  var ret = ""\n
end = Math.min(buf.length, end)\n  for (var i = start; i < end; ++i) {\n    ret += String.fromCharCode(buf[i])\n
}\n  return ret\n}\n\nfunction hexSlice (buf, start, end) {\n  var len = buf.length\n  if (!start || start < 0) start = 0\n
if (!end || end < 0 || end > len) end = len\n  var out = ""\n  for (var i = start; i < end; ++i) {\n    out +=
toHex(buf[i])\n  }\n  return out\n}\n\nfunction utf16leSlice (buf, start, end) {\n  var bytes = buf.slice(start, end)\n
var res = ""\n  for (var i = 0; i < bytes.length; i += 2) {\n    res += String.fromCharCode(bytes[i] + bytes[i + 1] *
256)\n  }\n  return res\n}\n\nBuffer.prototype.slice = function slice (start, end) {\n  var len = this.length\n  start =
~~start\n  end = end === undefined ? len : ~~end\n  if (start < 0) {\n    start += len\n    if (start < 0) start = 0\n  }
else if (start > len) {\n    start = len\n  }\n  if (end < 0) {\n    end += len\n    if (end < 0) end = 0\n  } else if (end >
len) {\n    end = len\n  }\n\n  if (end < start) end = start\n  var newBuf\n  if (Buffer.TYPED_ARRAY_SUPPORT) {\n    newBuf =
this.subarray(start, end)\n    newBuf.__proto__ = Buffer.prototype\n  } else {\n    var sliceLen = end - start\n
newBuf = new Buffer(sliceLen, undefined)\n    for (var i = 0; i < sliceLen; ++i) {\n      newBuf[i] = this[i + start]\n
}\n  }\n  return newBuf\n}\n\n/*\n * Need to make sure that buffer isn't trying to write out of bounds.\n
*\nfunction checkOffset (offset, ext, length) {\n  if ((offset % 1) !== 0 || offset < 0) throw new RangeError('offset is
not uint')\n  if (offset + ext > length) throw new RangeError('Trying to access beyond buffer
length')\n}\n\nBuffer.prototype.readUIntLE = function readUIntLE (offset, byteLength, noAssert) {\n  offset =
offset | 0\n  byteLength = byteLength | 0\n  if (!noAssert) checkOffset(offset, byteLength, this.length)\n  var val =
this[offset]\n  var mul = 1\n  var i = 0\n  while (++i < byteLength && (mul *= 0x100)) {\n    val += this[offset +
i] * mul\n  }\n  return val\n}\n\nBuffer.prototype.readUIntBE = function readUIntBE (offset, byteLength,
noAssert) {\n  offset = offset | 0\n  byteLength = byteLength | 0\n  if (!noAssert) {\n    checkOffset(offset,
byteLength, this.length)\n  }\n  var val = this[offset + --byteLength]\n  var mul = 1\n  while (byteLength > 0 &&
(mul *= 0x100)) {\n    val += this[offset + --byteLength] * mul\n  }\n  return val\n}\n\nBuffer.prototype.readUInt8
= function readUInt8 (offset, noAssert) {\n  if (!noAssert) checkOffset(offset, 1, this.length)\n  return
this[offset]\n}\n\nBuffer.prototype.readUInt16LE = function readUInt16LE (offset, noAssert) {\n  if (!noAssert)
checkOffset(offset, 2, this.length)\n  return this[offset] | (this[offset + 1] <<
8)\n}\n\nBuffer.prototype.readUInt16BE = function readUInt16BE (offset, noAssert) {\n  if (!noAssert)
checkOffset(offset, 2, this.length)\n  return (this[offset] << 8) | this[offset + 1]\n}\n\nBuffer.prototype.readUInt32LE
= function readUInt32LE (offset, noAssert) {\n  if (!noAssert) checkOffset(offset, 4, this.length)\n  return
((this[offset]) | (this[offset + 1] << 8) | (this[offset + 2] << 16)) + (this[offset + 3] * 0x1000000)\n}\n\nBuffer.prototype.readUInt32BE
= function readUInt32BE (offset, noAssert) {\n  if (!noAssert) checkOffset(offset, 4, this.length)\n  return
(this[offset] * 0x1000000) + ((this[offset + 1] << 16) | (this[offset + 2] << 8) | this[offset +
3])\n}\n\nBuffer.prototype.readIntLE = function readIntLE (offset, byteLength, noAssert) {\n  offset = offset | 0\n
byteLength = byteLength | 0\n  if (!noAssert) checkOffset(offset, byteLength, this.length)\n  var val =
this[offset]\n  var mul = 1\n  var i = 0\n  while (++i < byteLength && (mul *= 0x100)) {\n    val += this[offset + i] *
mul\n  }\n  mul *= 0x80\n  if (val >= mul) val -= Math.pow(2, 8 * byteLength)\n  return
val\n}\n\nBuffer.prototype.readIntBE = function readIntBE (offset, byteLength, noAssert) {\n  offset = offset | 0\n
byteLength = byteLength | 0\n  if (!noAssert) checkOffset(offset, byteLength, this.length)\n  var i = byteLength\n
var mul = 1\n  var val = this[offset + --i]\n  while (i > 0 && (mul *= 0x100)) {\n    val += this[offset + --i] * mul\n
}\n  mul *= 0x80\n  if (val >= mul) val -= Math.pow(2, 8 * byteLength)\n  return
val\n}

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return val\n}\n\nBuffer.prototype.readInt8 = function readInt8 (offset, noAssert) {\n if (!noAssert)
checkOffset(offset, 1, this.length)\n if (!(this[offset] & 0x80)) return (this[offset])\n return ((0xff - this[offset] + 1)
* -1)\n}\n\nBuffer.prototype.readInt16LE = function readInt16LE (offset, noAssert) {\n if (!noAssert)
checkOffset(offset, 2, this.length)\n var val = this[offset] | (this[offset + 1] << 8)\n return (val & 0x8000) ? val |
0xFFFF0000 : val\n}\n\nBuffer.prototype.readInt16BE = function readInt16BE (offset, noAssert) {\n if (!noAssert)
checkOffset(offset, 2, this.length)\n var val = this[offset + 1] | (this[offset] << 8)\n
return (val & 0x8000) ? val | 0xFFFF0000 : val\n}\n\nBuffer.prototype.readInt32LE = function readInt32LE
(offset, noAssert) {\n if (!noAssert) checkOffset(offset, 4, this.length)\n\n return (this[offset]) |\n (this[offset + 1]
<< 8) |\n (this[offset + 2] << 16) |\n (this[offset + 3] << 24)\n}\n\nBuffer.prototype.readInt32BE = function
readInt32BE (offset, noAssert) {\n if (!noAssert) checkOffset(offset, 4, this.length)\n\n return (this[offset] << 24)
|\n (this[offset + 1] << 16) |\n (this[offset + 2] << 8) |\n (this[offset + 3])\n}\n\nBuffer.prototype.readFloatLE =
function readFloatLE (offset, noAssert) {\n if (!noAssert) checkOffset(offset, 4, this.length)\n return
ieee754.read(this, offset, true, 23, 4)\n}\n\nBuffer.prototype.readFloatBE = function readFloatBE (offset, noAssert)
{\n if (!noAssert) checkOffset(offset, 4, this.length)\n return ieee754.read(this, offset, false, 23,
4)\n}\n\nBuffer.prototype.readDoubleLE = function readDoubleLE (offset, noAssert)
{\n if (!noAssert) checkOffset(offset, 8, this.length)\n return ieee754.read(this, offset, true, 52,
8)\n}\n\nBuffer.prototype.readDoubleBE = function readDoubleBE (offset, noAssert) {\n if (!noAssert)
checkOffset(offset, 8, this.length)\n return ieee754.read(this, offset, false, 52, 8)\n}\n\nfunction checkInt (buf,
value, offset, ext, max, min) {\n if (!Buffer.isBuffer(buf)) throw new TypeError('"buffer" argument must be a
Buffer instance')\n if (value > max || value < min) throw new RangeError('"value" argument is out of bounds')\n if
(offset + ext > buf.length) throw new RangeError('Index out of range')\n}\n\nBuffer.prototype.writeUIntLE =
function writeUIntLE (value, offset, byteLength, noAssert) {\n value = +value\n offset = offset | 0\n byteLength =
byteLength | 0\n if (!noAssert) {\n var maxBytes = Math.pow(2, 8 * byteLength) - 1\n checkInt(this, value,
offset, byteLength, maxBytes, 0)\n }\n\n var mul = 1\n var i = 0\n this[offset] = value & 0xFF\n
while (++i < byteLength && (mul *= 0x100)) {\n this[offset + i] = (value / mul) & 0xFF\n }\n\n return offset +
byteLength\n}\n\nBuffer.prototype.writeUIntBE = function writeUIntBE (value, offset, byteLength, noAssert) {\n
value = +value\n offset = offset | 0\n byteLength = byteLength | 0\n if (!noAssert) {\n var maxBytes =
Math.pow(2, 8 * byteLength) - 1\n checkInt(this, value, offset, byteLength, maxBytes, 0)\n }\n\n var i =
byteLength - 1\n var mul = 1\n this[offset + i] = value & 0xFF\n while (--i >= 0 && (mul *= 0x100)) {\n
this[offset + i] = (value / mul) & 0xFF\n }\n\n return offset + byteLength\n}\n\nBuffer.prototype.writeUInt8 =
function writeUInt8 (value, offset, noAssert) {\n value = +value\n offset = offset | 0\n if (!noAssert) checkInt(this,
value, offset, 1, 0xff, 0)\n if (!Buffer.TYPED_ARRAY_SUPPORT) value = Math.floor(value)\n this[offset] =
(value & 0xff)\n return offset + 1\n}\n\nfunction objectWriteUInt16 (buf, value, offset, littleEndian)
{\n if (value < 0) value = 0xffff + value + 1\n for (var i = 0, j = Math.min(buf.length - offset, 2); i < j; ++i) {\n
buf[offset + i] = (value & (0xff << (8 * (littleEndian ? i : 1 - i)))) >>>\n (littleEndian ? i : 1 - i) * 8\n
}\n}\n\nBuffer.prototype.writeUInt16LE = function writeUInt16LE (value, offset, noAssert) {\n value = +value\n
offset = offset | 0\n if (!noAssert) checkInt(this, value, offset, 2, 0xffff, 0)\n if
(Buffer.TYPED_ARRAY_SUPPORT) {\n this[offset] = (value & 0xff)\n this[offset + 1] = (value >>> 8)\n }
else {\n objectWriteUInt16(this, value, offset, true)\n }\n return offset + 2\n}\n\nBuffer.prototype.writeUInt16BE =
function writeUInt16BE (value, offset, noAssert) {\n value = +value\n offset = offset | 0\n if (!noAssert)
checkInt(this, value, offset, 2, 0xffff, 0)\n if (Buffer.TYPED_ARRAY_SUPPORT) {\n this[offset] = (value >>>
8)\n this[offset + 1] = (value & 0xff)\n } else {\n objectWriteUInt16(this, value, offset, false)\n
}\n return offset + 2\n}\n\nfunction objectWriteUInt32 (buf, value, offset, littleEndian) {\n if (value < 0) value =
0xffffffff + value + 1\n for (var i = 0, j = Math.min(buf.length - offset, 4); i < j; ++i) {\n buf[offset + i] = (value
>>> (littleEndian ? i : 3 - i) * 8) & 0xff\n }\n}\n\nBuffer.prototype.writeUInt32LE = function writeUInt32LE
(value, offset, noAssert) {\n value = +value\n offset = offset | 0\n if (!noAssert) checkInt(this, value, offset, 4,
0xffffffff, 0)\n if (Buffer.TYPED_ARRAY_SUPPORT) {\n this[offset + 3] = (value >>> 24)\n this[offset + 2]
= (value >>> 16)\n this[offset + 1] = (value >>> 8)\n this[offset] = (value & 0xff)\n } else {\n

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objectWriteUInt32(this, value, offset, true)\n }\n return offset + 4\n}\n\nBuffer.prototype.writeUInt32BE =
function writeUInt32BE (value, offset, noAssert) {\n value = +value\n offset = offset | 0\n if (!noAssert)
checkInt(this, value, offset, 4, 0xffffffff, 0)\n if (Buffer.TYPED_ARRAY_SUPPORT)
{\n this[offset] = (value >>> 24)\n this[offset + 1] = (value >>> 16)\n this[offset + 2] = (value >>> 8)\n
this[offset + 3] = (value & 0xff)\n } else {\n objectWriteUInt32(this, value, offset, false)\n }\n return offset +
4\n}\n\nBuffer.prototype.writeIntLE = function writeIntLE (value, offset, byteLength, noAssert) {\n value =
+value\n offset = offset | 0\n if (!noAssert) {\n var limit = Math.pow(2, 8 * byteLength - 1)\n\n checkInt(this,
value, offset, byteLength, limit - 1, -limit)\n }\n\n var i = 0\n var mul = 1\n var sub = 0\n this[offset] = value &
0xFF\n while (++i < byteLength && (mul *= 0x100)) {\n if (value < 0 && sub === 0 && this[offset + i - 1] !==
0) {\n sub = 1\n }\n this[offset + i] = ((value / mul) >> 0) - sub & 0xFF\n }\n\n return offset +
byteLength\n}\n\nBuffer.prototype.writeIntBE = function writeIntBE (value, offset, byteLength, noAssert) {\n
value = +value\n offset = offset | 0\n if (!noAssert) {\n var limit
= Math.pow(2, 8 * byteLength - 1)\n\n checkInt(this, value, offset, byteLength, limit - 1, -limit)\n }\n\n var i =
byteLength - 1\n var mul = 1\n var sub = 0\n this[offset + i] = value & 0xFF\n while (--i >= 0 && (mul *=
0x100)) {\n if (value < 0 && sub === 0 && this[offset + i + 1] !== 0) {\n sub = 1\n }\n this[offset + i] =
((value / mul) >> 0) - sub & 0xFF\n }\n\n return offset + byteLength\n}\n\nBuffer.prototype.writeInt8 = function
writeInt8 (value, offset, noAssert) {\n value = +value\n offset = offset | 0\n if (!noAssert) checkInt(this, value,
offset, 1, 0x7f, -0x80)\n if (!Buffer.TYPED_ARRAY_SUPPORT) value = Math.floor(value)\n if (value < 0) value
= 0xff + value + 1\n this[offset] = (value & 0xff)\n return offset + 1\n}\n\nBuffer.prototype.writeInt16LE =
function writeInt16LE (value, offset, noAssert) {\n value = +value\n offset = offset | 0\n if (!noAssert)
checkInt(this, value, offset, 2, 0x7fff, -0x8000)\n if (Buffer.TYPED_ARRAY_SUPPORT)
{\n this[offset] = (value & 0xff)\n this[offset + 1] = (value >>> 8)\n } else {\n objectWriteUInt16(this, value,
offset, true)\n }\n return offset + 2\n}\n\nBuffer.prototype.writeInt16BE = function writeInt16BE (value, offset,
noAssert) {\n value = +value\n offset = offset | 0\n if (!noAssert) checkInt(this, value, offset, 2, 0x7fff, -0x8000)\n
if (Buffer.TYPED_ARRAY_SUPPORT) {\n this[offset] = (value >>> 8)\n this[offset + 1] = (value & 0xff)\n }
else {\n objectWriteUInt16(this, value, offset, false)\n }\n return offset + 2\n}\n\nBuffer.prototype.writeInt32LE
= function writeInt32LE (value, offset, noAssert) {\n value = +value\n offset = offset | 0\n if (!noAssert)
checkInt(this, value, offset, 4, 0x7fffffff, -0x80000000)\n if (Buffer.TYPED_ARRAY_SUPPORT) {\n
this[offset] = (value & 0xff)\n this[offset + 1] = (value >>> 8)\n this[offset + 2] = (value >>> 16)\n this[offset
+ 3] = (value >>> 24)\n } else {\n objectWriteUInt32(this, value,
offset, true)\n }\n return offset + 4\n}\n\nBuffer.prototype.writeInt32BE = function writeInt32BE (value, offset,
noAssert) {\n value = +value\n offset = offset | 0\n if (!noAssert) checkInt(this, value, offset, 4, 0x7fffffff, -
0x80000000)\n if (value < 0) value = 0xffffffff + value + 1\n if (Buffer.TYPED_ARRAY_SUPPORT) {\n
this[offset] = (value >>> 24)\n this[offset + 1] = (value >>> 16)\n this[offset + 2] = (value >>> 8)\n this[offset
+ 3] = (value & 0xff)\n } else {\n objectWriteUInt32(this, value, offset, false)\n }\n return offset +
4\n}\n\nfunction checkIEEE754 (buf, value, offset, ext, max, min) {\n if (offset + ext > buf.length) throw new
RangeError('Index out of range')\n if (offset < 0) throw new RangeError('Index out of range')\n}\n\nfunction
writeFloat (buf, value, offset, littleEndian, noAssert) {\n if (!noAssert) {\n checkIEEE754(buf, value, offset, 4,
3.4028234663852886e+38, -3.4028234663852886e+38)\n }\n ieee754.write(buf, value, offset,
littleEndian, 23, 4)\n return offset + 4\n}\n\nBuffer.prototype.writeFloatLE = function writeFloatLE (value, offset,
noAssert) {\n return writeFloat(this, value, offset, true, noAssert)\n}\n\nBuffer.prototype.writeFloatBE = function
writeFloatBE (value, offset, noAssert) {\n return writeFloat(this, value, offset, false, noAssert)\n}\n\nfunction
writeDouble (buf, value, offset, littleEndian, noAssert) {\n if (!noAssert) {\n checkIEEE754(buf, value, offset, 8,
1.7976931348623157E+308, -1.7976931348623157E+308)\n }\n ieee754.write(buf, value, offset, littleEndian, 52,
8)\n return offset + 8\n}\n\nBuffer.prototype.writeDoubleLE = function writeDoubleLE (value, offset, noAssert)
{\n return writeDouble(this, value, offset, true, noAssert)\n}\n\nBuffer.prototype.writeDoubleBE = function
writeDoubleBE (value, offset, noAssert) {\n return writeDouble(this, value, offset, false, noAssert)\n}\n\n//
copy(targetBuffer, targetStart=0, sourceStart=0, sourceEnd=buffer.length)\nBuffer.prototype.copy

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= function copy (target, targetStart, start, end) {\n  if (!start) start = 0\n  if (!end && end !== 0) end = this.length\n  if (targetStart >= target.length) targetStart = target.length\n  if (!targetStart) targetStart = 0\n  if (end > 0 && end < start) end = start\n  // Copy 0 bytes; we're done\n  if (end === start) return 0\n  if (target.length === 0 || this.length === 0) return 0\n  // Fatal error conditions\n  if (targetStart < 0) {\n    throw new RangeError('targetStart out of bounds')\n  }\n  if (start < 0 || start >= this.length) throw new RangeError('sourceStart out of bounds')\n  if (end < 0) throw new RangeError('sourceEnd out of bounds')\n  // Are we oob?\n  if (end > this.length) end = this.length\n  if (target.length - targetStart < end - start) {\n    end = target.length - targetStart + start\n  }\n  var len = end - start\n  var i\n  if (this === target && start < targetStart && targetStart < end) {\n    // descending copy from end\n    for (i = len = end - targetStart; i >= 0; --i) {\n      target[i + targetStart] = this[i + start]\n    }\n  } else if (len < 1000 || !Buffer.TYPED_ARRAY_SUPPORT) {\n    // ascending copy from start\n    for (i = 0; i < len; ++i) {\n      target[i + targetStart] = this[i + start]\n    }\n  } else {\n    Uint8Array.prototype.set.call(\n      target,\n      this.subarray(start, start + len),\n      targetStart\n    )\n  }\n  return len\n}\n\n// Usage:\n// buffer.fill(number[, offset[, end]])\n// buffer.fill(buffer[, offset[, end]])\n// buffer.fill(string[, offset[, end]][, encoding])\nBuffer.prototype.fill = function fill (val, start, end, encoding) {\n  // Handle string cases:\n  if (typeof val === 'string') {\n    if (typeof start === 'string') {\n      encoding = start\n      start = 0\n      end = this.length\n    } else if (typeof end === 'string') {\n      encoding = end\n      end = this.length\n    }\n    if (val.length === 1) {\n      var code = val.charCodeAt(0)\n      if (code < 256) {\n        val = code\n      }\n    }\n    if (encoding !== undefined && typeof encoding !== 'string') {\n      throw new TypeError('encoding must be a string')\n    }\n    if (typeof encoding === 'string' && !Buffer.isEncoding(encoding)) {\n      throw new TypeError('Unknown encoding: ' + encoding)\n    }\n  } else if (typeof val === 'number') {\n    val = val & 255\n  }\n  // Invalid ranges are not set to a default, so can range check early.\n  if (start < 0 || this.length < start || this.length < end) {\n    throw new RangeError('Out of range index')\n  }\n  if (end <= start) {\n    return this\n  }\n  start = start >>> 0\n  end = end === undefined ? this.length : end >>> 0\n  if (!val) val = 0\n  var i\n  if (typeof val === 'number') {\n    for (i = start; i < end; ++i) {\n      this[i] = val\n    }\n  } else {\n    var bytes = Buffer.isBuffer(val) ? val : utf8ToBytes(new Buffer(val, encoding).toString())\n    var len = bytes.length\n    for (i = 0; i < end - start; ++i) {\n      this[i + start] = bytes[i % len]\n    }\n  }\n  return this\n}\n\n// HELPER FUNCTIONS\n\nvar INVALID_BASE64_RE = /[^+\\/0-9A-Za-z-_]/g\nfunction base64clean (str) {\n  // Node strips out invalid characters like \\n and \\t from the string, base64-js does not\n  str = stringtrim(str).replace(INVALID_BASE64_RE, '')\n  // Node converts strings with length < 2 to '' if (str.length < 2) return ''\n  // Node allows for non-padded base64 strings (missing trailing ===), base64-js does not\n  while (str.length % 4 !== 0) {\n    str = str + '='\n  }\n  return str\n}\nfunction stringtrim (str) {\n  if (str.trim) return str.trim()\n  return str.replace(/^\\s+|\\s+$/g, '')\n}\nfunction toHex (n) {\n  if (n < 16) return '0' + n.toString(16)\n  return n.toString(16)\n}\nfunction utf8ToBytes (string, units) {\n  units = units || Infinity\n  var codePoint\n  var length = string.length\n  var leadSurrogate = null\n  var bytes = []\n  for (var i = 0; i < length; ++i) {\n    codePoint = string.charCodeAt(i)\n    // is surrogate component\n    if (codePoint > 0xD7FF && codePoint < 0xE000) {\n      // last char was a lead\n      if (!leadSurrogate) {\n        // no lead yet\n        if (codePoint > 0xDBFF) {\n          // unexpected trail\n          if ((units -= 3) > -1) bytes.push(0xEF, 0xBF, 0xBD)\n          continue\n        } else if (i + 1 === length) {\n          // unpaired lead\n          if ((units -= 3) > -1) bytes.push(0xEF, 0xBF, 0xBD)\n          continue\n        }\n        // valid lead\n        leadSurrogate = codePoint\n        continue\n      }\n      // 2 leads in a row\n      if (codePoint < 0xDC00) {\n        if ((units -= 3) > -1) bytes.push(0xEF, 0xBF, 0xBD)\n        leadSurrogate = codePoint\n        continue\n      }\n      // valid surrogate pair\n      codePoint = (leadSurrogate - 0xD800 << 10 | codePoint - 0xDC00) + 0x10000\n    } else if (leadSurrogate) {\n      // valid bmp char, but last char was a lead\n      if ((units -= 3) > -1) bytes.push(0xEF, 0xBF, 0xBD)\n      leadSurrogate = null\n    }\n    // encode utf8\n    if (codePoint < 0x80) {\n      if ((units -= 1) < 0) break\n      bytes.push(codePoint)\n    } else if (codePoint < 0x800) {\n      if ((units -= 2) < 0) break\n      bytes.push(\n        codePoint >> 0x6 | 0xC0,\n        codePoint & 0x3F | 0x80\n      )\n    }\n  }\n}

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    }\n } else if (codePoint < 0x10000) {\n   if ((units -= 3) < 0) break\n   bytes.push(\n     codePoint >> 0xC |
0xE0,\n     codePoint >> 0x6 & 0x3F | 0x80,\n     codePoint & 0x3F | 0x80)\n   }\n } else if (codePoint <
0x110000) {\n   if ((units -= 4) < 0) break\n   bytes.push(\n     codePoint >> 0x12 | 0xF0,\n     codePoint >>
0xC & 0x3F | 0x80,\n     codePoint >> 0x6 & 0x3F | 0x80,\n     codePoint & 0x3F | 0x80)\n   }\n } else {\n
throw new Error('Invalid code point')\n   }\n }\n\n return bytes\n}\n\nfunction asciiToBytes (str) {\n var
byteArray = []\n for (var
i = 0; i < str.length; ++i) {\n   // Node's code seems to be doing this and not & 0x7F.\n
byteArray.push(str.charCodeAt(i) & 0xFF)\n }\n return byteArray\n}\n\nfunction utf16leToBytes (str, units) {\n
var c, hi, lo\n var byteArray = []\n for (var i = 0; i < str.length; ++i) {\n   if ((units -= 2) < 0) break\n   c =
str.charCodeAt(i)\n   hi = c >> 8\n   lo = c % 256\n   byteArray.push(lo)\n   byteArray.push(hi)\n }\n\n return
byteArray\n}\n\nfunction base64ToBytes (str) {\n return base64.toByteArray(base64clean(str))\n}\n\nfunction
blitBuffer (src, dst, offset, length) {\n for (var i = 0; i < length; ++i) {\n   if ((i + offset >= dst.length) || (i >=
src.length)) break\n   dst[i + offset] = src[i]\n }\n return i\n}\n\nfunction isnan (val) {\n return val !== val // eslint-
disable-line no-self-compare\n}\n\n", "/*\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n *
Licensed under the Apache License, Version 2.0 (the "License");\n * you may not
use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*\n
*\n\nimport {complex} from '../ops/complex';\nimport {tensor} from '../ops/tensor';\nimport {NamedTensor,
NamedTensorMap} from '../tensor_types';\nimport {TypedArray} from '../types';\nimport {sizeFromShape} from
'../util';\nimport {DTYPE_VALUE_SIZE_MAP, ModelArtifacts, ModelArtifactsInfo, WeightGroup,
WeightsManifestEntry} from './types';\n\n/** Number of bytes reserved for the length of the string. (32bit integer).
*\nconst
NUM_BYTES_STRING_LENGTH = 4;\n\n/**\n * Encode a map from names to weight values as an ArrayBuffer,
along with an\n * `Array` of `WeightsManifestEntry` as specification of the encoded weights.\n *\n * This function
does not perform sharding.\n *\n * This function is the reverse of `decodeWeights`.\n *\n * @param tensors A map
("dict") from names to tensors.\n * @param group Group to which the weights belong (optional).\n * @returns A
`Promise` of\n * - A flat `ArrayBuffer` with all the binary values of the `Tensor`'s\n * concatenated.\n * - An
`Array` of `WeightManifestEntry`'s, carrying information including\n * tensor names, `dtype`'s and shapes.\n *
@throws Error: on unsupported tensor `dtype`.\n */\nexport async function encodeWeights(\n  tensors:
NamedTensorMap|NamedTensor[], group?: WeightGroup): Promise<{data: ArrayBuffer, specs:
WeightsManifestEntry[]}> {\n  // TODO(adarob, cais): Support quantization.\n  const specs:
WeightsManifestEntry[] = [];\n  const dataPromises:
Array<Promise<TypedArray>> = [];\n\n  const names: string[] = Array.isArray(tensors) ?\n    tensors.map(tensor
=> tensor.name) :\n    Object.keys(tensors);\n\n  for (let i = 0; i < names.length; ++i) {\n    const name =
names[i];\n    const t = Array.isArray(tensors) ? tensors[i].tensor : tensors[name];\n    if (t.dtype !== 'float32' &&
t.dtype !== 'int32' && t.dtype !== 'bool' && t.dtype !== 'string' && t.dtype !== 'complex64') {\n      throw
new Error(`Unsupported dtype in weight '${name}': ${t.dtype}`);\n    }\n    const spec: WeightsManifestEntry =
{name, shape: t.shape, dtype: t.dtype};\n    if (t.dtype === 'string') {\n      const utf8bytes = new
Promise<TypedArray>(async resolve => {\n        const vals = await t.bytes() as Uint8Array[];\n        const
totalNumBytes = vals.reduce((p, c) => p + c.length, 0) +\n          NUM_BYTES_STRING_LENGTH *
vals.length;\n        const bytes = new Uint8Array(totalNumBytes);\n        let offset = 0;\n        for (let
i = 0; i < vals.length; i++) {\n          const val = vals[i];\n          const bytesOfLength =\n            new
Uint8Array(new Uint32Array([val.length]).buffer);\n          bytes.set(bytesOfLength, offset);\n          offset +=
NUM_BYTES_STRING_LENGTH;\n          bytes.set(val, offset);\n          offset += val.length;\n        }\n

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resolve(bytes);\n    });\n    dataPromises.push(utf8bytes);\n  } else {\n    dataPromises.push(t.data());\n  }\n  if
(group != null) {\n    spec.group = group;\n  }\n  specs.push(spec);\n}\n\nconst tensorValues = await
Promise.all(dataPromises);\nreturn {data: concatenateTypedArrays(tensorValues), specs};\n}\n\n/**\n * Decode
flat ArrayBuffer as weights.\n *\n * This function does not handle sharding.\n *\n * This function is the reverse of
`encodeWeights`.\n *\n * @param buffer A flat ArrayBuffer carrying the binary values of the tensors\n *
concatenated in the order specified in `specs`.\n *\n * @param specs Specifications of
the names, dtypes and shapes of the tensors\n * whose value are encoded by `buffer`.\n *\n * @return A map from
tensor name to tensor value, with the names corresponding\n * to names in `specs`.\n *\n * @throws Error, if any of
the tensors has unsupported dtype.\n */\nexport function decodeWeights(\n  buffer: ArrayBuffer, specs:
WeightsManifestEntry[]): NamedTensorMap {\n  // TODO(adarob, cais): Support quantization.\n  const out:
NamedTensorMap = {};\n  let float16Decode: (buffer: Uint16Array) => Float32Array | undefined;\n  let offset =
0;\n  for (const spec of specs) {\n    const name = spec.name;\n    const dtype = spec.dtype;\n    const shape =
spec.shape;\n    const size = sizeFromShape(shape);\n    let values: TypedArray|string[]|Uint8Array[];\n    if
('quantization' in spec) {\n      const quantization = spec.quantization;\n      if (quantization.dtype === 'uint8' ||
quantization.dtype === 'uint16') {\n        if (!('min' in quantization && 'scale' in quantization)) {\n
          throw new Error(\n            `Weight ${spec.name} with quantization ${quantization.dtype} ` +\n
            `doesn't have corresponding metadata min and scale.`);\n        }\n      } else if (quantization.dtype === 'float16') {\n        if
(dtype !== 'float32') {\n          throw new Error(\n            `Weight ${spec.name} is quantized with
${quantization.dtype} ` +\n
            `which only supports weights of type float32 not ${dtype}.`);\n        }\n      }
      else {\n        throw new Error(\n          `Weight ${spec.name} has unknown ` +\n
          `quantization dtype ${quantization.dtype}. ` +\n
          `Supported quantization dtypes are: ` +\n
          `'uint8', 'uint16', and 'float16'.`);\n      }\n      const quantizationSizeFactor = DTYPE_VALUE_SIZE_MAP[quantization.dtype];\n
      const byteBuffer =\n        buffer.slice(offset, offset + size * quantizationSizeFactor);\n      const quantizedArray =
(quantization.dtype === 'uint8') ?\n        new Uint8Array(byteBuffer)\n      :\n        new Uint16Array(byteBuffer);\n      if (dtype === 'float32') {\n        if (quantization.dtype === 'uint8' ||
quantization.dtype === 'uint16') {\n          values = new Float32Array(quantizedArray.length);\n          for (let i = 0; i
< quantizedArray.length; i++) {\n            const v = quantizedArray[i];\n            values[i] = v * quantization.scale +
quantization.min;\n          }\n        } else if (quantization.dtype === 'float16') {\n          if (float16Decode ===
undefined) {\n            float16Decode = getFloat16Decoder();\n          }\n          values =
float16Decode(quantizedArray as Uint16Array);\n        } else {\n          throw new Error(\n            `Unsupported
quantization type ${quantization.dtype} ` +\n
            `for weight type float32.`);\n        }\n      } else if (dtype ===
'int32') {\n        if (quantization.dtype !== 'uint8' && quantization.dtype !== 'uint16') {\n          throw new Error(\n
            `Unsupported quantization
type ${quantization.dtype} ` +\n
            `for weight type int32.`);\n        }\n        values = new
Int32Array(quantizedArray.length);\n        for (let i = 0; i < quantizedArray.length; i++) {\n          const v =
quantizedArray[i];\n          values[i] = Math.round(v * quantization.scale + quantization.min);\n        }\n      } else {\n
        throw new Error(`Unsupported dtype in weight '${name}': ${dtype}`);\n      }\n      offset += size *
quantizationSizeFactor;\n    } else if (dtype === 'string') {\n      const size = sizeFromShape(spec.shape);\n      values
= [];\n      for (let i = 0; i < size; i++) {\n        const byteLength = new Uint32Array(\n          buffer.slice(offset,
offset + NUM_BYTES_STRING_LENGTH))[0];\n        offset += NUM_BYTES_STRING_LENGTH;\n        const
bytes = new Uint8Array(buffer.slice(offset, offset + byteLength));\n        (values as Uint8Array[]).push(bytes);\n
        offset += byteLength;\n      }\n    } else {\n      const dtypeFactor
= DTYPE_VALUE_SIZE_MAP[dtype];\n      const byteBuffer = buffer.slice(offset, offset + size *
dtypeFactor);\n      if (dtype === 'float32') {\n        values = new Float32Array(byteBuffer);\n      } else if (dtype
=== 'int32') {\n        values = new Int32Array(byteBuffer);\n      } else if (dtype === 'bool') {\n        values = new
Uint8Array(byteBuffer);\n      } else if (dtype === 'complex64') {\n        values = new Float32Array(byteBuffer);\n
        const real = new Float32Array(values.length / 2);\n        const image = new Float32Array(values.length / 2);\n
        for (let i = 0; i < real.length; i++) {\n          real[i] = values[i * 2];\n          image[i] = values[i * 2 + 1];\n        }\n

```

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const realTensor = tensor(real, shape, 'float32');\n    const imageTensor = tensor(image, shape, 'float32');\n    out[name] = complex(realTensor, imageTensor);\n    realTensor.dispose();\n    imageTensor.dispose();\n  }\n  else {\n    throw new Error('Unsupported\n      dtype in weight `${name}`: `${dtype}`');\n  }\n  offset += size * dtypeFactor;\n}\nif (dtype !==\n'complex64') {\n  out[name] = tensor(values, shape, dtype);\n}\nreturn out;\n}\n\n/**\n * Concatenate\n TypedArrays into an ArrayBuffer.\n */\nexport function concatenateTypedArrays(xs: TypedArray[]): ArrayBuffer\n{\n  // TODO(adarob, cais): Support quantization.\n  if (xs === null) {\n    throw new Error('Invalid input value:\n    ${JSON.stringify(xs)}');\n  }\n  let totalByteLength = 0;\n  // `normalizedXs` is here for this reason: a\n  `TypedArray`'s `buffer`\n  // can have a different byte length from that of the `TypedArray` itself,\n  // for example,\n  when the `TypedArray` is created from an offset in an\n  // `ArrayBuffer`. `normlializedXs` holds `TypedArray`'s\n  whose `buffer`'s match\n  // the `TypedArray` in byte length. If an element of `xs` does not show\n  // this property, a\n  new `TypedArray` that satisfy this property will be\n  // constructed and pushed\n  into `normalizedXs`.\n  const normalizedXs: TypedArray[] = [];\n  xs.forEach((x: TypedArray) => {\n    totalByteLength += x.byteLength;\n    // tslint:disable:no-any\n    normalizedXs.push(\n      x.byteLength ===\n      x.buffer.byteLength ? x :\n      new (x.constructor as any)(x);\n    if (!(x as any instanceof\n      Float32Array || x as any instanceof Int32Array ||\n      x as any instanceof Uint8Array)) {\n      throw new\n      Error('Unsupported TypedArray subtype: `${x.constructor.name}`');\n    }\n    // tslint:enable:no-any\n  });\n  const\n  y = new Uint8Array(totalByteLength);\n  let offset = 0;\n  normalizedXs.forEach((x: TypedArray) => {\n    y.set(new Uint8Array(x.buffer), offset);\n    offset += x.byteLength;\n  });\n  return y.buffer;\n}\n\n// Use Buffer\non Node.js instead of Blob/atob/btoa\nconst useNodeBuffer = typeof Buffer !== 'undefined' &&\n  (typeof Blob\n  === 'undefined' || typeof atob === 'undefined' ||\n  typeof btoa === 'undefined');\n\n/**\n * Calculate the byte length of a JavaScript string.\n * * Note that a JavaScript string can contain wide characters,\n * therefore the\n * length of the string is not necessarily equal to the byte length.\n * * @param str Input string.\n * * @returns Byte length.\n */\nexport function stringByteLength(str: string): number {\n  if (useNodeBuffer) {\n    return Buffer.byteLength(str);\n  }\n  return new Blob([str]).size;\n}\n\n/**\n * Encode an ArrayBuffer as a base64\n encoded string.\n * * @param buffer `ArrayBuffer` to be converted.\n * * @returns A string that base64-encodes\n `buffer`.\n */\nexport function arrayBufferToBase64String(buffer: ArrayBuffer): string {\n  if (useNodeBuffer) {\n    return Buffer.from(buffer).toString('base64');\n  }\n  const buf = new Uint8Array(buffer);\n  let s = '';\n  for (let i = 0,\n    l = buf.length; i < l; i++) {\n    s += String.fromCharCode(buf[i]);\n  }\n  return btoa(s);\n}\n\n/**\n * Decode a\n base64 string as an ArrayBuffer.\n * * @param\n str Base64 string.\n * * @returns Decoded `ArrayBuffer`.\n */\nexport function base64StringToArrayBuffer(str:\n  string): ArrayBuffer {\n  if (useNodeBuffer) {\n    const buf = Buffer.from(str, 'base64');\n    return\n    buf.buffer.slice(buf.byteOffset, buf.byteOffset + buf.byteLength);\n  }\n  const s = atob(str);\n  const buffer = new\n  Uint8Array(s.length);\n  for (let i = 0; i < s.length; ++i) {\n    buffer.set([s.charCodeAt(i)], i);\n  }\n  return\n  buffer.buffer;\n}\n\n/**\n * Concatenate a number of ArrayBuffers into one.\n * * @param buffers A number of\n array buffers to concatenate.\n * * @returns Result of concatenating `buffers` in order.\n */\nexport function\n  concatenateArrayBuffers(buffers: ArrayBuffer[]): ArrayBuffer {\n  if (buffers.length === 1) {\n    return\n    buffers[0];\n  }\n  let totalByteLength = 0;\n  buffers.forEach((buffer: ArrayBuffer) => {\n    totalByteLength +=\n    buffer.byteLength;\n  });\n  const temp = new Uint8Array(totalByteLength);\n  let offset = 0;\n  buffers.forEach((buffer:\n    ArrayBuffer) => {\n    temp.set(new Uint8Array(buffer), offset);\n    offset += buffer.byteLength;\n  });\n  return\n  temp.buffer;\n}\n\n/**\n * Get the basename of a path.\n * * Behaves in a way analogous to Linux's basename\n command.\n * * @param path\n */\nexport function basename(path: string): string {\n  const SEPARATOR = '/';\n  path = path.trim();\n  while (path.endsWith(SEPARATOR)) {\n    path = path.slice(0, path.length - 1);\n  }\n  const\n  items = path.split(SEPARATOR);\n  return items[items.length - 1];\n}\n\n/**\n * Populate ModelArtifactsInfo\n fields for a model with JSON topology.\n * * @param modelArtifacts\n * * @returns A ModelArtifactsInfo object.\n */\nexport function\n  getModelArtifactsInfoForJSON(modelArtifacts: ModelArtifacts): ModelArtifactsInfo {\n  if\n  (modelArtifacts.modelTopology instanceof ArrayBuffer) {\n    throw new Error('Expected JSON model topology,\n
```

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received ArrayBuffer.);\n }\n\n return {\n   dateSaved: new Date(),\n   modelTopologyType:
'JSON',\n   modelTopologyBytes: modelArtifacts.modelTopology == null ?\n    0 :\nstringByteLength(JSON.stringify(modelArtifacts.modelTopology)),\n   weightSpecsBytes:
modelArtifacts.weightSpecs == null ?\n    0 :\nstringByteLength(JSON.stringify(modelArtifacts.weightSpecs)),\n   weightDataBytes: modelArtifacts.weightData
== null ?\n    0 :\n    modelArtifacts.weightData.byteLength,\n   };\n}\n\n/**\n * Computes mantisa table for
casting Float16 to Float32\n * See http://www.fox-toolkit.org/ftp/fasthalffloatconversion.pdf\n * @returns
Uint32Array, 2048 mantissa lookup values.\n */\nfunction computeFloat16MantisaTable(): Uint32Array {\n  const
convertMantissa = (i: number): number => {\n    let m = i << 13;\n    let e = 0;\n    while ((m & 0x00800000) ===
0) {\n      e -= 0x00800000;\n      m <=<= 1;\n    }\n    m &= ~0x00800000;\n    e += 0x38800000;\n    return m | e;\n
};\n\n  const mantisaTable = new Uint32Array(2048);\n\n  mantisaTable[0]
= 0;\n  for (let i = 1; i < 1024; i++) {\n    mantisaTable[i] = convertMantissa(i);\n  }\n  for (let i = 1024; i < 2048;
i++) {\n    mantisaTable[i] = 0x38000000 + ((i - 1024) << 13);\n  }\n\n  return mantisaTable;\n}\n\n/**\n *
Computes exponent table for casting Float16 to Float32\n * See http://www.fox-
toolkit.org/ftp/fasthalffloatconversion.pdf\n * @returns Uint32Array, 64 exponent lookup values.\n */\nfunction
computeFloat16ExponentTable(): Uint32Array {\n  const exponentTable = new Uint32Array(64);\n\n  exponentTable[0] = 0;\n  exponentTable[31] = 0x47800000;\n  exponentTable[32] = 0x80000000;\n
exponentTable[63] = 0xc7800000;\n  for (let i = 1; i < 31; i++) {\n    exponentTable[i] = i << 23;\n  }\n  for (let i =
33; i < 63; i++) {\n    exponentTable[i] = 0x80000000 + ((i - 32) << 23);\n  }\n\n  return exponentTable;\n}\n\n/**\n *
Computes offset table for casting Float16 to Float32\n * See http://www.fox-
toolkit.org/ftp/fasthalffloatconversion.pdf\n * @returns Uint32Array,
6d offset values.\n */\nfunction computeFloat16OffsetTable(): Uint32Array {\n  const offsetTable = new
Uint32Array(64);\n\n  for (let i = 0; i < 64; i++) {\n    offsetTable[i] = 1024;\n  }\n  offsetTable[0] = offsetTable[32]
= 0;\n\n  return offsetTable;\n}\n\n/**\n * Retrieve a Float16 decoder which will decode a ByteArray of Float16
values\n * to a Float32Array.\n */\n * @returns Function (buffer: Uint16Array) => Float32Array which decodes\n *
the Uint16Array of Float16 bytes to a Float32Array.\n */\nexport function getFloat16Decoder(): (buffer:
Uint16Array) => Float32Array {\n  // Algorithm is based off of\n  // http://www.fox-
toolkit.org/ftp/fasthalffloatconversion.pdf\n  // Cache lookup tables\n  const mantisaTable =
computeFloat16MantisaTable();\n  const exponentTable = computeFloat16ExponentTable();\n  const offsetTable =
computeFloat16OffsetTable();\n\n  return (quantizedArray: Uint16Array) => {\n    const buffer = new
ArrayBuffer(4 * quantizedArray.length);\n\n    const bufferUint32View = new Uint32Array(buffer);\n    for (let index = 0; index < quantizedArray.length;\n    index++) {\n      const float16Bits = quantizedArray[index];\n      const float32Bits =\n      mantisaTable[offsetTable[float16Bits >> 10] + (float16Bits & 0x3ff)] +\n      exponentTable[float16Bits >> 10];\n      bufferUint32View[index] = float32Bits;\n    }\n    return new Float32Array(buffer);\n  };\n}\n\n"/**\n *
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2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language
governing permissions and\n * limitations under the License.\n */
=====
\n\n*/\n\nimport {IOHandler, LoadOptions} from './types';\n\nexport type IORouter = (url: string|string[], loadOptions?:
LoadOptions) =>\n  IOHandler;\n\nexport class IORouterRegistry {\n  // Singleton instance.\n  private static
instance: IORouterRegistry;\n  private saveRouters: IORouter[];\n  private loadRouters: IORouter[];\n\n  private
constructor() {\n    this.saveRouters = [];\n    this.loadRouters = [];\n  }\n\n  private static getInstance():
IORouterRegistry {\n    if (IORouterRegistry.instance == null) {\n      IORouterRegistry.instance = new

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```
IORouterRegistry();\n    }\n    return IORouterRegistry.getInstance().saveRouter(saveHandler);\n\n    /**\n     * Register a save-handler router.\n     *\n     * @param saveRouter A function that maps a URL-like string onto an instance\n     *   of `IOHandler` with the `save` method defined or `null`.\n     */\n    static registerSaveRouter(saveRouter: IORouter) {\n      IORouterRegistry.getInstance().saveRouters.push(saveRouter);\n    }\n\n    /**\n     * Register a load-handler router.\n     *\n     * @param loadRouter A function that maps a URL-like string onto an instance\n     *   of `IOHandler` with the `load` method defined or `null`.\n     */\n    static registerLoadRouter(loadRouter: IORouter) {\n      IORouterRegistry.getInstance().loadRouters.push(loadRouter);\n    }\n\n    /**\n     * Look up IOHandler for saving, given a URL-like string.\n     *\n     * @param url\n     * @returns If only one match is found, an instance of IOHandler with the\n     *   `save` method defined. If no match is found, `null`. \n     * @throws Error, if more than one match is found.\n     */\n    static getSaveHandlers(url: string|string[]): IOHandler[] {\n      return IORouterRegistry.getHandlers(url, 'save');\n    }\n\n    /**\n     * Look up IOHandler for loading, given a URL-like string.\n     *\n     * @param url\n     * @param loadOptions Optional, custom load options.\n     *\n     * @returns All valid handlers for `url`, given the currently registered\n     *   handler routers.\n     */\n    static getLoadHandlers(url: string|string[], loadOptions?: LoadOptions):\n      IOHandler[] {\n      return IORouterRegistry.getHandlers(url, 'load', loadOptions);\n    }\n\n    private static getHandlers(\n      url: string|string[],\n      handlerType: 'save'|'load',\n      loadOptions?: LoadOptions): IOHandler[] {\n      const validHandlers: IOHandler[] = [];\n      const routers = handlerType === 'load' ?\n        IORouterRegistry.getInstance().loadRouters : \n        IORouterRegistry.getInstance().saveRouters;\n      routers.forEach(router => {\n        const handler = router(url,\n          loadOptions);\n        if (handler !== null) {\n          validHandlers.push(handler);\n        }\n      });\n      return validHandlers;\n    }\n\n    export const registerSaveRouter = (loadRouter: IORouter) =>\n      IORouterRegistry.registerSaveRouter(loadRouter);\n    export const registerLoadRouter = (loadRouter: IORouter)\n      =>\n        IORouterRegistry.registerLoadRouter(loadRouter);\n    export const getSaveHandlers = (url: string|string[]) =>\n      IORouterRegistry.getSaveHandlers(url);\n    export const getLoadHandlers = (\n      url: string|string[], loadOptions?: LoadOptions) =>\n      IORouterRegistry.getLoadHandlers(url, loadOptions);\n"}\n\n/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,\n * software distributed under the License is distributed on an "AS IS"\n * BASIS, WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express\n * or implied. See the License for the specific language governing\n * permissions and limitations under the License.\n */\n\nimport './flags';\nimport {env} from './environment';\nimport {getModelArtifactsInfoForJSON} from './io_utils';\nimport {IORouter, IORouterRegistry} from './router_registry';\nimport {IOHandler, ModelArtifacts, ModelArtifactsInfo, ModelStoreManager, SaveResult} from './types';\n\nconst DATABASE_NAME = 'tensorflowjs';\nconst DATABASE_VERSION = 1;\n\n// Model data and ModelArtifactsInfo (metadata) are stored in two separate\n// stores for efficient access of the list of stored models and their metadata.\n// 1. The object store for model data: topology, weights and weight manifests.\nconst MODEL_STORE_NAME = 'models_store';\n// 2. The object store for ModelArtifactsInfo, including meta-information such as\n// the type of topology (JSON vs binary), byte size of the topology, byte\n// size of the weights, etc.\nconst INFO_STORE_NAME = 'model_info_store';\n\n/**\n * Delete the entire database for tensorflow.js, including the models store.\n */\nexport async function deleteDatabase(): Promise<void> {\n  const idbFactory = getIndexedDBFactory();\n  return new Promise<void>((resolve, reject) => {\n    const deleteRequest = idbFactory.deleteDatabase(DATABASE_NAME);\n    deleteRequest.onsuccess = () => resolve();\n    deleteRequest.onerror = error => reject(error);\n  });\n}\n\nfunction getIndexedDBFactory(): IDBFactory {\n  if (!env().getBool('IS_BROWSER')) {\n    // TODO(cais): Add more info about what IOHandler subtypes are available.\n    // Maybe point to a doc page on the web and/or automatically determine\n    // the available
```

```

IOHandlers and print them in the error message.\n    throw new Error(\n        'Failed to obtain IndexedDB factory
because the current environment' +\n        'is not a web browser.');
```

```

);\n    // tslint:disable-next-line:no-any\n    const
theWindow: any = typeof window === 'undefined' ? self : window;\n    const factory = theWindow.indexedDB ||
theWindow.mozIndexedDB ||\n        theWindow.webkitIndexedDB || theWindow.msIndexedDB
||\n        theWindow.shimIndexedDB;\n    if (factory == null) {\n        throw new Error(\n            'The current browser does
not appear to support IndexedDB.');
```

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);\n    return factory;\n}\n\nfunction setUpDatabase(openRequest:
IDBRequest) {\n    const db = openRequest.result as IDBDatabase;\n    db.createObjectStore(MODEL_STORE_NAME, {keyPath: 'modelPath'});\n    db.createObjectStore(INFO_STORE_NAME, {keyPath: 'modelPath'});\n}\n\n/**\n * IOHandler subclass: Browser
IndexedDB.\n * See the doc string of `browserIndexedDB` for more details.\n */\nexport class
BrowserIndexedDB implements IOHandler {\n    protected readonly indexedDB: IDBFactory;\n    protected readonly
modelPath: string;\n\n    static readonly URL_SCHEME = 'indexeddb://';\n\n    constructor(modelPath: string) {\n        this.indexedDB = getIndexedDBFactory();\n        if (modelPath == null || !modelPath) {\n            throw new Error(\n                'For IndexedDB, modelPath must not be null, undefined or empty.');
```

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);\n        this.modelPath
= modelPath;\n    }\n\n    async save(modelArtifacts: ModelArtifacts): Promise<SaveResult> {\n        // TODO(cais):
Support saving GraphDef models.\n        if (modelArtifacts.modelTopology instanceof ArrayBuffer) {\n            throw new
Error(\n                'BrowserLocalStorage.save() does not support saving model topology ' +\n                'in binary formats
yet.');
```

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);\n        }\n        return this.databaseAction(this.modelPath, modelArtifacts) as\n            Promise<SaveResult>;\n    }\n\n    async load(): Promise<ModelArtifacts> {\n        return this.databaseAction(this.modelPath) as
Promise<ModelArtifacts>;\n    }\n\n    /**\n     * Perform database action to put model artifacts into or read model
artifacts\n     * from IndexedDB object store.\n     * Whether the action is put or get depends on whether
`modelArtifacts` is\n     * specified. If it is specified, the action will be put; otherwise the action\n     * will be get.\n     * @param modelPath A unique string path for the model.\n     * @param modelArtifacts
If specified, it will be the model artifacts to be\n     * stored in IndexedDB.\n     * @returns A `Promise` of
`SaveResult`, if the action is put, or a `Promise` of `ModelArtifacts`, if the action is get.\n     */\n    private
databaseAction(modelPath: string, modelArtifacts?: ModelArtifacts):\n        Promise<ModelArtifacts|SaveResult> {\n        return new Promise<ModelArtifacts|SaveResult>((resolve, reject) => {\n            const openRequest =
this.indexedDB.open(DATABASE_NAME, DATABASE_VERSION);\n            openRequest.onupgradeneeded = () =>
setUpDatabase(openRequest);\n            openRequest.onsuccess = () => {\n                const db = openRequest.result;\n                if (modelArtifacts == null) {\n                    // Read model out from object store.\n                    const modelTx =
db.transaction(MODEL_STORE_NAME, 'readonly');\n                    const modelStore =
modelTx.objectStore(MODEL_STORE_NAME);\n                    const getRequest = modelStore.get(this.modelPath);\n                    getRequest.onsuccess = () => {\n                        if
(getRequest.result == null) {\n                            db.close();\n                            return reject(new Error(\n                                `Cannot find
model with path '${this.modelPath}'` +\n                                `in IndexedDB.`));\n                        } else {\n                            resolve(getRequest.result.modelArtifacts);\n                        }\n                    };\n                    getRequest.onerror = error => {\n                        db.close();\n                        return reject(getRequest.error);\n                    };\n                    modelTx.oncomplete = () => db.close();\n                } else {\n                    // Put model into object store.\n                    const modelArtifactsInfo: ModelArtifactsInfo =\n                        getModelArtifactsInfoForJSON(modelArtifacts);\n                    // First, put ModelArtifactsInfo into info store.\n                    const infoTx = db.transaction(INFO_STORE_NAME, 'readwrite');\n                    let infoStore =
infoTx.objectStore(INFO_STORE_NAME);\n                    const putInfoRequest =\n                        infoStore.put({ modelPath:
this.modelPath, modelArtifactsInfo });\n                    let modelTx:
IDBTransaction;\n                    putInfoRequest.onsuccess = () => {\n                        // Second, put model data into model store.\n                        modelTx = db.transaction(MODEL_STORE_NAME, 'readwrite');\n                        const modelStore =
modelTx.objectStore(MODEL_STORE_NAME);\n                        const putModelRequest = modelStore.put({\n                            modelPath: this.modelPath,\n                            modelArtifacts,\n                            modelArtifactsInfo\n                        });\n                        putModelRequest.onsuccess = () => resolve({modelArtifactsInfo});\n                        putModelRequest.onerror = error =>
{\n                            // If the put-model request fails, roll back the info entry as\n                            // well.\n                            infoStore =

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infoTx.objectStore(INFO_STORE_NAME);\n        const deleteInfoRequest =
infoStore.delete(this.modelPath);\n        deleteInfoRequest.onsuccess = () => {\n            db.close();\n
return reject(putModelRequest.error);\n        };\n        deleteInfoRequest.onerror
= error => {\n            db.close();\n            return reject(putModelRequest.error);\n        };\n
};\n        putInfoRequest.onerror = error => {\n            db.close();\n            return reject(putInfoRequest.error);\n
};\n        infoTx.oncomplete = () => {\n            if (modelTx == null) {\n                db.close();\n            } else {\n                modelTx.oncomplete = () => db.close();\n            }\n        };\n        openRequest.onerror = error
=> reject(openRequest.error);\n    });\n}\n\nexport const indexedDBRouter: IORouter = (url: string|string[]) =>
{\n    if (!env().getBool('IS_BROWSER')) {\n        return null;\n    } else {\n        if (!Array.isArray(url) &&
url.startsWith(BrowserIndexedDB.URL_SCHEME)) {\n            return
browserIndexedDB(url.slice(BrowserIndexedDB.URL_SCHEME.length));\n        } else {\n            return null;\n        }\n
};\n    IORouterRegistry.registerSaveRouter(indexedDBRouter);\n    IORouterRegistry.registerLoadRouter(indexedD
BRouter);\n}\n\n/**\n
 * Creates a browser IndexedDB IOHandler for saving and loading models.\n
 * @param modelPath A unique identifier for the model to be saved. Must be a non-empty string.\n
 * @returns An instance of `BrowserIndexedDB` (subclass of `IOHandler`), which can be used with, e.g., `tf.Model.save`.\n
 */\nexport function browserIndexedDB(modelPath: string): IOHandler {\n    return new
BrowserIndexedDB(modelPath);\n}\n\nfunction maybeStripScheme(key: string) {\n    return
key.startsWith(BrowserIndexedDB.URL_SCHEME) ?\n        key.slice(BrowserIndexedDB.URL_SCHEME.length)
:\n        key;\n}\n\nexport class BrowserIndexedDBManager implements ModelStoreManager {\n    private
indexedDB:
IDBFactory;\n\n    constructor() {\n        this.indexedDB = getIndexedDBFactory();\n    }\n\n    async listModels():
Promise<{[path: string]: ModelArtifactsInfo}> {\n        return new Promise<{[path: string]: ModelArtifactsInfo}>(\n
            (resolve, reject) => {\n                const openRequest =\n                    this.indexedDB.open(DATABASE_NAME,
DATABASE_VERSION);\n                openRequest.onupgradeneeded = () => setUpDatabase(openRequest);\n
                openRequest.onsuccess = () => {\n                    const db = openRequest.result;\n                    const tx =
db.transaction(INFO_STORE_NAME, 'readonly');\n                    const store = tx.objectStore(INFO_STORE_NAME);\n
                    // tslint:disable:max-line-length\n                    // Need to cast `store` as `any` here because TypeScript's DOM\n
                    // library does not have the `getAll()` method even though the\n                    // method is supported in the latest version of
most mainstream\n                    // browsers;\n                    // https://developer.mozilla.org/en-
US/docs/Web/API/IDBObjectStore/getAll\n                    // tslint:enable:max-line-length\n                    // tslint:disable-next-line:no-any\n                    const getAllInfoRequest =
(store as any).getAll() as IDBRequest;\n                    getAllInfoRequest.onsuccess = () => {\n                        const out: {[path:
string]: ModelArtifactsInfo} = {};\n                        for (const item of getAllInfoRequest.result) {\n
                            out[item.modelPath] = item.modelArtifactsInfo;\n                        }\n                        resolve(out);\n                    };\n
                    getAllInfoRequest.onerror = error => {\n                        db.close();\n                        return reject(getAllInfoRequest.error);\n
                    };\n                    tx.oncomplete = () => db.close();\n                };\n                openRequest.onerror = error =>
reject(openRequest.error);\n            });\n        }\n\n        async removeModel(path: string): Promise<ModelArtifactsInfo> {\n
            path = maybeStripScheme(path);\n            return new Promise<ModelArtifactsInfo>((resolve, reject) => {\n                const
openRequest
= this.indexedDB.open(DATABASE_NAME, DATABASE_VERSION);\n                openRequest.onupgradeneeded = ()
=> setUpDatabase(openRequest);\n                openRequest.onsuccess = () => {\n                    const db = openRequest.result;\n
                    const infoTx = db.transaction(INFO_STORE_NAME, 'readwrite');\n                    const infoStore =
infoTx.objectStore(INFO_STORE_NAME);\n                    const getInfoRequest = infoStore.get(path);\n                    let modelTx:
IDBTransaction;\n                    getInfoRequest.onsuccess = () => {\n                        if (getInfoRequest.result == null) {\n
                            db.close();\n                            return reject(new Error(\n                                `Cannot find model with path '${path}'` +\n
                                `in`

```

```

IndexedDB.));\n    } else {\n        // First, delete the entry in the info store.\n        const deleteInfoRequest =
infoStore.delete(path);\n        const deleteModelData = () => {\n            // Second, delete the entry in the model
store.\n            modelTx = db.transaction(MODEL_STORE_NAME,
'readwrite');\n            const modelStore = modelTx.objectStore(MODEL_STORE_NAME);\n            const
deleteModelRequest = modelStore.delete(path);\n            deleteModelRequest.onsuccess = () =>\n            resolve(getInfoRequest.result.modelArtifactsInfo);\n            deleteModelRequest.onerror = error =>\n            reject(getInfoRequest.error);\n        };\n        // Proceed with deleting model data regardless of whether
deletion\n        // of info data succeeds or not.\n        deleteInfoRequest.onsuccess = deleteModelData;\n        deleteInfoRequest.onerror = error => {\n            deleteModelData();\n            db.close();\n            return
reject(getInfoRequest.error);\n        };\n        }\n        };\n        getInfoRequest.onerror = error => {\n            db.close();\n            return reject(getInfoRequest.error);\n        };\n        infoTx.oncomplete = () => {\n            if
(modelTx == null) {\n                db.close();\n            } else {\n                modelTx.oncomplete = () => db.close();\n            }\n        };\n    }\n    openRequest.onerror = error => reject(openRequest.error);\n    });\n    }\n    }\n    }"/**\n * @license\n * Copyright 2018
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*/\n\nimport './flags';\nimport {env} from './environment';\n\nimport
{assert} from './util';\nimport {arrayBufferToBase64String, base64StringToArrayBuffer,
getModelArtifactsInfoForJSON} from './io_utils';\nimport {IORouter, IORouterRegistry} from
'/router_registry';\nimport {IOHandler, ModelArtifacts, ModelArtifactsInfo, ModelStoreManager, SaveResult}
from './types';\n\nconst PATH_SEPARATOR = '/';\nconst PATH_PREFIX = 'tensorflowjs_models';\nconst
INFO_SUFFIX = 'info';\nconst MODEL_TOPOLOGY_SUFFIX = 'model_topology';\nconst
WEIGHT_SPECS_SUFFIX = 'weight_specs';\nconst WEIGHT_DATA_SUFFIX = 'weight_data';\nconst
MODEL_METADATA_SUFFIX = 'model_metadata';\n\n/**\n * Purge all tensorflow.js-saved model artifacts from
local storage.\n * \n * @returns Paths of the models purged.\n */\nexport function purgeLocalStorageArtifacts():
string[] {\n    if (!env().getBool('IS_BROWSER') || typeof window === 'undefined' ||\n        typeof
window.localStorage === 'undefined') {\n        throw new Error(\n            'purgeLocalStorageModels() cannot proceed
because local storage is\n            ' +\n            'unavailable in the current environment.);\n    }\n    const LS = window.localStorage;\n    const
purgedModelPaths: string[] = [];\n    for (let i = 0; i < LS.length; ++i) {\n        const key = LS.key(i);\n        const prefix =
PATH_PREFIX + PATH_SEPARATOR;\n        if (key.startsWith(prefix) && key.length > prefix.length) {\n            LS.removeItem(key);\n            const modelName = getModelPathFromKey(key);\n            if
(purgedModelPaths.indexOf(modelName) === -1) {\n                purgedModelPaths.push(modelName);\n            }\n        }\n    }\n    return purgedModelPaths;\n}\n\nfunction getModelKeys(path: string): {\n    info: string,\n    topology: string,\n    weightSpecs: string,\n    weightData: string,\n    modelMetadata: string\n} {\n    return {\n        info: [PATH_PREFIX,
path, INFO_SUFFIX].join(PATH_SEPARATOR),\n        topology: [PATH_PREFIX, path,
MODEL_TOPOLOGY_SUFFIX].join(PATH_SEPARATOR),\n        weightSpecs: [PATH_PREFIX, path,
WEIGHT_SPECS_SUFFIX].join(PATH_SEPARATOR),\n        weightData: [PATH_PREFIX, path,
WEIGHT_DATA_SUFFIX].join(PATH_SEPARATOR),\n        modelMetadata: [PATH_PREFIX, path, MODEL_METADATA_SUFFIX].join(PATH_SEPARATOR)\n    };\n}\n\n/**\n * Get model path from a local-storage key.\n * \n * E.g., 'tensorflowjs_models/my/model/1/info' -->
'my/model/1'\n * \n * @param key\n */\nfunction getModelPathFromKey(key: string) {\n    const items =
key.split(PATH_SEPARATOR);\n    if (items.length < 3) {\n        throw new Error('Invalid key format: ${key}');\n    }\n}

```



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return items.slice(1, items.length - 1).join(PATH_SEPARATOR);\n}\n\nfunction maybeStripScheme(key: string) {\n  return key.startsWith(BrowserLocalStorage.URL_SCHEME) ?\n    key.slice(BrowserLocalStorage.URL_SCHEME.length) : key;\n}\n\n// declare type LocalStorageKeys = {\n  info: string,\n  topology: string,\n  weightSpecs: string,\n  weightData: string,\n  modelMetadata: string\n};\n\n/**\n * IOHandler subclass: Browser Local Storage.\n * See the doc string to `browserLocalStorage` for more details.\n */\nexport class BrowserLocalStorage implements IOHandler {\n  protected readonly LS: Storage;\n  protected readonly modelPath: string;\n  protected readonly keys: LocalStorageKeys;\n\n  static readonly URL_SCHEME = 'localStorage://';\n\n  constructor(modelPath: string) {\n    if (!env().getBool('IS_BROWSER') || typeof window === 'undefined' ||\n      typeof window.localStorage === 'undefined') {\n      // TODO(cais): Add more info about what IOHandler subtypes are\n      // available.\n      // Maybe point to a doc page on the web and/or automatically determine\n      // the available IOHandlers and print them in the error message.\n      throw new Error(\n        'The current environment does not support local storage.);\n    }\n    this.LS = window.localStorage;\n\n    if (modelPath === null || !modelPath) {\n      throw new Error(\n        'For local storage, modelPath must not be null, undefined or empty.);\n    }\n    this.modelPath = modelPath;\n    this.keys = getModelKeys(this.modelPath);\n  }\n\n  /**\n   * Save model artifacts to browser local storage.\n   * See the documentation to `browserLocalStorage` for details on the saved\n   * artifacts.\n   * @param modelArtifacts The model artifacts to be stored.\n   * @returns An instance of SaveResult.\n   */\n  async save(modelArtifacts: ModelArtifacts): Promise<SaveResult> {\n    if (modelArtifacts.modelTopology instanceof ArrayBuffer) {\n      throw new Error(\n        'BrowserLocalStorage.save() does not support saving model topology ' +\n        'in binary formats yet.);\n    } else {\n      const topology = JSON.stringify(modelArtifacts.modelTopology);\n      const weightSpecs = JSON.stringify(modelArtifacts.weightSpecs);\n      const modelArtifactsInfo: ModelArtifactsInfo =\n        getModelArtifactsInfoForJSON(modelArtifacts);\n      try {\n        this.LS.setItem(this.keys.info, JSON.stringify(modelArtifactsInfo));\n        this.LS.setItem(this.keys.topology, topology);\n        this.LS.setItem(this.keys.weightSpecs, weightSpecs);\n        this.LS.setItem(\n          this.keys.weightData, arrayBufferToBase64String(modelArtifacts.weightData));\n        const result: ModelArtifacts = {\n          format: modelArtifacts.format,\n          generatedBy: modelArtifacts.generatedBy,\n          convertedBy: modelArtifacts.convertedBy\n        }; \n        if (modelArtifacts.signature != null) {\n          result.signature = modelArtifacts.signature;\n        }\n        if (modelArtifacts.userDefinedMetadata != null) {\n          result.userDefinedMetadata = modelArtifacts.userDefinedMetadata;\n        }\n        if (modelArtifacts.modelInitializer != null) {\n          result.modelInitializer = modelArtifacts.modelInitializer;\n        }\n        this.LS.setItem(this.keys.modelMetadata, JSON.stringify(result));\n        return {modelArtifactsInfo};\n      } catch (err) {\n        // If saving failed, clean up all items saved so far.\n        this.LS.removeItem(this.keys.info);\n        this.LS.removeItem(this.keys.topology);\n        this.LS.removeItem(this.keys.weightSpecs);\n        this.LS.removeItem(this.keys.weightData);\n        this.LS.removeItem(this.keys.modelMetadata);\n        throw new Error(\n          `Failed to save model '${this.modelPath}' to local storage: ` +\n          `size quota being exceeded is a possible cause of this failure: ` +\n          `modelTopologyBytes=${modelArtifactsInfo.modelTopologyBytes}, ` +\n          `weightSpecsBytes=${modelArtifactsInfo.weightSpecsBytes}, ` +\n          `weightDataBytes=${modelArtifactsInfo.weightDataBytes}.);\n      }\n    }\n  }\n\n  /**\n   * Load a model from local storage.\n   * See the documentation to `browserLocalStorage` for details on the saved\n   * artifacts.\n   * @returns The loaded model (if loading succeeds).\n   */\n  async load(): Promise<ModelArtifacts> {\n    const info =\n      JSON.parse(this.LS.getItem(this.keys.info)) as ModelArtifactsInfo;\n    if (info == null) {\n      throw new Error(\n        `In local storage, there is no model with name '${this.modelPath}'.);\n    }\n    if (info.modelTopologyType !== 'JSON') {\n      throw new Error(\n        'BrowserLocalStorage does not support loading non-JSON model ' +\n        'topology yet.);\n    }\n    const out: ModelArtifacts = {};\n    // Load topology.\n    const topology =\n      JSON.parse(this.LS.getItem(this.keys.topology));\n    if (topology == null) {\n      throw new Error(\n        `In local

```

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storage, the topology of model '${this.modelPath}' `+` is missing.`);
    }
    out.modelTopology = topology;
    // Load weight specs.
    const weightSpecs = JSON.parse(this.LS.getItem(this.keys.weightSpecs));
    if (weightSpecs == null) {
        throw new Error(`In local storage, the weight specs of model '${this.modelPath}' `+` are missing.`);
    }
    out.weightSpecs = weightSpecs;
    // Load meta-data fields.
    const metadataString = this.LS.getItem(this.keys.modelMetadata);
    if (metadataString != null) {
        const metadata = JSON.parse(metadataString) as ModelArtifacts;
        out.format = metadata['format'];
        out.generatedBy = metadata['generatedBy'];
        out.convertedBy = metadata['convertedBy'];
        if (metadata['signature'] != null) {
            out.signature = metadata['signature'];
        }
        if (metadata['userDefinedMetadata'] != null) {
            out.userDefinedMetadata = metadata['userDefinedMetadata'];
        }
        if (metadata['modelInitializer'] != null) {
            out.modelInitializer = metadata['modelInitializer'];
        }
    }
    // Load weight data.
    const weightDataBase64 = this.LS.getItem(this.keys.weightData);
    if (weightDataBase64 == null) {
        throw new Error(`In local storage, the binary weight values of model `+`${this.modelPath}` are missing.`);
    }
    out.weightData = base64StringToArrayBuffer(weightDataBase64);

    return out;
}

export const localStorageRouter: IORouter = (url: string|string[]) => {
    if (!env().getBool('IS_BROWSER')) {
        return null;
    } else {
        if (!Array.isArray(url) && url.startsWith(BrowserLocalStorage.URL_SCHEME)) {
            return browserLocalStorage(url.slice(BrowserLocalStorage.URL_SCHEME.length));
        } else {
            return null;
        }
    }
};

IORouterRegistry.registerSaveRouter(localStorageRouter);
IORouterRegistry.registerLoadRouter(localStorageRouter);

/**
 * Factory function for local storage IOHandler.
 * This `IOHandler` supports both `save` and `load`.
 * For each model's saved artifacts, four items are saved to local storage.
 * - `${PATH_SEPARATOR}/${modelPath}/info`: Contains meta-info about the model, such as date saved, type of the topology, size in bytes, etc.
 * - `${PATH_SEPARATOR}/${modelPath}/topology`: Model topology. For Keras-style models, this is a stringized JSON.
 * - `${PATH_SEPARATOR}/${modelPath}/weight_specs`: Weight specs of the model, can be used to decode the saved binary weight values (see item below).
 * - `${PATH_SEPARATOR}/${modelPath}/weight_data`: Concatenated binary weight values, stored as a base64-encoded string.
 * Saving may throw an `Error` if the total size of the artifacts exceed the browser-specific quota.
 * @param modelPath A unique identifier for the model to be saved. Must be a non-empty string.
 * @returns An instance of `IOHandler`, which can be used with, e.g., `tf.Model.save`.
 */
export function browserLocalStorage(modelPath: string): IOHandler {
    return new BrowserLocalStorage(modelPath);
}

export class BrowserLocalStorageManager implements ModelStoreManager {
    private readonly LS: Storage;

    constructor() {
        assert(!env().getBool('IS_BROWSER'), () => 'Current environment is not a web browser');
        assert(typeof window === 'undefined' || typeof window.localStorage !== 'undefined', () => 'Current browser does not appear to support localStorage');
        this.LS = window.localStorage;
    }

    async listModels(): Promise<[[path: string]: ModelArtifactsInfo]> {
        const out: {[path: string]: ModelArtifactsInfo} = {};
        const prefix = PATH_PREFIX + PATH_SEPARATOR;
        const suffix = PATH_SEPARATOR + INFO_SUFFIX;
        for (let i = 0; i < this.LS.length; ++i) {
            const key = this.LS.key(i);
            if (key.startsWith(prefix) && key.endsWith(suffix)) {
                const modelPath = getModelPathFromKey(key);
                out[modelPath] = JSON.parse(this.LS.getItem(key)) as ModelArtifactsInfo;
            }
        }
        return out;
    }

    async removeModel(path: string): Promise<ModelArtifactsInfo> {
        path = maybeStripScheme(path);
        const keys = getModelKeys(path);
        if (this.LS.getItem(keys.info) == null) {
            throw new Error(`Cannot find model at path '${path}'`);
        }
        const info = JSON.parse(this.LS.getItem(keys.info)) as ModelArtifactsInfo;
        this.LS.removeItem(keys.info);
        this.LS.removeItem(keys.topology);
        this.LS.removeItem(keys.weightSpecs);
        this.LS.removeItem(keys.weightData);
        return info;
    }
}

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```

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=====\n\n * /\n\n * Classes and functions for model management across multiple storage mediums.\n * Supported client actions:\n * - Listing models on all registered storage mediums.\n * - Remove model by URL from any registered storage mediums, by using URL\n *   string.\n * - Moving or copying model from one path to another in the same medium or from\n *   one medium to another, by using URL strings.\n * /\n\nimport {assert} from './util';\nimport {IORouterRegistry} from './router_registry';\nimport {ModelArtifactsInfo, ModelStoreManager} from './types';\n\nconst URL_SCHEME_SUFFIX = '://';\n\nexport class ModelStoreManagerRegistry {\n  // Singleton instance.\n  private static instance: ModelStoreManagerRegistry;\n  private managers: {[scheme: string]: ModelStoreManager};\n\n  private constructor() {\n    this.managers = {};\n  }\n\n  private static getInstance(): ModelStoreManagerRegistry {\n    if (ModelStoreManagerRegistry.instance == null) {\n      ModelStoreManagerRegistry.instance\n        = new ModelStoreManagerRegistry();\n    }\n    return ModelStoreManagerRegistry.instance;\n  }\n\n  /**\n   * Register a save-handler router.\n   * @param saveRouter A function that maps a URL-like string onto an instance\n   * of `IOHandler` with the `save` method defined or `null`.\n   * /\n   * static registerManager(scheme: string, manager: ModelStoreManager) {\n   *   assert(scheme != null, () => 'scheme must not be undefined or null.);\n   *   if (scheme.endsWith(URL_SCHEME_SUFFIX)) {\n   *     scheme = scheme.slice(0, scheme.indexOf(URL_SCHEME_SUFFIX));\n   *   }\n   *   assert(scheme.length > 0, () => 'scheme must not be an empty string.);\n   *   const registry = ModelStoreManagerRegistry.getInstance();\n   *   assert(registry.managers[scheme] == null,\n   *     () => `A model store manager is already registered for scheme '${\n   *   scheme}'.`);\n   *   registry.managers[scheme] = manager;\n   * }\n\n  static getManager(scheme: string): ModelStoreManager {\n    const manager = this.getInstance().managers[scheme];\n    if (manager == null) {\n      throw new Error(`Cannot find model manager for scheme '${scheme}')`);\n    }\n    return manager;\n  }\n\n  static getSchemes(): string[] {\n    return Object.keys(this.getInstance().managers);\n  }\n\n  /**\n   * Helper method for parsing a URL string into a scheme and a path.\n   * @param url E.g., 'localStorage://my-model'\n   * @returns A dictionary with two fields: scheme and path.\n   * Scheme: e.g., 'localStorage' in the example above.\n   * Path: e.g., 'my-model' in the example above.\n   * /\n   * function parseURL(url: string): {scheme: string, path: string} {\n   *   if (url.indexOf(URL_SCHEME_SUFFIX) === -1) {\n   *     throw new Error(`The url string provided does not contain a scheme.`);\n   *     `Supported schemes are: ` +\n   *     `${ModelStoreManagerRegistry.getSchemes().join(',')}`);\n   *   }\n   *   return {\n   *     scheme: url.split(URL_SCHEME_SUFFIX)[0],\n   *     path: url.split(URL_SCHEME_SUFFIX)[1],\n   *   };\n   * }\n\n  async function cloneModelInternal(\n    sourceURL: string, destURL: string, deleteSource = false): Promise<ModelArtifactsInfo> {\n    assert(\n      sourceURL !== destURL,\n      () => `Old path and new path are the same: '${sourceURL}'`);\n\n    const loadHandlers = IORouterRegistry.getLoadHandlers(sourceURL);\n    assert(\n      loadHandlers.length > 0,\n      () => `Copying failed because no load handler is found for source URL ${\n      sourceURL}.`);\n    assert(\n      loadHandlers.length < 2,\n      () => `Copying failed because more than one (${loadHandlers.length}) ` +\n      `load handlers for source URL ${sourceURL}.`);\n    const loadHandler = loadHandlers[0];\n\n    const saveHandlers = IORouterRegistry.getSaveHandlers(destURL);\n    assert(\n      saveHandlers.length > 0,\n      () => `Copying failed because no save handler is found for destination ` +\n      `URL ${destURL}.`);\n    assert(\n      saveHandlers.length < 2,\n      () => `Copying failed because more than one (${loadHandlers.length}) ` +\n      `save handlers for destination URL ${destURL}.`);\n    const saveHandler = saveHandlers[0];\n\n    const sourceScheme = parseURL(sourceURL).scheme;\n    const sourcePath = parseURL(sourceURL).path;\n    const sameMedium = sourceScheme === parseURL(sourceURL).scheme;\n  }\n}
```

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const modelArtifacts = await loadHandler.load();\n\n // If moving within the same storage medium, remove the old
model as soon as\n // the loading is done. Without doing this, it is possible that the combined\n // size of the two
models will cause the cloning to fail.\n if (deleteSource && sameMedium) {\n   await
ModelStoreManagerRegistry.getManager(sourceScheme)\n     .removeModel(sourcePath);\n }\n\n const
saveResult = await saveHandler.save(modelArtifacts);\n\n // If moving between mediums, the deletion is done after
the save succeeds.\n // This guards against the case in which saving to the destination medium\n // fails.\n if
(deleteSource && !sameMedium)
  {\n    await ModelStoreManagerRegistry.getManager(sourceScheme)\n      .removeModel(sourcePath);\n  }\n\n
return saveResult.modelArtifactsInfo;\n}\n\n/**\n * List all models stored in registered storage mediums.\n *\n *
For a web browser environment, the registered mediums are Local Storage and\n * IndexedDB.\n *\n * ```js\n * //
First create and save a model.\n * const model = tf.sequential();\n * model.add(tf.layers.dense(\n *   {units: 1,
inputShape: [10], activation: 'sigmoid'}));\n * await model.save('localstorage://demo/management/model1');\n *\n *
// Then list existing models.\n * console.log(JSON.stringify(await tf.io.listModels()));\n *\n * // Delete the model.\n
*\n * await tf.io.removeModel('localstorage://demo/management/model1');\n *\n * // List models again.\n *
console.log(JSON.stringify(await tf.io.listModels()));\n * ```\n *\n * @returns A `Promise` of a dictionary mapping
URLs of existing models to\n * their model artifacts info. URLs include medium-specific schemes,
e.g.,\n * 'indexeddb://my/model/1'. Model artifacts info include type of the\n * model's topology, byte sizes of the
topology, weights, etc.\n *\n * @doc {\n *   heading: 'Models',\n *   subheading: 'Management',\n *   namespace:
'io',\n *   ignoreCI: true\n * }\n */\n\n@nasync function listModels(): Promise<{[url: string]: ModelArtifactsInfo}> {\n
const schemes = ModelStoreManagerRegistry.getSchemes();\n const out: {[url: string]: ModelArtifactsInfo} =
{\n};\n for (const scheme of schemes) {\n   const schemeOut =\n     await
ModelStoreManagerRegistry.getManager(scheme).listModels();\n   for (const path in schemeOut) {\n     const url =
scheme + URL_SCHEME_SUFFIX + path;\n     out[url] = schemeOut[path];\n   }\n }\n return out;\n}\n\n/**\n *
Remove a model specified by URL from a registered storage medium.\n *\n * ```js\n * // First create and save a
model.\n * const model = tf.sequential();\n * model.add(tf.layers.dense(\n *   {units: 1, inputShape: [10],
activation: 'sigmoid'}));\n *\n * await model.save('localstorage://demo/management/model1');\n *\n * // Then list existing models.\n *
console.log(JSON.stringify(await tf.io.listModels()));\n *\n * // Delete the model.\n * await
tf.io.removeModel('localstorage://demo/management/model1');\n *\n * // List models again.\n *
console.log(JSON.stringify(await tf.io.listModels()));\n * ```\n *\n * @param url A URL to a stored model, with a
scheme prefix, e.g.,\n * 'localstorage://my-model-1', 'indexeddb://my/model/2'.\n *\n * @returns ModelArtifactsInfo of
the deleted model (if and only if deletion\n * is successful).\n *\n * @throws Error if deletion fails, e.g., if no model
exists at `path`.\n *\n * @doc {\n *   heading: 'Models',\n *   subheading: 'Management',\n *   namespace: 'io',\n *
ignoreCI: true\n * }\n */\n\n@nasync function removeModel(url: string): Promise<ModelArtifactsInfo> {\n const
schemeAndPath = parseURL(url);\n const manager =
ModelStoreManagerRegistry.getManager(schemeAndPath.scheme);\n return
manager.removeModel(schemeAndPath.path);\n}\n\n/**\n * Copy a model from one URL to another.\n *\n * This
function supports:\n *\n * 1. Copying within a storage medium, e.g.,\n *   `tf.io.copyModel('localstorage://model-1',
'localstorage://model-2')`\n *\n * 2. Copying between two storage mediums, e.g.,\n *   `tf.io.copyModel('localstorage://model-1', 'indexeddb://model-1')`\n *\n * ```js\n * // First create and save a model.\n
*\n * const model = tf.sequential();\n * model.add(tf.layers.dense(\n *   {units: 1, inputShape: [10], activation:
'sigmoid'}));\n * await model.save('localstorage://demo/management/model1');\n *\n * // Then list existing
models.\n * console.log(JSON.stringify(await tf.io.listModels()));\n *\n * // Copy the model, from Local Storage to
IndexedDB.\n * await tf.io.copyModel(\n *   'localstorage://demo/management/model1',\n *   'indexeddb://demo/management/model1');\n *\n * // List models again.\n * console.log(JSON.stringify(await
tf.io.listModels()));\n *\n * //
Remove both models.\n * await tf.io.removeModel('localstorage://demo/management/model1');\n * await
tf.io.removeModel('indexeddb://demo/management/model1');\n * ```\n *\n * @param sourceURL Source URL of

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\n * @param destURL Destination URL of copying.\n * @returns ModelArtifactsInfo of the copied model\n(if and only if copying\n *   is successful).\n * @throws Error if copying fails, e.g., if no model exists at\n`sourceURL`, or\n *   if `oldPath` and `newPath` are identical.\n *\n * @doc {\n *   heading: 'Models',\n *   subheading: 'Management',\n *   namespace: 'io',\n *   ignoreCI: true\n * }\n */\n\nexport function copyModel(\n sourceURL: string, destURL: string): Promise<ModelArtifactsInfo> {\n const deleteSource = false;\n return cloneModelInternal(sourceURL, destURL, deleteSource);\n}\n\n/**\n * Move a model from one URL to another.\n *\n * This function supports:\n *\n * 1. Moving within a storage medium, e.g.,\n *\n *    tf.io.moveModel('localStorage://model-1', 'localStorage://model-2')`\n *\n * 2. Moving between two storage mediums, e.g.,\n *\n *    tf.io.moveModel('localStorage://model-1',\n'indexeddb://model-1')`\n *\n *    ```js\n // First create and save a model.\n const model = tf.sequential();\n model.add(tf.layers.dense({units: 1, inputShape: [10], activation: 'sigmoid'}));\n await\n model.save('localStorage://demo/management/model1');\n // Then list existing models.\n console.log(JSON.stringify(await tf.io.listModels()));\n // Move the model, from Local Storage to IndexedDB.\n await tf.io.moveModel('localStorage://demo/management/model1',\n'indexeddb://demo/management/model1');\n // List models again.\n console.log(JSON.stringify(await\n tf.io.listModels()));\n // Remove the moved model.\n await\n tf.io.removeModel('indexeddb://demo/management/model1');\n```\n *\n * @param sourceURL Source URL of moving.\n * @param destURL Destination URL of moving.\n * @returns ModelArtifactsInfo of the copied\n model (if and only if copying\n *   is successful).\n * @throws Error if moving fails, e.g., if no model exists at\n`sourceURL`, or\n *   if `oldPath` and `newPath` are identical.\n *\n * @doc {\n *   heading: 'Models',\n *   subheading: 'Management',\n *   namespace: 'io',\n *   ignoreCI: true\n * }\n */\n\nexport function moveModel(\n sourceURL: string, destURL: string): Promise<ModelArtifactsInfo> {\n const deleteSource = true;\n return cloneModelInternal(sourceURL, destURL, deleteSource);\n}\n\nexport {moveModel, copyModel, removeModel,\nlistModels};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an\n *\n * "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n\n\n=====\n*/\nimport './flags';\nimport {env} from './environment';\nimport {BrowserIndexedDB,\nBrowserIndexedDBManager} from '../io/indexed_db';\nimport {BrowserLocalStorage,\nBrowserLocalStorageManager} from '../io/local_storage';\nimport {ModelStoreManagerRegistry} from\n'../io/model_management';\nimport {Platform} from './platform';\n\nexport class PlatformBrowser implements\nPlatform {\n // According to the spec, the built-in encoder can do only UTF-8 encoding.\n https://developer.mozilla.org/en-US/docs/Web/API/TextEncoder/TextEncoder\n private textEncoder:\nTextEncoder;\n fetch(path: string, init?: RequestInit): Promise<Response> {\n return fetch(path, init);\n } \n now(): number {\n return performance.now();\n } \n encode(text: string, encoding: string): Uint8Array {\n if (encoding !== 'utf-8' &&\n encoding !== 'utf8') {\n throw new Error(`Browser's encoder only supports utf-8, but got\n${encoding}`);\n } \n if (this.textEncoder == null) {\n this.textEncoder = new TextEncoder();\n } \n return\nthis.textEncoder.encode(text);\n } \n decode(bytes: Uint8Array, encoding: string): string {\n return new\nTextDecoder(encoding).decode(bytes);\n }}\n\nif (env().get('IS_BROWSER')) {\n env().setPlatform('browser',\nnew PlatformBrowser());\n // Register LocalStorage IOHandler\n try {\n ModelStoreManagerRegistry.registerManager(BrowserLocalStorage.URL_SCHEME, new\nBrowserLocalStorageManager());\n } catch (err) {} \n // Register IndexedDB IOHandler\n try {\n ModelStoreManagerRegistry.registerManager(BrowserIndexedDB.URL_SCHEME, new
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BrowserIndexedDBManager());\n } catch (err) {\n }\n}\n"/**\n * @license\n
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 * License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
 * License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or
 * agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
 * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
 * the specific language governing permissions and\n * limitations under the License.\n *
 *=====\n
 */\nimport {env} from './environment';\nimport {Platform} from './platform';\n\n// We are wrapping this within an
 * object so it can be stubbed by Jasmine.\nexport const getNodeFetch = {\n // tslint:disable-next-line:no-require-
 * imports\n importFetch: () => require('node-fetch')\n};\n\ntype FetchFn
 * = (url: string, init?: RequestInit) => Promise<Response>;\nlet systemFetch: FetchFn;\n\n// These getters and setters
 * are for testing so we don't export a mutable\n// variable.\nexport function resetSystemFetch() {\n systemFetch =
 * null;\n}\n\nexport function setSystemFetch(fetchFn: FetchFn) {\n systemFetch = fetchFn;\n}\n\nexport function
 * getSystemFetch(): FetchFn {\n return systemFetch;\n}\n\n\nexport class PlatformNode implements Platform {\n
 * private textEncoder: TextEncoder;\n // tslint:disable-next-line:no-any\n util: any;\n\n constructor() {\n //
 * tslint:disable-next-line:no-require-imports\n this.util = require('util');\n // According to the spec, the built-in
 * encoder can do only UTF-8 encoding.\n // https://developer.mozilla.org/en-
 * US/docs/Web/API/TextEncoder/TextEncoder\n this.textEncoder = new this.util.TextEncoder();\n }\n\n
 * fetch(path: string, requestInit?: RequestInit): Promise<Response> {\n if (env().global.fetch != null) {\n return
 * env().global.fetch(path,
 * requestInit);\n }\n\n if (systemFetch == null) {\n systemFetch = getNodeFetch.importFetch();\n }\n
 * return systemFetch(path, requestInit);\n }\n\n now(): number {\n const time = process.hrtime();\n return
 * time[0] * 1000 + time[1] / 1000000;\n }\n\n encode(text: string, encoding: string): Uint8Array {\n if (encoding
 * !== 'utf-8' && encoding !== 'utf8') {\n throw new Error(\n `Node built-in encoder only supports utf-8, but
 * got ${encoding}`);\n }\n return this.textEncoder.encode(text);\n }\n\n decode(bytes: Uint8Array, encoding:
 * string): string {\n if (bytes.length === 0) {\n return '';\n }\n return new
 * this.util.TextDecoder(encoding).decode(bytes);\n }\n}\n\nif (env().get('IS_NODE')) {\n env().setPlatform('node',
 * new PlatformNode());\n}\n\n"/**\n * @license\n * Copyright 2020 Google Inc. All Rights Reserved.\n * Licensed
 * under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except
 * in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
 * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
 * software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
 * OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
 * governing permissions and\n * limitations under the License.\n *
 *=====\n
 */\n\nimport {TensorBuffer} from './tensor';\nimport {DataType, DataTypeMap, Rank, ShapeMap} from
 * './types';\nimport * as util from './util';\n\n/**\n * Creates an empty `tf.TensorBuffer` with the specified `shape` and
 * `dtype`.\n *\n * The values are stored in CPU as `TypedArray`. Fill the buffer using\n * `buffer.set()`, or by
 * modifying directly `buffer.values`.\n *\n * When done, call `buffer.toTensor()` to get an immutable `tf.Tensor`
 * with\n *\n * those values.\n *\n * ```\n * // Create a buffer and set values at particular indices.\n * const buffer = tf.buffer([2,
 * 2]);\n * buffer.set(3, 0, 0);\n * buffer.set(5, 1, 0);\n *\n * // Convert the buffer back to a tensor.\n *
 * buffer.toTensor().print();\n * ```\n *\n * @param shape An array of integers defining the output tensor shape.\n *\n * @param dtype The dtype of the buffer. Defaults to 'float32'.  
\n * @param values The values of the buffer as
 * `TypedArray`. Defaults to\n * zeros.\n *\n * @doc {heading: 'Tensors', subheading: 'Creation'}\n */\n\nexport
 * function buffer<R extends Rank, D extends DataType = 'float32'>(\n shape: ShapeMap[R], dtype: D = 'float32' as
 * D,\n values?: DataTypeMap[D]): TensorBuffer<R, D> {\n dtype = dtype || 'float32' as D;\n

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util.assertNonNegativeIntegerDimensions(shape);\n return new TensorBuffer<R, D>(shape, dtype,
values);\n}\n", "/*\n * @license\n * Copyright 2020 Google Inc. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the
\"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====
\n
*\nimport {ENGINE} from '../engine';\nimport {Cast, CastAttrs, CastInputs} from '../kernel_names';\nimport
{NamedAttrMap} from '../kernel_registry';\nimport {Tensor} from '../tensor';\nimport {NamedTensorMap} from
 '../tensor_types';\nimport {convertToTensor} from '../tensor_util_env';\nimport {DataType, TensorLike} from
 '../types';\nimport * as util from '../util';\nimport {op} from '../operation';\n\n/*\n * Casts a `tf.Tensor` to a new dtype.\n *\n * ``js\n * const x = tf.tensor1d([1.5, 2.5, 3]);\n * tf.cast(x,
'int32').print();\n *\n * @param x The input tensor to be casted.\n * @param dtype The dtype to cast the input
tensor to.\n *\n * @doc {heading: 'Tensors', subheading: 'Transformations'}\n *\nfunction cast_<T extends
Tensor>(x: T|TensorLike, dtype: DataType): T {\n  const $x = convertToTensor(x, 'x', 'cast');\n  \n  // Sanity checks.\n  if (!util.isValidDtype(dtype)) {\n    throw new Error('Failed to cast to unknown dtype ${dtype}');\n  }\n  if (dtype
=== 'string' && $x.dtype !== 'string' ||\n    dtype !== 'string' && $x.dtype === 'string') {\n    throw new Error('Only
strings can be casted to strings');\n  }\n  \n  const inputs: CastInputs = {x: $x};\n  const attrs: CastAttrs = {dtype};\n  \n  return ENGINE.runKernel(\n    Cast, inputs as {} as NamedTensorMap, attrs as {} as
NamedAttrMap);\n}\n\nexport const cast = op({cast_});\n", "/*\n * @license\n * Copyright 2020
Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you
may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
\n
*\n\nimport {ENGINE} from '../engine';\nimport {Identity, IdentityInputs} from '../kernel_names';\nimport
{Tensor} from '../tensor';\nimport {NamedTensorMap} from '../tensor_types';\nimport {convertToTensor} from
 '../tensor_util_env';\nimport {TensorLike} from '../types';\nimport {op} from '../operation';\n\n/*\n * Creates a new tensor with the same values and shape as the specified\n * tensor.\n *\n * ``js\n * const x =
tf.tensor([1, 2]);\n *\n * x.clone().print();\n *\n * @param x The tensor to clone.\n *\n * @doc {heading:
'Tensors', subheading: 'Creation'}\n *\nfunction clone_<T extends Tensor>(x: T|TensorLike): T {\n  const $x =
convertToTensor(x, 'x', 'clone', 'string_or_numeric');\n  \n  const inputs: IdentityInputs = {x: $x};\n  \n  // Note this op is
called tf.identity in python. Hence the kernel name used\n  // here.\n  return ENGINE.runKernel(Identity, inputs as
{} as NamedTensorMap);\n}\n\nexport const clone = op({clone_});\n", "/*\n * @license\n * Copyright 2020
Google Inc. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you
may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed
to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT
WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific
language governing permissions and\n * limitations under the License.\n *
=====
\n
*\n\nimport {Tensor} from '../tensor';\n\n/*\n * Prints information about the `tf.Tensor` including its data.\n *\n * ``js\n * const verbose = true;\n * tf.tensor2d([1, 2, 3, 4], [2, 2]).print(verbose);\n *\n * @param x The tensor to
be printed.\n * @param verbose Whether to print verbose information about the `Tensor`,\n * including dtype and

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size.\n * \n * @doc {heading: 'Tensors', subheading: 'Creation'}\n *\nexport function print<T extends Tensor>(x: T,
verbose = false): void {\n  console.log(x.toString(verbose));\n}\n\n", "/*\n * @license\n * Copyright 2020 Google
Inc. All Rights Reserved.\n * Licensed under the Apache
License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You
may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required
by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\"
BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the
License for the specific language governing permissions and\n * limitations under the License.\n *
=====
*\n\n// Required side effectful code for tfjs-core\n\n// Set up Engine and ENV\nimport {getOrMakeEngine} from
'./engine';\ngetOrMakeEngine();\n\n// Register backend-agnostic flags.\nimport './flags';\n\n// Register
platforms\nimport './platforms/platform_browser';\nimport './platforms/platform_node';\n\n// Set up
OpHandler\nimport {buffer} from './ops/buffer';\nimport {cast}
from './ops/cast';\nimport {clone} from './ops/clone';\nimport {print} from './ops/print';\nimport {OpHandler,
setOpHandler} from './tensor';\nconst opHandler: OpHandler = {\n  buffer,\n  cast,\n  clone,\n  print\n};\nsetOpHandler(opHandler);\n\n", "/*\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n
* Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in
compliance with the License.\n * You may obtain a copy of the License at\n * \n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*\n\n/**\n * IOHandlers related
to files, such as browser-triggered file downloads,\n * user-selected files in browser.\n *\n\nimport
'./flags';\nimport {env} from './environment';\n\nimport {basename, concatenateArrayBuffers,
getModelArtifactsInfoForJSON} from './io_utils';\nimport {IORouter, IORouterRegistry} from
'./router_registry';\nimport {IOHandler, ModelArtifacts, ModelJSON, SaveResult, WeightsManifestConfig,
WeightsManifestEntry} from './types';\n\nconst DEFAULT_FILE_NAME_PREFIX = 'model';\nconst
DEFAULT_JSON_EXTENSION_NAME = '.json';\nconst DEFAULT_WEIGHT_DATA_EXTENSION_NAME =
'.weights.bin';\n\nfunction defer<T>(f: () => T): Promise<T> {\n  return new Promise(resolve =>
setTimeout(resolve)).then(f);\n}\n\nexport class BrowserDownloads implements IOHandler {\n  private readonly
modelTopologyFileName: string;\n  private readonly weightDataFileName: string;\n  private readonly jsonAnchor:
HTMLAnchorElement;\n  private readonly weightDataAnchor: HTMLAnchorElement;\n\n  static readonly
URL_SCHEME = 'downloads://';\n\n  constructor(fileNamePrefix?: string) {\n    if (!env().getBool('IS_BROWSER')) {\n      // TODO(cais): Provide info
on what IOHandlers are available under the\n      // current environment.\n      throw new Error(\n
'browserDownloads() cannot proceed because the current environment ' +\n      'is not a browser.);\n    }\n\n    if
(fileNamePrefix.startsWith(BrowserDownloads.URL_SCHEME)) {\n      fileNamePrefix =
fileNamePrefix.slice(BrowserDownloads.URL_SCHEME.length);\n    }\n\n    if (fileNamePrefix == null ||
fileNamePrefix.length === 0) {\n      fileNamePrefix = DEFAULT_FILE_NAME_PREFIX;\n    }\n\n    this.modelTopologyFileName = fileNamePrefix + DEFAULT_JSON_EXTENSION_NAME;\n
this.weightDataFileName =\n      fileNamePrefix + DEFAULT_WEIGHT_DATA_EXTENSION_NAME;\n  }\n\n  async save(modelArtifacts: ModelArtifacts): Promise<SaveResult> {\n    if (typeof (document) === 'undefined') {\n
throw new Error(\n      'Browser downloads are not supported in\n
' +\n      'this environment since `document` is not present');\n    }\n\n    const weightsURL =
window.URL.createObjectURL(new Blob(\n      [modelArtifacts.weightData], {type: 'application/octet-
stream'}));\n\n    if (modelArtifacts.modelTopology instanceof ArrayBuffer) {\n      throw new Error(\n

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'BrowserDownloads.save() does not support saving model topology ' + '\n      'in binary formats yet.);\n    } else {\n      const weightsManifest: WeightsManifestConfig = [{\n        paths: ['./' + this.weightDataFileName],\n        weights:\nmodelArtifacts.weightSpecs\n      }];\n      const modelTopologyAndWeightManifest: ModelJSON = {\nmodelTopology: modelArtifacts.modelTopology,\n        format: modelArtifacts.format,\n        generatedBy:\nmodelArtifacts.generatedBy,\n        convertedBy: modelArtifacts.convertedBy,\n        weightsManifest\n      };\n      if (modelArtifacts.signature != null) {\n        modelTopologyAndWeightManifest.signature =\nmodelArtifacts.signature;\n      }\n      if (modelArtifacts.userDefinedMetadata != null) {\nmodelTopologyAndWeightManifest.userDefinedMetadata =\n        modelArtifacts.userDefinedMetadata;\n      }\n      if (modelArtifacts.modelInitializer != null) {\n        modelTopologyAndWeightManifest.modelInitializer =\nmodelArtifacts.modelInitializer;\n      }\n      const modelTopologyAndWeightManifestURL =\nwindow.URL.createObjectURL(new Blob([\n        JSON.stringify(modelTopologyAndWeightManifest),\n        {type: 'application/json'}]));\n      // If anchor elements are not provided, create them without attaching them\n// to parents, so that the downloaded file names can be controlled.\n      const jsonAnchor = this.jsonAnchor == null\n? document.createElement('a') :\n        this.jsonAnchor;\n      jsonAnchor.download =\nthis.modelTopologyFileName;\n      jsonAnchor.href = modelTopologyAndWeightManifestURL;\n      // Trigger downloads by evoking a click event on the download anchors.\n      // When multiple downloads are\nstarted synchronously, Firefox will only\n      // save the last one.\n      await defer() =>\njsonAnchor.dispatchEvent(new MouseEvent('click')));\n      if (modelArtifacts.weightData != null) {\n        const\nweightDataAnchor = this.weightDataAnchor == null ?\n        document.createElement('a') :\nthis.weightDataAnchor;\n        weightDataAnchor.download = this.weightDataFileName;\nweightDataAnchor.href = weightsURL;\n        await defer(\n        () => weightDataAnchor.dispatchEvent(new\nMouseEvent('click')));\n      }\n      return {modelArtifactsInfo:\ngetModelArtifactsInfoForJSON(modelArtifacts)};\n    }\n  }\n}\n\nclass BrowserFiles implements IOHandler {\n  private readonly files: File[];\n  constructor(files: File[]) {\n    if (files == null || files.length < 1) {\n      throw new\nError(\n        `When calling browserFiles, at least\n1 file is required,`\n        + '\n        `but received ${files}`);\n    }\n    this.files = files;\n  }\n  async load():\nPromise<ModelArtifacts> {\n    const jsonFile = this.files[0];\n    const weightFiles = this.files.slice(1);\n    return\nnew Promise<ModelArtifacts>((resolve, reject) => {\n      const jsonReader = new FileReader();\n      jsonReader.onload = (event: Event) => {\n        // tslint:disable-next-line:no-any\n        const modelJSON =\nJSON.parse((event.target as any).result) as ModelJSON;\n        const modelTopology =\nmodelJSON.modelTopology;\n        if (modelTopology == null) {\n          reject(new Error(\n            `modelTopology field is missing from file ${jsonFile.name}`));\n          return;\n        }\n        if\n(weightFiles.length === 0) {\n          resolve({modelTopology});\n        }\n        const weightsManifest =\nmodelJSON.weightsManifest;\n        if (weightsManifest == null) {\n          reject(new Error(\n            `weightManifest field\nis missing from file ${jsonFile.name}`));\n          return;\n        }\n        let pathToFile: {[path: string]: File};\n        try {\n          pathToFile =\nthis.checkManifestAndWeightFiles(weightsManifest, weightFiles);\n        }\n        catch (err) {\n          reject(err);\n          return;\n        }\n        const weightSpecs: WeightsManifestEntry[] = [];\n        const paths: string[] = [];\n        const perFileBuffers: ArrayBuffer[] = [];\n        weightsManifest.forEach(weightsGroup => {\n          weightsGroup.paths.forEach(path => {\n            paths.push(path);\n            perFileBuffers.push(null);\n          });\n          weightSpecs.push(...weightsGroup.weights);\n        });\n        weightsManifest.forEach(weightsGroup => {\n          weightsGroup.paths.forEach(path => {\n            const weightFileReader = new FileReader();\n            weightFileReader.onload = (event: Event) => {\n              // tslint:disable-next-line:no-any\n              const weightData = (event.target as any).result as ArrayBuffer;\n              const index = paths.indexOf(path);\n              perFileBuffers[index] = weightData;\n              if (perFileBuffers.indexOf(null) === -1) {\n                const result:\nModelArtifacts = {\n                  modelTopology,\n                  weightSpecs,\n                  weightData:\n
```

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concatenateArrayBuffers(perFileBuffers),\n          format: modelJSON.format,\n          generatedBy:\nmodelJSON.generatedBy,\n          convertedBy: modelJSON.convertedBy\n        });\n        if\n(modelJSON.signature != null) {\n          result.signature = modelJSON.signature;\n        }\n        if\n(modelJSON.userDefinedMetadata != null) {\n          result.userDefinedMetadata =\nmodelJSON.userDefinedMetadata;\n        }\n        if (modelJSON.modelInitializer != null) {\nresult.modelInitializer = modelJSON.modelInitializer;\n        }\n        resolve(result);\n      });\n      weightFileReader.onerror = error =>\n        reject(`Failed to weights data from file of path '${path}'.`);\nweightFileReader.readAsArrayBuffer(pathToFile[path]);\n    });\n  });\n  jsonReader.onerror =\nerror => reject(`Failed to read model topology and weights manifest JSON ` +\n    `from file\n'${jsonFile.name}'. BrowserFiles supports loading ` +\n    `Keras-style tf.Model artifacts only.`);\njsonReader.readAsText(jsonFile);\n  });\n}\n\n/**\n * Check the compatibility between weights manifest and\nweight files.\n */\nprivate checkManifestAndWeightFiles(\n  manifest: WeightsManifestConfig, files: File[]):\n{[path: string]: File} {\n  const basenames: string[] = [];\n  const fileNames = files.map(file =>\n    basename(file.name));\n  const pathToFile: {[path: string]: File} = {};\n  for (const\n    group of manifest) {\n    group.paths.forEach(path => {\n      const pathBasename = basename(path);\n      if\n(basenames.indexOf(pathBasename) !== -1) {\n        throw new Error(`Duplicate file basename found in\nweights manifest: ` +\n          ` '${pathBasename}'`);\n      }\n      basenames.push(pathBasename);\n      if\n(fileNames.indexOf(pathBasename) === -1) {\n        throw new Error(`Weight file with basename\n'${pathBasename}' is not provided.`);\n      }\n      else {\n        pathToFile[path] =\nfiles[fileNames.indexOf(pathBasename)];\n      }\n    });\n  }\n  if (basenames.length !== files.length) {\n    throw new Error(`Mismatch in the number of files in weights manifest ` +\n      ` (${basenames.length})\nand the number of weight files provided ` +\n      ` (${files.length}).`);\n  }\n  return pathToFile;\n}\n\nexport const browserDownloadsRouter: IORouter = (url: string|string[]) => {\n  if (!env().getBool('IS_BROWSER')) {\n    return null;\n  } else {\n    if (!Array.isArray(url) &&\n      url.startsWith(BrowserDownloads.URL_SCHEME)) {\n      return\nbrowserDownloads(url.slice(BrowserDownloads.URL_SCHEME.length));\n    } else {\n      return null;\n    }\n  }\n}\n\nIORouterRegistry.registerSaveRouter(browserDownloadsRouter);\n\n/**\n * Creates an IOHandler that\ntriggers file downloads from the browser.\n */\n * The returned `IOHandler` instance can be used as model exporting\nmethods such\n * as `tf.Model.save` and supports only saving.\n */\n * ``js\n * const model = tf.sequential();\n * model.add(tf.layers.dense({units: 1, inputShape: [10], activation: 'sigmoid'}));\n * const saveResult = await\nmodel.save('downloads://mymodel');\n * // This will trigger downloading of two files:\n * // 'mymodel.json' and\n'mymodel.weights.bin'.\n * console.log(saveResult);\n * ``\n */\n * @param fileNamePrefix Prefix name of the files\nto be downloaded. For use with\n * `tf.Model`,\n * `fileNamePrefix` should follow either of the following two\n * formats:\n * 1. `null` or `undefined`, in which\ncase the default file\n * names will be used:\n * - 'model.json' for the JSON file containing the model topology\nand\n * weights manifest.\n * - 'model.weights.bin' for the binary file containing the binary weight\n * values.\n * 2. A single string or an Array of a single string, as the file name prefix.\n * For example, if `foo` is\nprovided, the downloaded JSON\n * file and binary weights file will be named 'foo.json' and\n * 'foo.weights.bin', respectively.\n */\n * @param config Additional configuration for triggering downloads.\n */\n * @returns\nAn instance of `BrowserDownloads` `IOHandler`.\n */\n * @doc {\n * heading: 'Models',\n * subheading:\n'Loading',\n * namespace: 'io',\n * ignoreCI: true\n * }\n */\nexport function browserDownloads(fileNamePrefix =\n'model'): IOHandler {\n  return new BrowserDownloads(fileNamePrefix);\n}\n\n/**\n * Creates an IOHandler that loads model artifacts from user-selected files.\n */\n * This method can be used for\nloading from files such as user-selected files\n * in the browser.\n */\n * When used in conjunction with\n`tf.loadLayersModel`, an instance of\n * `tf.LayersModel` (Keras-style) can be constructed from the loaded\nartifacts.\n */\n * ``js\n * // Note: This code snippet won't run properly without the actual file input\n * // elements\nin the HTML DOM.\n */\n * // Suppose there are two HTML file input (<input type="file" ...>)\n * // elements.\n
```

```
* const uploadJSONInput = document.getElementById('upload-json');\n * const uploadWeightsInput =\ndocument.getElementById('upload-weights');\n * const model = await tf.loadLayersModel(tf.io.browserFiles([\n * [uploadJSONInput.files[0], uploadWeightsInput.files[0]]]);\n * ```\n * @param files `File`s to load from.\nCurrently, this function supports only\n * loading from files that contain Keras-style models (i.e., `tf.Models`),\nfor\n * which an `Array` of `File`s is expected (in that order):\n * - A JSON file containing the model topology\nand weight manifest.\n * - Optionally, One or more binary files containing the binary weights.\n * These files\nmust have names that match the paths in the `weightsManifest`\n * contained by the aforementioned JSON file, or\nerrors will be thrown\n * during loading. These weights files have the same format as the ones\n * generated by\n`tensorflowjs_converter` that comes with the `tensorflowjs`\n * Python PIP package. If no weights files are\nprovided, only the model\n * topology will be loaded from the JSON file above.\n * @returns An instance of\n`Files` `IOHandler`.\n * @doc {\n * heading: 'Models',\n * subheading: 'Loading',\n * namespace: 'io',\n * ignoreCI: true\n * }\n */\nexport function browserFiles(files: File[]): IOHandler {\n  return new\nBrowserFiles(files);\n}\n"/**\n * @license\n * Copyright 2019 Google LLC. All\nRights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this\nfile except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,\nsoftware\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES\nOR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\ngoverning permissions and\n * limitations under the License.\n */
```

```
*/\n\nimport {env} from '../environment';\n\nimport {NamedTensorMap} from '../tensor_types';\n\nimport * as util\n  from '../util';\n\nimport {decodeWeights} from './io_utils';\n\nimport {monitorPromisesProgress} from
```

```

./progress';\nimport {DTTYPE_VALUE_SIZE_MAP, LoadOptions, WeightsManifestConfig,
WeightsManifestEntry} from './types';\n\n/**\n * Reads binary weights data from a number of URLs.\n * \n * @param fetchURLs URLs to send the HTTP requests at, using `fetch` calls.\n * @param requestOptions
RequestInit
(options) for the HTTP requests.\n * @param fetchFunc Optional overriding value for the `window.fetch`
function.\n * @param onProgress Optional, progress callback function, fired periodically\n * before the load is
completed.\n * @returns A `Promise` of an Array of `ArrayBuffer`. The Array has the same\n * length as
`fetchURLs`.\n */\nexport async function loadWeightsAsArrayBuffer(\n  fetchURLs: string[], loadOptions?:
LoadOptions): Promise<ArrayBuffer[]> {\n  if (loadOptions == null) {\n    loadOptions = {};\n  }\n  const
fetchFunc = loadOptions.fetchFunc == null ? env().platform.fetch : \n
loadOptions.fetchFunc;\n  \n  // Create the requests for all of the weights in parallel.\n  const requests =
fetchURLs.map(\n    fetchURL =>\n      fetchFunc(fetchURL, loadOptions.requestInit, {isBinary: true});\n  );\n  const
fetchStartFraction = 0;\n  const fetchEndFraction = 0.5;\n  const responses = loadOptions.onProgress == null
? \n    await Promise.all(requests) : \n    await monitorPromisesProgress(\n      requests, loadOptions.onProgress,
fetchStartFraction, \n      fetchEndFraction);\n  const bufferPromises = responses.map(response =>
response.arrayBuffer());\n  const bufferStartFraction = 0.5;\n  const bufferEndFraction = 1;\n  const buffers =
loadOptions.onProgress == null ? \n    await Promise.all(bufferPromises) : \n    await monitorPromisesProgress(\n
bufferPromises, loadOptions.onProgress, bufferStartFraction, \n    bufferEndFraction);\n  return
buffers;\n}\n\n/**\n * Reads a weights manifest JSON configuration, fetches the weights and\n * returns them as
`Tensor`s.\n * \n * @param manifest The weights manifest JSON.\n * @param filePathPrefix The path prefix for
filenames given in the manifest.\n * Defaults to the empty string.\n * @param weightNames The names of the
weights to be fetched.\n */\nexport async function loadWeights(\n  manifest: WeightsManifestConfig,
filePathPrefix = "",\n  weightNames?: string[],\n  requestInit?: RequestInit): Promise<NamedTensorMap> {\n  //
TODO(nsthorat): Groups are currently fetched atomically. If you need a\n // single weight from a group, the whole
group will be fetched. At a future\n // date, we should support fetching only the individual shards within a\n //
group that are needed to reconstruct the requested weight.\n // TODO(cais): Use `decodeWeights` for
implementation.\n  const fetchWeights = (fetchUrls: string[]) =>\n    loadWeightsAsArrayBuffer(fetchUrls,
{requestInit});\n  const loadWeights = weightsLoaderFactory(fetchWeights);\n  return loadWeights(manifest,
filePathPrefix, weightNames);\n}\n\n/**\n * Creates a function, which reads a weights manifest JSON
configuration,\n * fetches the weight files using the specified function and returns them as\n * `Tensor`s.\n */\n
```\n * // example for creating a nodejs weight loader, which reads the weight files\n * // from disk using
fs.readFileSync\n\n * \n * import * as fs from 'fs'\n * \n * const fetchWeightsFromDisk = (filePaths: string[]) =>\n *
filePaths.map(filePath => fs.readFileSync(filePath).buffer)\n * \n * const loadWeights =
tf.io.weightsLoaderFactory(fetchWeightsFromDisk)\n * \n * const manifest = JSON.parse(\n *
fs.readFileSync('./my_model-weights_manifest').toString())\n * \n * const weightMap = await
loadWeights(manifest, './')\n * ```\n * @param fetchWeightsFunction The function used for fetching the weight
files.\n * @returns Weight loading function.\n */\nexport function weightsLoaderFactory(\n
fetchWeightsFunction: (fetchUrls: string[]) => Promise<ArrayBuffer[]>):\n (manifest: WeightsManifestConfig,
filePathPrefix?: string,\n weightNames?: string[]) => Promise<NamedTensorMap> {\n return async(\n
manifest: WeightsManifestConfig, filePathPrefix = "",\n weightNames?: string[]):\n Promise<NamedTensorMap> => {\n // Collect all the groups, weights, and their relative offsets
to be\n // fetched.\n const groupIndicesToFetchMap = manifest.map(() => false);\n const
groupWeightsToFetch: {\n [group: number]: Array<{\n manifestEntry: WeightsManifestEntry; groupOffset:
number;\n sizeBytes: number;\n }>\n } = {};\n const weightsFound = \n weightNames != null ?
weightNames.map(() => false) : [];\n const allManifestWeightNames: string[] = [];\n manifest.forEach((manifestGroupConfig, groupIndex) => {\n let groupOffset = 0;\n manifestGroupConfig.weights.forEach(weightsEntry => {\n const rawDtype = ('quantization' in weightsEntry)

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?\\n weightsEntry.quantization.dtype :\\n weightsEntry.dtype;\\n\\n const weightsBytes =
DTYPE_VALUE_SIZE_MAP[rawDtype] *\\n util.sizeFromShape(weightsEntry.shape);\\n\\n const
enqueueWeightsForFetchingFn = () => {\\n groupIndicesToFetchMap[groupIndex] = true;\\n if
(groupWeightsToFetch[groupIndex] == null) {\\n
 groupWeightsToFetch[groupIndex] = [];\\n }\\n\\n groupWeightsToFetch[groupIndex].push({\\n
manifestEntry: weightsEntry,\\n groupOffset,\\n sizeBytes: weightsBytes\\n });\\n };\\n\\n if
(weightNames != null) {\\n weightNames.forEach((weightName, weightIndex) => {\\n if (weightName
=== weightsEntry.name) {\\n enqueueWeightsForFetchingFn();\\n weightsFound[weightIndex] =
true;\\n }\\n });\\n } else {\\n enqueueWeightsForFetchingFn();\\n }\\n\\n
allManifestWeightNames.push(weightsEntry.name);\\n groupOffset += weightsBytes;\\n });\\n });\\n\\n if
(!weightsFound.every(found => found)) {\\n const weightsNotFound = weightNames.filter((_, i) =>
!weightsFound[i]);\\n throw new Error(\\n `Could not find weights in manifest with names: ` +\\n
`${weightsNotFound.join(', ')}. \\n` +\\n `Manifest JSON has
weights with names: ` +\\n `${allManifestWeightNames.join(', ')}.`);\\n }\\n\\n // Convert the one-hot boolean
groupId => shouldFetch map to a list of group\\n // IDs.\\n const groupIndicesToFetch =\\n
groupIndicesToFetchMap.reduce((accumulator, shouldFetch, i) => {\\n if (shouldFetch) {\\n
accumulator.push(i);\\n }\\n return accumulator;\\n }, []);\\n\\n const fetchUrls: string[] = [];\\n
groupIndicesToFetch.forEach(i => {\\n manifest[i].paths.forEach(filepath => {\\n const fetchUrl =
filePathPrefix +\\n (!filePathPrefix.endsWith('/') ? '/' : '') + filepath;\\n fetchUrls.push(fetchUrl);\\n });\\n
});\\n const buffers = await fetchWeightsFunction(fetchUrls);\\n const weightsTensorMap: NamedTensorMap =
{};\\n let bufferIndexOffset = 0;\\n groupIndicesToFetch.forEach(i => {\\n const numBuffers =
manifest[i].paths.length;\\n let groupBytes = 0;\\n for (let i = 0; i <
numBuffers; i++) {\\n groupBytes += buffers[bufferIndexOffset + i].byteLength;\\n }\\n\\n // Create a buffer
for the whole group.\\n const groupBuffer = new ArrayBuffer(groupBytes);\\n const groupByteBuffer = new
Uint8Array(groupBuffer);\\n let groupBufferOffset = 0;\\n for (let i = 0; i < numBuffers; i++) {\\n const
buffer = new Uint8Array(buffers[bufferIndexOffset + i]);\\n groupByteBuffer.set(buffer, groupBufferOffset);\\n
 groupBufferOffset += buffer.byteLength;\\n }\\n\\n const weightsEntries = groupWeightsToFetch[i];\\n
weightsEntries.forEach(weightsEntry => {\\n const byteBuffer = groupBuffer.slice(\\n
weightsEntry.groupOffset,\\n weightsEntry.groupOffset + weightsEntry.sizeBytes);\\n const
nameToTensorMap =\\n decodeWeights(byteBuffer, [weightsEntry.manifestEntry]);\\n for (const name in
nameToTensorMap) {\\n weightsTensorMap[name] = nameToTensorMap[name];\\n }\\n
});\\n\\n bufferIndexOffset += numBuffers;\\n });\\n\\n return weightsTensorMap;\\n };\\n}\\n", "/*\\n *
@license\\n * Copyright 2018 Google LLC. All Rights Reserved.\\n * Licensed under the Apache License, Version
2.0 (the "License");\\n * you may not use this file except in compliance with the License.\\n * You may obtain a
copy of the License at\\n * \\n * http://www.apache.org/licenses/LICENSE-2.0\\n * \\n * Unless required by applicable
law or agreed to in writing, software\\n * distributed under the License is distributed on an "AS IS" BASIS,\\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\\n * See the License for
the specific language governing permissions and\\n * limitations under the License.\\n *
=====\\n
\\n\\n/\\n * IOHandler implementations based on HTTP requests in the web browser.\\n *\\n * Uses
[fetch`](https://developer.mozilla.org/en-US/docs/Web/API/Fetch_API).\\n *\\n\\nimport
{ env } from './environment';\\n\\nimport { assert } from './util';\\n\\nimport { concatenateArrayBuffers,
getModelArtifactsInfoForJSON } from './io_utils';\\n\\nimport { IORouter, IORouterRegistry } from
'./router_registry';\\n\\nimport { IOHandler, LoadOptions, ModelArtifacts, ModelJSON, OnProgressCallback,
SaveResult, WeightsManifestConfig, WeightsManifestEntry } from './types';\\n\\nimport { loadWeightsAsArrayBuffer }
from './weights_loader';\\n\\nconst OCTET_STREAM_MIME_TYPE = 'application/octet-stream';\\nconst
JSON_TYPE = 'application/json';\\nexport class HTTPRequest implements IOHandler {\\n protected readonly path:
string;\\n protected readonly requestInit: RequestInit;\\n\\n private readonly fetch: Function;\\n private readonly

```

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weightUrlConverter: (weightName: string) => Promise<string>;\n\n readonly DEFAULT_METHOD = 'POST';\n\n static readonly URL_SCHEME_REGEX = /^https?:\\|\\|/;\n\n private readonly weightPathPrefix: string;\n private\n readonly onProgress: OnProgressCallback;\n\n constructor(path:\n string, loadOptions?: LoadOptions) {\n if (loadOptions == null) {\n loadOptions = {};\n }\n this.weightPathPrefix = loadOptions.weightPathPrefix;\n this.onProgress = loadOptions.onProgress;\n this.weightUrlConverter = loadOptions.weightUrlConverter;\n\n if (loadOptions.fetchFunc != null) {\n assert(\n typeof loadOptions.fetchFunc === 'function',\n () => 'Must pass a function that matches the\n signature of ' +\n `fetch` (see ' +\n 'https://developer.mozilla.org/en-US/docs/Web/API/Fetch_API'));\n this.fetch = loadOptions.fetchFunc;\n } else {\n this.fetch =\n env().platform.fetch;\n }\n\n assert(\n path != null && path.length > 0,\n () => 'URL path for http must\n not be null, undefined or ' +\n 'empty.');\n\n if (Array.isArray(path)) {\n assert(\n path.length ===\n 2,\n () => 'URL paths for http must have a length of 2, ' +\n `(actual\n length is ${path.length}).`);\n this.path = path;\n\n if (loadOptions.requestInit != null &&\n loadOptions.requestInit.body != null) {\n throw new Error(\n 'requestInit is expected to have no pre-\n existing body, but has one.');\n }\n this.requestInit = loadOptions.requestInit || {};\n }\n\n async\n save(modelArtifacts: ModelArtifacts): Promise<SaveResult> {\n if (modelArtifacts.modelTopology instanceof\n ArrayBuffer) {\n throw new Error(\n 'BrowserHTTPRequest.save() does not support saving model topology\n ' +\n 'in binary formats yet.');\n }\n\n const init = Object.assign({method: this.DEFAULT_METHOD},\n this.requestInit);\n init.body = new FormData();\n\n const weightsManifest: WeightsManifestConfig = [{\n paths: ['./model.weights.bin'],\n weights: modelArtifacts.weightSpecs,\n }];\n const\n modelTopologyAndWeightManifest: ModelJSON = {\n modelTopology: modelArtifacts.modelTopology,\n format:\n modelArtifacts.format,\n generatedBy: modelArtifacts.generatedBy,\n convertedBy:\n modelArtifacts.convertedBy,\n weightsManifest\n };\n if (modelArtifacts.signature != null) {\n modelTopologyAndWeightManifest.signature = modelArtifacts.signature;\n }\n if\n (modelArtifacts.userDefinedMetadata != null) {\n modelTopologyAndWeightManifest.userDefinedMetadata =\n modelArtifacts.userDefinedMetadata;\n }\n if (modelArtifacts.modelInitializer != null) {\n modelTopologyAndWeightManifest.modelInitializer =\n modelArtifacts.modelInitializer;\n }\n\n init.body.append(\n 'model.json',\n new Blob([\n JSON.stringify(modelTopologyAndWeightManifest),\n {type: JSON_TYPE}],\n 'model.json'));\n\n if\n (modelArtifacts.weightData != null) {\n init.body.append(\n 'model.weights.bin',\n new\n Blob([\n modelArtifacts.weightData,\n {type: OCTET_STREAM_MIME_TYPE}],\n 'model.weights.bin'));\n }\n\n const response = await this.fetch(this.path, init);\n if (response.ok) {\n return {\n modelArtifactsInfo: getModelArtifactsInfoForJSON(modelArtifacts),\n responses: [response],\n }; \n } else {\n throw new Error(\n `BrowserHTTPRequest.save() failed due to HTTP response status ` +\n `${response.status}.`);\n }\n }\n\n /**\n * Load model artifacts via HTTP request(s).\n * @returns The loaded model artifacts (if\n * loading succeeds).\n */\n async load(): Promise<ModelArtifacts> {\n const modelConfigRequest = await\n this.fetch(this.path, this.requestInit);\n if (!modelConfigRequest.ok) {\n throw new Error(\n `Request to\n ${this.path} failed with status code ` +\n `${modelConfigRequest.status}. Please verify this URL points to ` +\n `the model JSON of the model to\n load.`);\n }\n let modelConfig: ModelJSON;\n try {\n modelConfig = await modelConfigRequest.json();\n } catch (e) {\n let message = `Failed to parse model JSON of response from ${this.path}.`; \n //\n TODO(nsthorat): Remove this after some time when we're comfortable that\n // .pb files are mostly gone.\n if\n (this.path.endsWith('.pb')) {\n message += ' Your path contains a .pb file extension. ' +\n 'Support for .pb\n models have been removed in TensorFlow.js 1.0 ' +\n 'in favor of .json models. You can re-convert your\n Python ' +\n 'TensorFlow model using the TensorFlow.js 1.0 conversion scripts ' +\n 'or you can\n convert your .pb models with the \\pb2json\\ ' +\n 'NPM script in the tensorflow/tfjs-converter repository.';\n }\n }\n }\n }\n}

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 } else {\n message += ' Please make sure the server is serving valid ' +\n 'JSON for this request.';\n }\n throw new Error(message);\n }\n\n const modelTopology = modelConfig.modelTopology;\n const weightsManifest =\n modelConfig.weightsManifest;\n const generatedBy = modelConfig.generatedBy;\n const convertedBy =\n modelConfig.convertedBy;\n const format = modelConfig.format;\n const signature = modelConfig.signature;\n const userDefinedMetadata = modelConfig.userDefinedMetadata;\n // We do not allow both modelTopology\n and weightsManifest to be missing.\n if (modelTopology == null && weightsManifest == null) {\n throw new\n Error(\n `The JSON from HTTP path ${this.path} contains neither model`\n ` topology or manifest for\n weights.`);\n }\n\n let weightSpecs: WeightsManifestEntry[];\n let weightData: ArrayBuffer;\n if\n (weightsManifest != null) {\n const results = await this.loadWeights(weightsManifest);\n [weightSpecs,\n weightData] = results;\n }\n\n const artifacts: ModelArtifacts = {\n modelTopology,\n weightSpecs,\n weightData,\n generatedBy,\n convertedBy,\n format\n };\n\n if (signature != null) {\n artifacts.signature =\n signature;\n }\n\n if (userDefinedMetadata != null) {\n artifacts.userDefinedMetadata =\n userDefinedMetadata;\n }\n\n const initializer = modelConfig.modelInitializer;\n if (initializer) {\n artifacts.modelInitializer = initializer;\n }\n\n return artifacts;\n}\n\nprivate async\nloadWeights(weightsManifest: WeightsManifestConfig):\n Promise<[WeightsManifestEntry[], ArrayBuffer]>\n{\n const weightPath = Array.isArray(this.path) ? this.path[1] : this.path;\n const [prefix, suffix] =\n parseUrl(weightPath);\n const pathPrefix = this.weightPathPrefix || prefix;\n\n const weightSpecs = [];\n for\n (const entry of weightsManifest) {\n weightSpecs.push(...entry.weights);\n }\n\n const fetchURLs: string[] =\n [];\n const urlPromises: Array<Promise<string>> = [];\n for (const weightsGroup of weightsManifest) {\n for (const path of weightsGroup.paths) {\n if (this.weightUrlConverter != null) {\n urlPromises.push(this.weightUrlConverter(path));\n } else {\n fetchURLs.push(pathPrefix + path +\n suffix);\n }\n }\n }\n\n if (this.weightUrlConverter) {\n fetchURLs.push(...await\n Promise.all(urlPromises));\n }\n\n const buffers = await loadWeightsAsArrayBuffer(fetchURLs, {\n requestInit: this.requestInit,\n fetchFunc: this.fetch,\n onProgress: this.onProgress\n });\n\n return\n [weightSpecs, concatenateArrayBuffers(buffers)];\n}\n\n/**\n * Extract the prefix and suffix of the url, where\n the prefix is the path before\n * the last file, and suffix is the search params after the last file.\n * ``\n * const url =\n 'http://tfhub.dev/model/1/tensorflowjs_model.pb?tfjs-format=file'\n * [prefix, suffix] = parseUrl(url)\n * // prefix =\n 'http://tfhub.dev/model/1/'\n * // suffix = '?tfjs-format=file'\n * @param url the model\n url to be parsed.\n */\nexport function parseUrl(url: string): [string, string] {\n const lastSlash =\n url.lastIndexOf('/');\n const lastSearchParam = url.lastIndexOf('?');\n const prefix = url.substring(0, lastSlash);\n const suffix =\n lastSearchParam > lastSlash ? url.substring(lastSearchParam) : '';\n return [prefix + '/',\n suffix];\n}\n\nexport function isHTTPScheme(url: string): boolean {\n return\n url.match(HTTPRequest.URL_SCHEME_REGEX) != null;\n}\n\nexport const httpRouter: IORouter = (url:\n string, loadOptions?: LoadOptions) => {\n if (typeof fetch === 'undefined' &&\n (loadOptions == null ||\n loadOptions.fetchFunc == null)) {\n // `http` uses `fetch` or `node-fetch`, if one wants to use it in\n // an\n environment that is not the browser or node they have to setup a\n // global fetch polyfill.\n return null;\n } else {\n let isHTTP = true;\n if (Array.isArray(url)) {\n isHTTP = url.every(urlItem\n => isHTTPScheme(urlItem));\n } else {\n isHTTP = isHTTPScheme(url);\n }\n if (isHTTP) {\n return http(url, loadOptions);\n }\n return null;\n }\n};\n\nIORouterRegistry.registerSaveRouter(httpRouter);\nIORouterRegistry.registerLoadRouter(httpRouter);\n\n/**\n * Creates an IOHandler subtype that sends model artifacts to HTTP server.\n * An HTTP request of the\n `multipart/form-data` mime type will be sent to the\n * `path` URL. The form data includes artifacts that represent\n the topology\n * and/or weights of the model. In the case of Keras-style `tf.Model`, two\n * blobs (files) exist in\n form-data:\n * - A JSON file consisting of `modelTopology` and `weightsManifest`.\n * - A binary weights file\n consisting of the concatenated weight values.\n * These files are in the same format as the one generated by\n * [tfjs_converter](https://js.tensorflow.org/tutorials/import-keras.html).\n * The following code snippet

```





```

concatenated in the order described by the weightSpecs.\n * @param trainingConfig Model training configuration.
Optional.\n *\n * @returns A passthrough `IOHandler` that simply loads the provided data.\n */\nexport function
fromMemory(\n modelArtifacts: {}|ModelArtifacts, weightSpecs?: WeightsManifestEntry[],\n weightData?:
ArrayBuffer, trainingConfig?: TrainingConfig): IOHandler {\n if (arguments.length === 1) {\n const
isModelArtifacts =\n (modelArtifacts as ModelArtifacts).modelTopology != null ||\n (modelArtifacts as
ModelArtifacts).weightSpecs != null;\n if (isModelArtifacts) {\n return new PassthroughLoader(modelArtifacts
as ModelArtifacts);\n } else {\n // Legacy support: with only modelTopology.\n // TODO(cais): Remove this
deprecated API.\n console.warn(\n 'Please call tf.io.fromMemory() with only one argument. ' +\n 'The
argument should be of type ModelArtifacts. ' +\n 'The multi-argument signature of tf.io.fromMemory() has
been ' +\n 'deprecated and will be removed in a future release.);\n return
new PassthroughLoader({\n modelTopology: modelArtifacts as {},\n });\n } else {\n // Legacy support.\n //
TODO(cais): Remove this deprecated API.\n console.warn(\n 'Please call tf.io.fromMemory() with only one
argument. ' +\n 'The argument should be of type ModelArtifacts. ' +\n 'The multi-argument signature of
tf.io.fromMemory() has been ' +\n 'deprecated and will be removed in a future release.);\n return new
PassthroughLoader({\n modelTopology: modelArtifacts as {},\n weightSpecs,\n weightData,\n trainingConfig\n });\n }\n }\n\n /**\n * Creates an IOHandler that passes saved model artifacts to a callback.\n *\n * ```js\n * function handleSave(artifacts) {\n * // ... do something with the artifacts ... \n * return
{modelArtifactsInfo: {...}, ...};\n * }\n * const saveResult = model.save(tf.io.withSaveHandler(handleSave));\n * ```\n *\n * @param saveHandler A function that accepts a `ModelArtifacts` and returns
a\n * `SaveResult`.\n */\nexport function withSaveHandler(\n saveHandler: (artifacts: ModelArtifacts) =>\n Promise<SaveResult>): IOHandler {\n return new PassthroughSaver(saveHandler);\n}\n"/**\n * @license\n *
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"License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
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agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n */\n
=====
*\n\n// Importing local_storage and indexed_db is necessary for the routers
to be\n// registered.\nimport './indexed_db';\nimport './local_storage';\nimport {browserFiles} from
'./browser_files';\nimport {browserHTTPRequest, http, isHTTPScheme} from './http';\nimport
{concatenateArrayBuffers, decodeWeights, encodeWeights, getModelArtifactsInfoForJSON} from
'./io_utils';\nimport {fromMemory, withSaveHandler} from './passthrough';\nimport {getLoadHandlers,
getSaveHandlers, registerLoadRouter, registerSaveRouter} from './router_registry';\nimport {IOHandler,
LoadHandler, LoadOptions, ModelArtifacts, ModelArtifactsInfo, ModelJSON, ModelStoreManager,
OnProgressCallback, RequestDetails, SaveConfig, SaveHandler, SaveResult, WeightGroup,
WeightsManifestConfig, WeightsManifestEntry} from './types';\nimport {loadWeights, weightsLoaderFactory}
from './weights_loader';\n\nexport {copyModel, listModels, moveModel, removeModel} from
'./model_management';\nexport {\n browserFiles,\n browserHTTPRequest,\n concatenateArrayBuffers,\n decodeWeights,\n encodeWeights,\n fromMemory,\n getLoadHandlers,\n getModelArtifactsInfoForJSON,\n getSaveHandlers,\n http,\n IOHandler,\n isHTTPScheme,\n LoadHandler,\n LoadOptions,\n loadWeights,\n ModelArtifacts,\n ModelArtifactsInfo,\n ModelJSON,\n ModelStoreManager,\n OnProgressCallback,\n registerLoadRouter,\n registerSaveRouter,\n RequestDetails,\n SaveConfig,\n SaveHandler,\n SaveResult,\n WeightGroup,\n weightsLoaderFactory,\n WeightsManifestConfig,\n WeightsManifestEntry,\n withSaveHandler\n};\n"/**\n *
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=====
\n
*\nimport {ENGINE} from '../engine';\nimport {BatchMatMul, BatchMatMulAttrs, BatchMatMulInputs} from
'../kernel_names';\nimport {NamedAttrMap} from '../kernel_registry';\nimport {Tensor} from '../tensor';\nimport
{NamedTensorMap} from '../tensor_types';\nimport {makeTypesMatch} from '../tensor_util';\nimport
{convertToTensor} from '../tensor_util_env';\nimport {TensorLike} from '../types';\n\nimport {op} from
'./operation';\n\n/**\n * Computes the dot product of two matrices, A * B. These must be matrices.\n *\n * ```js\n const a = tf.tensor2d([1, 2], [1, 2]);\n * const b = tf.tensor2d([1, 2, 3, 4], [2, 2]);\n *\n * a.matMul(b).print(); // or\n tf.matMul(a, b)\n *\n * @param a First matrix in dot product operation.\n * @param b Second matrix in dot\n product operation.\n *\n * @param transposeA If true, `a` is transposed before multiplication.\n * @param transposeB If true, `b` is\n transposed before multiplication.\n *\n * @doc {heading: 'Operations', subheading: 'Matrices'}\n *\nfunction\n matMul<T extends Tensor>(\n a: Tensor|TensorLike, b: Tensor|TensorLike, transposeA = false,\n transposeB =\n false): T {\n let $a = convertToTensor(a, 'a', 'matMul');\n let $b = convertToTensor(b, 'b', 'matMul');\n [$a, $b] =\n makeTypesMatch($a, $b);\n const inputs: BatchMatMulInputs = {a: $a, b: $b};\n const attrs: BatchMatMulAttrs\n = {transposeA, transposeB};\n return ENGINE.runKernel(\n BatchMatMul, inputs as { } as NamedTensorMap,\n attrs as { } as NamedAttrMap);\n }\n\nexport const matMul = op({matMul_});\n\n"/**\n * @license\n * Copyright\n 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\n License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or\n agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n the specific language governing permissions and\n * limitations under the License.\n *
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=====
\n
*\n\nimport {ENGINE} from '../engine';\nimport {OneHot, OneHotAttrs, OneHotInputs} from
'../kernel_names';\nimport {NamedAttrMap} from '../kernel_registry';\nimport {Tensor} from '../tensor';\nimport
{NamedTensorMap} from '../tensor_types';\nimport {convertToTensor} from '../tensor_util_env';\nimport
{TensorLike} from '../types';\n\nimport {op} from './operation';\n\n/**\n * Creates a one-hot `tf.Tensor`. The\n locations represented by `indices` take\n * value `onValue` (defaults to 1), while all other locations take\n value\n * `offValue` (defaults to 0). If `indices` is rank `R`, the output has rank\n * `R+1` with the last axis of size\n `depth`.\n *\n * ```js\n * tf.oneHot(tf.tensor1d([0, 1], 'int32'), 3).print();\n *\n * @param indices `tf.Tensor`\n of indices with dtype `int32`.\n * @param depth The depth of the one hot dimension.\n * @param onValue A number\n used to fill in the output when the index matches\n * the location.\n * @param offValue A number used to fill in the\n output when the index does\n * not match the location.\n *\n * @doc {heading: 'Tensors', subheading:\n 'Creation'}\n *\nfunction oneHot(\n indices: Tensor|TensorLike, depth: number, onValue = 1,\n offValue = 0):\n Tensor {\n if (depth < 2) {\n throw new Error(`Error in oneHot: depth must be >=2, but it is ${depth}`);\n }\n const $indices = convertToTensor(indices, 'indices', 'oneHot', 'int32');\n const inputs: OneHotInputs = {indices:\n $indices};\n const attrs: OneHotAttrs = {depth, onValue, offValue};\n return ENGINE.runKernel(\n OneHot, inputs as unknown as NamedTensorMap,\n attrs as unknown as\n NamedAttrMap);\n }\n\nexport const oneHot = op({oneHot_});\n\n"/**\n * @license\n * Copyright 2018 Google\n LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not\n use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,\n software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\n OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
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=====
*\n\nimport {ENGINE} from './engine';\nimport {Transpose, TransposeAttrs, TransposeInputs} from
 './kernel_names';\nimport
 {NamedAttrMap} from './kernel_registry';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from
 './tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\nimport
 * as util from './util';\n\nimport {op} from './operation';\n\n/*\n * Transposes the `tf.Tensor`. Permutates the
 dimensions according to `perm`. \n * The returned `tf.Tensor`'s dimension `i` will correspond to the input \n *
 dimension `perm[i]`. If `perm` is not given, it is set to `[n-1...0]`, \n * where `n` is the rank of the input `tf.Tensor`.
 Hence by default, this \n * operation performs a regular matrix transpose on 2-D input `tf.Tensor`s. \n *
`js` \n *
const a = tf.tensor2d([1, 2, 3, 4, 5, 6], [2, 3]); \n * a.transpose().print(); // or tf.transpose(a) \n *
`js` \n *
@param x The tensor to transpose. \n * @param perm The permutation of the dimensions of a. \n * @doc
 {heading: 'Operations', subheading: 'Matrices'} \n */\nfunction transpose_<T
 extends Tensor>(x: T|TensorLike, perm?: number[]): T {\n const $x = convertToTensor(x, 'x', 'transpose'); \n\n if
 (perm == null) {\n perm = $x.shape.map((s, i) => i).reverse(); \n } \n\n util.assert(\n $x.rank === perm.length, \n
 () => `Error in transpose: rank of input ${$x.rank}` + \n `must match length of perm ${perm}`.);\n\n
 perm.forEach(axis => {\n util.assert(\n axis >= 0 && axis < $x.rank, \n () => `All entries in 'perm' must be
 between 0 and ${$x.rank - 1}` + \n `but got ${perm}`.);\n }); \n\n if ($x.rank <= 1) {\n return $x.clone(); \n
 } \n\n const inputs: TransposeInputs = {x: $x}; \n const attrs: TransposeAttrs = {perm}; \n\n return
 ENGINE.runKernel(\n Transpose, inputs as {} as NamedTensorMap, attrs as {} as
 NamedAttrMap); \n} \n\nexport const transpose = op({transpose_}); \n\n/*\n * @license \n * Copyright 2018
 Google LLC. All Rights Reserved. \n * Licensed under the Apache License, Version 2.0 (the "License"); \n
 * you may not use this file except in compliance with the License. \n * You may obtain a copy of the License at \n
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 WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied. \n * See the License for the specific
 language governing permissions and \n * limitations under the License. \n */
=====
```

```
*\n\nimport {Tensor1D, Tensor2D} from './tensor';\nimport {convertToTensor} from './tensor_util_env';\nimport
 {TensorLike} from './types';\nimport * as util from './util';\n\nimport {cast} from './cast';\nimport {matMul} from
 './mat_mul';\nimport {oneHot} from './one_hot';\nimport {op} from './operation';\nimport {transpose} from
 './transpose'; \n\n/*\n * Computes the confusion matrix from true labels and predicted
 labels. \n * `js` \n * const labels = tf.tensor1d([0, 1, 2, 1, 0], 'int32'); \n * const predictions = tf.tensor1d([0, 2, 2,
 1, 0], 'int32'); \n * const numClasses = 3; \n * const out = tf.math.confusionMatrix(labels, predictions, numClasses); \n
 * out.print(); \n * // Expected output matrix: \n * // [[2, 0, 0], \n * // [0, 1, 1], \n * // [0, 0, 1]] \n *
`js` \n * @param
 labels The target labels, assumed to be 0-based integers \n * for the classes. The shape is `[numExamples]`, where \n
 * `numExamples` is the number of examples included. \n * @param predictions The predicted classes, assumed to
 be \n * 0-based integers for the classes. Must have the same shape as `labels`. \n * @param numClasses Number of
 all classes, as an integer. \n * Its value must be larger than the largest element in `labels` and \n * `predictions`. \n
 * @returns The confusion matrix as a int32-type 2D tensor. The value at \n * row `r` and column `c` is the number of
 times examples of actual class \n * `r` were
 predicted as class `c`. \n * @doc {heading: 'Operations', subheading: 'Evaluation'} \n */\nexport function
 confusionMatrix_<T>(\n labels: Tensor1D|TensorLike, predictions: Tensor1D|TensorLike, \n numClasses: number):
 Tensor2D {\n const $labels = convertToTensor(labels, 'labels', 'confusionMatrix'); \n const $predictions = \n
convertToTensor(predictions, 'predictions', 'confusionMatrix'); \n\n util.assert(\n numClasses == null ||
 numClasses > 0 && Number.isInteger(numClasses), \n () => `If provided, numClasses must be a positive integer,
` + \n `but got ${numClasses}`.);\n\n util.assert(\n $labels.rank === 1, \n () => `Expected the rank of labels
 to be 1, but got ${$labels.rank}`.);\n\n util.assert(\n $predictions.rank === 1, \n () => `Expected the rank of
`
```

```

predictions to be 1, `+` but got ${predictions.rank}`);
util.assert(labels.shape[0] ===
predictions.shape[0], () => `Mismatch in the number of examples: `+
`${labels.shape[0]} vs. ${predictions.shape[0]}`);
Labels and predictions should have the same
number of elements.`);
util.assert(numClasses > 0 && Number.isInteger(numClasses), () =>
`numClasses is required to be a positive integer, but got `+
`${numClasses}`);
// TODO(cais): In the
future, if oneHot supports tensors inputs for `numClasses`, `confusionMatrix` can make `numClasses`
optional.
const oneHotLabels = oneHot(cast(labels, 'int32'), numClasses) as Tensor2D;
const oneHotPredictions = oneHot(cast(predictions, 'int32'), numClasses) as Tensor2D;
const oneHotLabelsT:
Tensor2D = transpose(oneHotLabels);
const product: Tensor2D = matMul(oneHotLabelsT, oneHotPredictions);
return cast(product, 'int32');
}
export const confusionMatrix = op({ confusionMatrix_ });
"/**
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WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.
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language governing permissions and
 * limitations under the License.
 */
=====
*/
 * Exports under the tf.math.* namespace.
 */
import { confusionMatrix } from
'./ops/confusion_matrix';
export { confusionMatrix };
"/**
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 * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.
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 * limitations under the License.
 */
=====
*/
import { Tensor3D } from './tensor';
import { inferShape } from './tensor_util_env';
import { TensorLike3D }
from './types';
import { DataType } from './types';
import { assertNonNull } from './util';
import { makeTensor }
from './tensor_ops_util';
/**
 * Creates rank-3 `tf.Tensor` with the provided values, shape and dtype.
 * The same functionality can be achieved with `tf.tensor`, but in general
 * we recommend using `tf.tensor3d` as it makes
the code more readable.
 * ```js
 * // Pass a nested array.
 * tf.tensor3d([[[[1,
[2]], [[3], [4]]]], print();
 * ```
 * ```js
 * // Pass a flat array and specify a shape.
 * tf.tensor3d([1, 2, 3, 4], [2, 2,
1]), print();
 * ```
 * @param values The values of the tensor. Can be nested array of numbers,
or a flat
array, or a `TypedArray`.
 * @param shape The shape of the tensor. If not provided, it is inferred from
`values`.
 * @param dtype The data type.
 * @doc { heading: 'Tensors', subheading: 'Creation' }
 */
export
function tensor3d(values: TensorLike3D, shape?: [number, number, number], dtype?:
DataType): Tensor3D {
 assertNonNull(values);
 if (shape != null && shape.length !== 3) {
 throw new Error('tensor3d() requires
shape to have three numbers');
 }
 const inferredShape = inferShape(values, dtype);
 if (inferredShape.length
!== 3 && inferredShape.length !== 1) {
 throw new Error('tensor3d() requires values to be number[][],
or flat/TypedArray');
 }
 if (inferredShape.length
=== 1 && shape == null) {
 throw new Error('tensor3d() requires shape to be provided when `values`
are a flat array');
 }
 return makeTensor(values, shape, inferredShape, dtype) as Tensor3D;
}
"/**
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 * See the License for

```

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```
=====
*\n\nimport {ENGINE} from '../engine';\nimport
{FromPixels, FromPixelsAttrs, FromPixelsInputs} from '../kernel_names';\nimport {getKernel, NamedAttrMap}
from '../kernel_registry';\nimport {Tensor, Tensor2D, Tensor3D} from '../tensor';\nimport {NamedTensorMap} from
 '../tensor_types';\nimport {convertToTensor} from '../tensor_util_env';\nimport {PixelData, TensorLike} from
 '../types';\n\nimport {cast} from './cast';\nimport {op} from './operation';\nimport {tensor3d} from './tensor3d';\n\nlet
fromPixels2DContext: CanvasRenderingContext2D;\n\n/**\n * Creates a `tf.Tensor` from an image.\n * \n * ``js\n *
const image = new ImageData(1, 1);\n * image.data[0] = 100;\n * image.data[1] = 150;\n * image.data[2] = 200;\n *
image.data[3] = 255;\n * \n * tf.browser.fromPixels(image).print();\n * ``\n * \n * @param pixels The input image to
construct the tensor from. The\n * supported image types are all 4-channel. You can also pass in an image\n * object
with following attributes:\n * `{data: Uint8Array; width: number; height: number}`\n * @param
numChannels The number of channels of the output tensor. A\n * numChannels value less than 4 allows you to
ignore channels. Defaults to\n * 3 (ignores alpha channel of input image).\n * \n * @doc {heading: 'Browser',
namespace: 'browser', ignoreCI: true}\n */\nfunction fromPixels_(\n pixels:
PixelData|ImageData|HTMLImageElement|HTMLCanvasElement|\n HTMLVideoElement|ImageBitmap,\n numChannels = 3): Tensor3D {\n // Sanity checks.\n if (numChannels > 4) {\n throw new Error(\n 'Cannot
construct Tensor with more than 4 channels from pixels.');
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height).data;\n }\n let values: Int32Array;\n if (numChannels === 4) {\n values = new Int32Array(vals);\n } else\n {\n const numPixels = width * height;\n values = new Int32Array(numPixels * numChannels);\n for (let i = 0;\n i < numPixels; i++) {\n for (let channel = 0; channel < numChannels; ++channel) {\n values[i * numChannels + channel] = vals[i * 4 + channel];\n }\n }\n }\n const outShape: [number,\n number, number] = [height, width, numChannels];\n return tensor3d(values, outShape, 'int32');\n }\n\n/**\n * Draws a `tf.Tensor` of pixel values to a byte array or optionally a\n * canvas.\n * When the dtype of the input is 'float32', we assume values in the range\n * [0-1]. Otherwise, when input is 'int32', we assume values in the range\n * [0-255].\n * Returns a promise that resolves when the canvas has been drawn to.\n * @param img A rank-2 or rank-3 tensor. If rank-2, draws grayscale. If\n * rank-3, must have depth of 1, 3 or 4. When depth of 1,\n * draws\n * grayscale. When depth of 3, we draw with the first three components of\n * the depth dimension corresponding to r, g, b and alpha = 1. When depth of\n * 4, all four components of the depth dimension correspond to r, g, b, a.\n * @param canvas The canvas to draw to.\n * @doc {heading: 'Browser', namespace: 'browser'}\n */\nexport async function toPixels(\n img: Tensor2D|Tensor3D|TensorLike,\n canvas?: HTMLCanvasElement): Promise<Uint8ClampedArray> {\n let $img = convertToTensor(img, 'img', 'toPixels');\n if (!img instanceof Tensor) {\n // Assume int32 if user passed a native array.\n const originalImgTensor = $img;\n $img = cast(originalImgTensor, 'int32');\n originalImgTensor.dispose();\n }\n if ($img.rank !== 2 && $img.rank !== 3) {\n throw new Error(\n `toPixels only supports rank 2 or 3 tensors, got rank\n ${$img.rank}`);\n }\n const [height, width] = $img.shape.slice(0, 2);\n const depth = $img.rank === 2 ? 1 : $img.shape[2];\n if (depth > 4 || depth === 2) {\n throw new Error(\n `toPixels only supports depth of size\n +\n `1, 3 or 4 but got ${depth}`);\n }\n if ($img.dtype !== 'float32' && $img.dtype !== 'int32') {\n throw new Error(\n `Unsupported type for toPixels: ${$img.dtype}` +\n ` Please use float32 or int32 tensors.`);\n }\n const data = await $img.data();\n const multiplier = $img.dtype === 'float32' ? 255 : 1;\n const bytes = new Uint8ClampedArray(width * height * 4);\n for (let i = 0; i < height * width; ++i) {\n const rgba = [0, 0, 0, 255];\n for (let d = 0; d < depth; d++) {\n const value = data[i * depth + d];\n if ($img.dtype === 'float32') {\n if (value < 0 || value > 1) {\n throw new Error(\n `Tensor values for a float32 Tensor must be in the\n `range [0 - 1] but encountered ${value}`);\n }\n } else if ($img.dtype === 'int32') {\n if (value < 0 || value > 255) {\n throw new Error(\n `Tensor values for a int32 Tensor must be in the\n `range [0 - 255] but encountered ${value}`);\n }\n }\n if (depth === 1) {\n rgba[0] = value * multiplier;\n rgba[1] = value * multiplier;\n rgba[2] = value * multiplier;\n } else {\n rgba[d] = value * multiplier;\n }\n const j = i * 4;\n bytes[j + 0] = Math.round(rgba[0]);\n bytes[j + 1] = Math.round(rgba[1]);\n bytes[j + 2] = Math.round(rgba[2]);\n bytes[j + 3] = Math.round(rgba[3]);\n }\n if (canvas != null) {\n canvas.width = width;\n canvas.height = height;\n const ctx = canvas.getContext('2d');\n const imageData = new ImageData(bytes, width, height);\n ctx.putImageData(imageData, 0, 0);\n }\n if ($img !== img) {\n $img.dispose();\n }\n return bytes;\n }\n}\n\nexport const fromPixels = op({fromPixels_});\n\n"/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n\n\n\nimport {TensorInfo} from '../kernel_registry';\nimport {computeStrides, sizeFromShape} from '../util';\n\n/**\n * Validate gather nd inputs.\n * @param tensor The tensor contains the source values.\n * @param indices The tensor contains the indices to slice the source.\n * @returns [resultShape, numUpdates, sliceSize, strides]\n */\nexport function prepareAndValidate(tensor: TensorInfo, indices: TensorInfo):\n [number[], number, number,

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```

number[] {\n const tensorRank = tensor.shape.length;\n const indicesRank = indices.shape.length;\n if
(tensorRank < 1) {\n throw new Error(\n 'tf.gatherND() expects the input to be rank
1 or higher,' +\n ` but the rank was ${tensorRank}.`);\n }\n if (indicesRank < 1) {\n throw new Error(\n
'tf.gatherND() expects the indices to be rank 1 or higher,' +\n ` but the rank was ${indicesRank}.`);\n }\n if
(indices.dtype !== 'int32') {\n throw new Error(\n 'tf.gatherND() expects the indices to be int32 type,' +\n
` but the dtype was ${indices.dtype}.`);\n }\n if (indices.shape[indicesRank - 1] > tensorRank) {\n throw new
Error(\n 'index innermost dimension length must be <= tensor rank; saw: ' +\n
`${indices.shape[indicesRank - 1]} vs. ${tensorRank}`);\n }\n if (sizeFromShape(tensor.shape) === 0) {\n
throw new Error(\n 'Requested more than 0 entries, but input is empty.' +\n ` Input shape:
${tensor.shape}.`);\n }\n const indicesShape = indices.shape;\n const sliceRank =
indicesShape[indicesShape.length - 1];\n // The result shape is\n // indices.shape[:-1] +
params.shape[indices.shape[-1]:]\n let nResult = 1;\n for (let i = 0; i < indicesShape.length - 1; ++i) {\n nResult *= indicesShape[i];\n }\n const
inputShape = tensor.shape;\n const resultShape = indicesShape.slice();\n resultShape.pop();\n let sliceSize =
1;\n for (let i = sliceRank; i < tensorRank; ++i) {\n sliceSize *= inputShape[i];\n }\n resultShape.push(inputShape[i]);\n const strides =\n [...computeStrides(tensor.shape).map(stride => stride
/ sliceSize),\n 1].slice(0, sliceRank);\n return [resultShape, nResult, sliceSize, strides];\n}\n"/**\n *
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License.\n */
=====
*/\nimport {TensorInfo} from '../kernel_registry';\nimport {Tensor} from '../tensor';\nimport {computeStrides,
sizeFromShape} from '../util';\n/**\n * Check whether updates.shape = indices.shape[:batchDim] +\n *
shape[sliceDim:]\n * @param x The input tensor.\n */\nexport function validateUpdateShape(\n shape:
number[], indices: Tensor, updates: Tensor) {\n const sliceDim = (indices.rank > 1) ? indices.shape[indices.rank -
1] : 1;\n const batchDim = (indices.rank > 1) ? indices.rank - 1 : 1;\n const shapeError = 'Must have
updates.shape = indices.shape[:batchDim] + ` +\n ` shape[sliceDim:], got updates.shape: ${updates.shape}` +\n
`, indices.shape: ${indices.shape}, shape: ${shape}`\n +\n `, sliceDim: ${sliceDim}, and batchDim: ${batchDim}.`;\n if (updates.rank < batchDim) {\n throw new
Error(shapeError + ` update.rank < ${batchDim}.`);\n }\n if (shape.length < sliceDim + (updates.rank -
batchDim)) {\n throw new Error(\n shapeError +\n ` Output shape length < ${sliceDim + (updates.rank -
batchDim)}`);\n }\n if (updates.rank !== batchDim + shape.length - sliceDim) {\n throw new Error(\n
shapeError + ` update.rank != ${batchDim + shape.length - sliceDim}`);\n }\n for (let d = 0; d < batchDim; ++d)
{\n if (updates.shape[d] !== indices.shape[d]) {\n throw new Error(\n shapeError +\n `
updates.shape[${d}] (${updates.shape[d]}) != indices.shape[${d}] (${indices.shape[d]})`);\n }\n }\n for (let d = 0; d < updates.rank - batchDim; ++d) {\n if (updates.shape[d + batchDim] !== shape[d + sliceDim])
{\n throw new Error(\n shapeError +\n ` updates.shape[${d
+ batchDim}] (${updates.shape[d + batchDim]}) != shape[${d + batchDim}] (${shape[d +
batchDim]})`);\n }\n }\n}\n\nexport interface ScatterShapeInfo {\n sliceRank: number;\n numUpdates:
number;\n sliceSize: number;\n strides: number[];\n outputSize: number;\n}\n/**\n * Validate scatter nd inputs.\n
*\n * @param update The tensor contains the update values.\n * @param indices The tensor contains the indices for
the update values.\n * @param shape The shape of the output tensor.\n */\nexport function validateInput(\n
updates: Tensor, indices: Tensor, shape: number[]) {\n if (indices.rank < 1) {\n throw new Error(\n
'tf.scatterND() expects the indices to be rank 1 or higher,' +\n ` but the rank was ${indices.rank}.`);\n }\n if

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(updates.rank < 1) {\n throw new Error(\n `tf.scatterND() expects the updates to be rank 1 or higher,` +\n `but the rank was ${updates.rank}.`);\n }\n if (indices.dtype !== 'int32')\n throw new Error(`The dtype of 'indices' should be int32, but got dtype: ${\n indices.dtype}`);\n }\n if\n (shape.length < 1) {\n throw new Error(\n `Output rank must be greater or equal to 1, but got shape:\n ${shape}`);\n }\n if (shape.length === 0) {\n if (indices.size === 0) {\n throw new Error(`Indices specified\n for empty output. indices shape: ${\n indices.shape}`);\n }\n if (updates.size === 0) {\n throw new\n Error(`Updates specified for empty output. updates shape: ${\n updates.shape}`);\n }\n }\n validateUpdateShape(shape, indices, updates);\n }\n}\n\n/**\n * Calculate the shape information for the output.\n *\n * @param update The tensor contains the update values.\n * @param indices The tensor contains the indices for the\n * update values.\n * @param shape The shape of the output tensor.\n *\n * @returns ScatterShapeInfo\n */\nexport\nfunction calculateShapes(\n updates: TensorInfo, indices: TensorInfo,\n shape:\n number[]): ScatterShapeInfo {\n // Calculate the number of dimensions in indices\n const indicesRank =\n indices.shape.length;\n const sliceRank = (indicesRank > 1) ? indices.shape[indicesRank - 1] : 1;\n // Calculate\n the number of elements that make up each slice of our updated\n // tensor. This allows us to work with flattened\n tensors and copy over whole\n // slices at a time.\n const totalNd = shape.length;\n let sliceSize = 1;\n for (let i =\n sliceRank; i < totalNd; ++i) {\n sliceSize *= shape[i];\n }\n const safeSliceDim = (sliceRank < 1) ? 1 :\n sliceRank;\n const numUpdates = sizeFromShape(indices.shape) / safeSliceDim;\n const strides =\n [...computeStrides(shape.slice(0, sliceRank)), 1];\n const outputSize = sizeFromShape(shape);\n return {sliceRank,\n numUpdates, sliceSize, strides, outputSize};\n}\n\n"/**\n * @license\n * Copyright 2017 Google LLC. All Rights\n * Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not\n * use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\n * OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n * governing permissions and\n * limitations under the License.\n */\n\n=====\n\n*/\nimport {TensorInfo} from '../kernel_registry';\nimport * as util from '../util';\nexport type SliceInfo = {\n nonStrided: boolean,\n $begin: number[],\n $end: number[],\n $strides: number[],\n size: number[],\n newShape:\n number[],\n outShape: number[]\n};\n\nexport function assertParamsValid(\n input: TensorInfo, begin: number[],\n size: number[]): void {\n const inputRank = input.shape.length;\n util.assert(\n inputRank === begin.length,\n () => `Error in slice${inputRank}D: Length of begin ${begin} must`\n `match the rank of the array (${inputRank}).`);\n util.assert(\n inputRank === size.length,\n () => `Error in\n slice${inputRank}D: Length of size ${size} must`\n `match the rank of the array (${inputRank}).`);\n for\n (let i = 0; i < inputRank; ++i) {\n util.assert(\n begin[i] + size[i] <= input.shape[i],\n () => `Error in\n slice${inputRank}D: begin[${i}] + size[${i}]`\n `(${begin[i] + size[i]}) would overflow input.shape[${i}]\n (${input.shape[i]});`\n);\n }\n}\n\n/**\n * Converts a binary mask to an array of axes. Used in stridedSlice().\n */\nexport function maskToAxes(mask: number): number[] {\n const axes = [];\n let axis = 0;\n while (mask > 0)\n {\n if (mask & 1) {\n axes.push(axis);\n }\n mask /= 2;\n axis++;\n }\n return axes;\n}\n\n/**\n * Computes the output shape given the strided\n * slice params.\n */\nexport function computeOutShape(\n begin: number[], end: number[], strides: number[]):\n number[] {\n const size = [];\n for (let axis = 0; axis < begin.length; axis++) {\n size[axis] = Math.ceil((end[axis]\n - begin[axis]) / strides[axis]);\n }\n return size;\n}\n\n// Creates full selection at the elided dimensions. If the\n// dimension matches the ellipsis mask, override the current stride value. Otherwise, insert.\nexport function\n stridesWithElidedDims(\n strides: number[], ellipsisInsertionIndex: number, numElidedAxes: number,\n inputShape: number[]): number[] {\n const newStrides = [...strides];\n for (let i = newStrides.length; i <\n inputShape.length; i++) {\n newStrides.push(1);\n }\n for (let i = 0; i < numElidedAxes; i++) {\n if (i === 0)\n {\n newStrides[ellipsisInsertionIndex] = 1;\n }\n else {\n newStrides.splice(\n ellipsisInsertionIndex, 0 /\n num elements to delete *,\n 1 /* element to add */);\n newStrides.pop();\n }\n }\n }\n}
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 }\n }\n return newStrides;\n}\n\nfunction unnormalizeAxis(\n ellipsisInsertionIndex: number, numElidedAxes:
number,\n normalizedAxis: number): number {\n if (normalizedAxis <= ellipsisInsertionIndex) {\n return
normalizedAxis;\n }\n }\n }\n return normalizedAxis - (numElidedAxes - 1);\n}\n}\n\nfunction
getElidedAxes(numElidedAxes: number, ellipsisInsertionIndex: number) {\n const elidedAxes = [];\n for (let i = 0;
i < numElidedAxes; i++) {\n elidedAxes.push(ellipsisInsertionIndex + i);\n }\n return elidedAxes;\n}\n}\n\n//
Normalize the start, end and strides.\n\nexport function getNormalizedAxes(\n inputShape: number[], ellipsisAxes:
number[], numInterpolatedAxes: number,\n begin: number[], end: number[], strides: number[], beginMask:
number,\n endMask: number,\n ellipsisMask: number): {begin: number[], end: number[], strides: number[]} {\n
const inputRank = inputShape.length;\n let normalizedBegin = new Array(inputRank),\n normalizedEnd =
new Array(inputRank),\n normalizedStrides = new Array(inputRank);\n if (ellipsisAxes.length &&
numInterpolatedAxes > 0) {\n const fullIndex = ellipsisAxes[0];\n // The ellipsis applies to the masked index
as well as any dimensions\n // that are interpolated.\n const numElidedAxes = numInterpolatedAxes + 1;\n
normalizedBegin = startIndicesWithElidedDims(\n beginMask, fullIndex, numElidedAxes, begin,
inputShape);\n normalizedEnd = stopIndicesWithElidedDims(\n endMask, fullIndex, numElidedAxes, end,
inputShape);\n normalizedStrides =\n stridesWithElidedDims(strides, fullIndex, numElidedAxes,
inputShape);\n } else {\n for (let axis = 0; axis < inputRank; axis++) {\n normalizedBegin[axis] =
startForAxis(\n beginMask, begin, strides, inputShape, axis, ellipsisMask);\n normalizedEnd[axis] =\n
stopForAxis(endMask, end, strides, inputShape, axis, ellipsisMask);\n normalizedStrides[axis] =
stridesForAxis(strides,
axis, ellipsisMask);\n }\n }\n }\n return {\n begin: normalizedBegin,\n end: normalizedEnd,\n strides:
normalizedStrides\n };\n}\n}\n\n// Creates full selection at the elided dimensions. If the dimension matches\n// the
ellipsis mask, override the current start value. Otherwise, insert.\n\nexport function startIndicesWithElidedDims(\n
beginMask: number, ellipsisInsertionIndex: number, numElidedAxes: number,\n originalBegin: number[],
inputShape: number[]): number[] {\n const newIndices = [...inputShape];\n const elidedAxes =
getElidedAxes(numElidedAxes, ellipsisInsertionIndex);\n for (let axis = 0; axis < newIndices.length; axis++) {\n
if (elidedAxes.indexOf(axis) > -1) {\n newIndices[axis] = 0;\n } else {\n const originalAxis =\n
unnormalizeAxis(ellipsisInsertionIndex, numElidedAxes, axis);\n let originalValue =
originalBegin[originalAxis];\n if (beginMask & 1 << originalAxis) {\n originalValue = 0;\n }\n }\n
newIndices[axis]
= originalValue;\n }\n }\n return newIndices;\n}\n}\n\n// Creates full selection at the elided dimensions. If the
dimension matches\n// the ellipsis mask, override the current stop value. Otherwise, insert.\n\nexport function
stopIndicesWithElidedDims(\n endMask: number, ellipsisInsertionIndex: number, numElidedAxes: number,\n
originalEnd: number[], inputShape: number[]): number[] {\n const newIndices = [...inputShape];\n const
elidedAxes = getElidedAxes(numElidedAxes, ellipsisInsertionIndex);\n for (let axis = 0; axis <
newIndices.length; axis++) {\n if (elidedAxes.indexOf(axis) > -1) {\n newIndices[axis] =
Number.MAX_SAFE_INTEGER;\n } else {\n const originalAxis =\n
unnormalizeAxis(ellipsisInsertionIndex, numElidedAxes, axis);\n let originalValue =
originalEnd[originalAxis];\n if (endMask & 1 << originalAxis) {\n originalValue =
Number.MAX_SAFE_INTEGER;\n }\n newIndices[axis] = originalValue;\n }\n }\n }\n return
newIndices;\n}\n}\n\n// Handle negative indices\n const axisSize = inputShape[i];\n if
(newIndices[i] < 0) {\n newIndices[i] += axisSize;\n }\n newIndices[i] = util.clamp(0, newIndices[i],
inputShape[i]);\n }\n }\n return newIndices;\n}\n}\n\nexport function stridesForAxis(\n strides: number[], axis: number,
ellipsisMask: number): number {\n let stride = strides[axis];\n if (ellipsisMask & (1 << axis) || stride == null) {\n
stride = 1;\n }\n }\n return stride;\n}\n}\n\nexport function startForAxis(\n beginMask: number, startIndices:
number[], strides: number[],\n inputShape: number[], axis: number, ellipsisMask: number): number {\n // Begin
with the specified index\n let start = startIndices[axis];\n const stride = strides[axis] || 1;\n // Check the axis bit
from right of masked axes, or the begin index is not set\n // for the axis.\n if (beginMask & 1 << axis || ellipsisMask
& 1 << axis || start == null) {\n if (stride

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> 0) {\n // Forward iteration - use the first element. These values will get\n // clamped below (Note: We could
have set them to 0 and axis_size-1, but\n // use lowest() and max() to maintain symmetry with StopForAxis())\n
start = Number.MIN_SAFE_INTEGER;\n } else {\n // Backward iteration - use the last element.\n start =
Number.MAX_SAFE_INTEGER;\n }\n\n // Handle negative indices\n const axisSize = inputShape[axis];\n
if (start < 0) {\n start += axisSize;\n }\n\n // Clamping\n start = util.clamp(0, start, axisSize - 1);\n\n return
start;\n}\n\nexport function stopForAxis(\n endMask: number, stopIndices: number[], strides: number[],\n
inputShape: number[], axis: number, ellipsisMask: number): number {\n // Begin with the specified index\n let stop
= stopIndices[axis];\n const stride = strides[axis] || 1;\n\n // Check the axis bit from right of masked axes, or if the
stop index is not\n // set for this axis.\n if (endMask &
(1 << axis) || ellipsisMask & (1 << axis) || stop == null) {\n if (stride > 0) {\n // Forward iteration - use the last
element. These values will get\n // clamped below\n stop = Number.MAX_SAFE_INTEGER;\n } else {\n
// Backward iteration - use the first element.\n stop = Number.MIN_SAFE_INTEGER;\n }\n }\n\n // Handle
negative indices\n const axisSize = inputShape[axis];\n if (stop < 0) {\n stop += axisSize;\n }\n\n // Clamping\n
// Because the end index points one past the last element, we need slightly\n // different clamping ranges depending
on the direction.\n if (stride > 0) {\n // Forward iteration\n stop = util.clamp(0, stop, axisSize);\n } else {\n //
Backward iteration\n stop = util.clamp(-1, stop, axisSize - 1);\n }\n\n return stop;\n}\n\n/**\n * Returns true if the
slice occupies a continuous set of elements in the\n * 'flat' space.\n */\nexport function isSliceContinuous(\n shape:
number[], begin: number[], size:
number[]) {\n // Index of the first axis that has size > 1.\n let firstNonOneAxis = size.length;\n for (let i = 0; i <
size.length; i++) {\n if (size[i] > 1) {\n firstNonOneAxis = i;\n break;\n }\n }\n\n for (let i =
firstNonOneAxis + 1; i < size.length; i++) {\n if (begin[i] > 0 || size[i] !== shape[i]) {\n return false;\n }\n
 }\n return true;\n}\n\nexport function computeFlatOffset(begin: number[], strides: number[]): number {\n let
flatOffset = begin.length > 0 ? begin[begin.length - 1] : 1;\n for (let i = 0; i < begin.length - 1; i++) {\n flatOffset
+= begin[i] * strides[i];\n }\n return flatOffset;\n}\n\nexport function parseSliceParams(\n x: TensorInfo, begin:
number|number[], size?: number|number[]) {\n // The following logic allows for more ergonomic calls.\n let
begin_: number[];\n const xRank = x.shape.length;\n if (typeof begin === 'number') {\n begin_ = [begin, ...new
Array(xRank - 1).fill(0)];\n } else if (begin.length <
xRank) {\n begin_ = begin.concat(new Array(xRank - begin.length).fill(0));\n } else {\n begin_ =
begin.slice();\n }\n begin_.forEach(d => {\n util.assert(\n d !== -1, () => 'slice() does not support negative
begin indexing.);\n });\n let size_: number[];\n if (size == null) {\n size_ = new Array(xRank).fill(-1);\n } else
if (typeof size === 'number') {\n size_ = [size, ...new Array(xRank - 1).fill(-1)];\n } else if (size.length < xRank)
{\n size_ = size.concat(new Array(xRank - size.length).fill(-1));\n } else {\n size_ = size;\n }\n size_ =
size_.map((d, i) => {\n if (d >= 0) {\n return d;\n } else {\n util.assert(\n d === -1,\n () =>
`Negative size values should be exactly -1 but got ` +\n `${d} for the slice() size at index ${i}.`);\n return
x.shape[i] - begin_[i];\n }\n });\n return [begin_, size_];\n}\n\nexport function sliceInfo(\n xShape: number[],
begin: number[], end: number[],
strides: number[],\n beginMask: number, endMask: number, ellipsisMask: number,\n newAxisMask: number,
shrinkAxisMask: number): SliceInfo {\n // make a copy because it may be modified further down.\n let $begin =
begin.slice();\n let $end = end.slice();\n let $strides = strides;\n\n if (strides == null) {\n $strides = new
Array($begin.length);\n }\n\n const ellipsisAxes = maskToAxes(ellipsisMask);\n if (ellipsisAxes.length > 1) {\n
throw new Error('Multiple ellipses in slice is not allowed.);\n }\n\n if (ellipsisMask !== 0 && newAxisMask !==
0) {\n throw new Error(\n 'Using both ellipsisMask and newAxisMask is not yet supported.);\n }\n\n if
(ellipsisMask !== 0 && shrinkAxisMask !== 0) {\n throw new Error(\n 'Using both ellipsisMask and
shrinkAxisMask is not yet supported.);\n }\n\n const numInterpolatedAxes = xShape.length - $begin.length;\n\n //
Expand the dims of x based on the newAxisMask.\n const expandAxes = maskToAxes(newAxisMask);\n
 const newShape = xShape.slice();\n expandAxes.forEach(axis => {\n $begin[axis] = 0;\n $end[axis] = 1;\n
 });\n newShape.splice(axis, 0, 1);\n });\n\n const {\n begin: normalizedBegin,\n end: normalizedEnd,\n strides:
normalizedStrides\n } =\n getNormalizedAxes(\n newShape, ellipsisAxes, numInterpolatedAxes, $begin,

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Send, $strides, \n beginMask, endMask, ellipsisMask);\n $begin = normalizedBegin;\n $end =
normalizedEnd;\n $strides = normalizedStrides;\n\n const shrinkAxes = maskToAxes(shrinkAxisMask);\n //
Adjust the ends based on the shrink mask.\n shrinkAxes.forEach(axis => {\n $end[axis] = $begin[axis] + 1;\n
$strides[axis] = 1;\n });\n\n // Figure out the output shape.\n const size = computeOutShape($begin, $end,
$strides);\n // Remove the axes based on shrinkMask.\n const outShape = size.filter(, axis) =>
shrinkAxes.indexOf(axis) === -1);\n\n const nonStrided = $strides.every(v => v === 1);\n\n return {nonStrided,
$begin,
 $end, $strides, size, newShape, outShape};\n}\n", "/*\n * @license\n * Copyright 2018 Google LLC. All Rights
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http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n */
=====
*\n\nimport {assert} from './util';\n\n/**\n * Types to support JSON-esque data structures internally.\n *\n *
Internally ConfigDict's use camelCase keys and values where the\n * values are class names to be instantiated. On
the python side, these\n * will be snake_case. Internally we allow Enums into the values for better\n * type safety,
but these need to be converted to raw primitives (usually\n * strings) for round-tripping with python.\n *\n *
toConfig returns the TS-friendly representation. model.toJSON() returns\n * the pythonic version as that's the
portable format. If you need to\n * python-ify a non-model level toConfig output, you'll need to use a\n *
convertTsToPythonic from serialization_utils in -Layers.\n *\n */\n\nexport declare type ConfigDictValue =\nboolean | number | string | null | ConfigDictArray | ConfigDict;\n\nexport declare interface ConfigDict {\n [key:
string]: ConfigDictValue;\n}\n\nexport declare interface ConfigDictArray extends Array<ConfigDictValue>
{\n}\n\n/**\n * Type to represent the class-type of Serializable objects.\n *\n * Is the class prototype with access to
the constructor and any\n * static members/methods. Instance methods are not listed here.\n *\n * Source for
this idea: https://stackoverflow.com/a/43607255\n *\n */\n\nexport declare type SerializableConstructor<T extends
Serializable> = {\n // tslint:disable-next-line:no-any\n new (...args: any[]): T; className: string; fromConfig:
FromConfigMethod<T>;\n};\n\nexport declare type FromConfigMethod<T extends Serializable> =\n (cls:
SerializableConstructor<T>, config: ConfigDict) => T;\n\n/**\n * Serializable defines the serialization contract.\n
*\n * TFJS requires serializable classes to return their className when asked\n * to avoid issues with
minification.\n *\n */\n\nexport abstract class Serializable {\n /**\n * Return the class name for this class to use in
serialization contexts.\n *\n * Generally speaking this will be the same thing that constructor.name\n * would
have returned. However, the class name needs to be robust\n * against minification for serialization/deserialization
to work properly.\n *\n * There's also places such as initializers.VarianceScaling, where\n * implementation
details between different languages led to different\n * class hierarchies and a non-leaf node is used for
serialization purposes.\n *\n */\n getClassName(): string {\n return (this.constructor as
SerializableConstructor<Serializable>).className;\n }\n\n /**\n * Return all the non-weight state needed
to serialize this object.\n *\n */\n abstract getConfig(): ConfigDict;\n\n /**\n * Creates an instance of T from a
ConfigDict.\n *\n * This works for most descendants of serializable. A few need to\n * provide special
handling.\n * @param cls A Constructor for the class to instantiate.\n * @param config The Configuration for the
object.\n */\n /** @nocollapse */\n static fromConfig<T extends Serializable>(\n cls:
SerializableConstructor<T>, config: ConfigDict): T {\n return new cls(config);\n }\n}\n\n/**\n * Maps string
keys to class constructors.\n *\n * Used during (de)serialization from the cross-language JSON format, which\n *
requires the class name in the serialization format matches the class\n * names as used in Python, should it exist.\n
*/\n\nexport class SerializationMap {\n private static instance: SerializationMap;\n classNameMap: {\n
[className: string]:\n [SerializableConstructor<Serializable>, FromConfigMethod<Serializable>]\n };\n\n

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private constructor() {\n this.classNameMap = {};\n }\n\n /**\n * Returns the singleton instance of the map.\n *\n static getMap(): SerializationMap {\n if (SerializationMap.instance == null) {\n SerializationMap.instance = new SerializationMap();\n }\n return SerializationMap.instance;\n }\n\n /**\n * Registers the class as serializable.\n *\n static register<T extends Serializable>(cls: SerializableConstructor<T>) {\n SerializationMap.getMap().classNameMap[cls.className] =\n [cls, cls.fromConfig];\n }\n\n\n /**\n * Register a class with the serialization map of TensorFlow.js.\n *\n * This is often used for registering custom Layers, so they can be\n * serialized and deserialized.\n *\n * Example:\n *\n ```js\n class MyCustomLayer extends tf.layers.Layer {\n static className = 'MyCustomLayer';\n constructor(config) {\n super(config);\n }\n }\n tf.serialization.registerClass(MyCustomLayer);\n ```\n *\n * @param cls The class to be registered. It must have a public static member\n * called `className` defined and the value must be a non-empty string.\n *\n * @doc {heading: 'Models', subheading: 'Serialization', ignoreCI: true}\n *\n export function registerClass<T extends Serializable>(\n cls: SerializableConstructor<T>) {\n assert(\n cls.className != null,\n () => `Class being registered does not have the static className ` +\n `property defined.`);\n assert(\n typeof cls.className === 'string',\n () => `className is required to be a string, but got type ` +\n typeof cls.className);\n assert(\n cls.className.length > 0,\n () => `Class being registered has an empty-string as its className, ` +\n `which is disallowed.`);\n SerializationMap.register(cls);\n }\n\n", "/*\n * @license\n * Copyright 2017 Google LLC. All Rights Reserved.\n *\n Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n http://www.apache.org/licenses/LICENSE-2.0\n *\n Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *\n =====\n *\n import {ENGINE} from './engine';\n import {inferShape} from './tensor_util_env';\n import {RecursiveArray, TensorLike, TypedArray} from './types';\n import {arraysEqual, encodeString, flatten, isString, isTypedArray} from './util';\n \n const TEST_EPSILON_FLOAT32 = 1e-3;\n export const TEST_EPSILON_FLOAT16 = 1e-1;\n \n export function expectArraysClose(\n actual: TypedArray|number|RecursiveArray<number>,\n expected: TypedArray|number|RecursiveArray<number>, epsilon?: number) {\n if (epsilon == null) {\n epsilon = testEpsilon();\n }\n return expectArraysPredicate(\n actual, expected, (a, b) => areClose(a as number, b as number, epsilon));\n }\n \n export function testEpsilon() {\n return ENGINE.backend.floatPrecision() === 32 ? TEST_EPSILON_FLOAT32 :\n TEST_EPSILON_FLOAT16;\n }\n \n function expectArraysPredicate(\n actual: TensorLike, expected: TensorLike,\n predicate: (a: {}, b: {}) => boolean) {\n let checkClassType = true;\n if (isTypedArray(actual) || isTypedArray(expected)) {\n checkClassType = false;\n }\n if (isTypedArray(actual) && isTypedArray(expected)) {\n checkClassType = true;\n }\n if (checkClassType) {\n const aType = actual.constructor.name;\n const bType = expected.constructor.name;\n if (aType !== bType) {\n throw new Error(\n `Arrays are of different type. Actual: ${aType}. ` +\n `Expected: ${bType}`);\n }\n }\n if (Array.isArray(actual) && Array.isArray(expected)) {\n const actualShape = inferShape(actual);\n const expectedShape = inferShape(expected);\n if (!arraysEqual(actualShape, expectedShape)) {\n throw new Error(\n `Arrays have different shapes. ` +\n `Actual: [${actualShape}]. Expected: [${expectedShape}]`);\n }\n }\n const actualFlat =\n isTypedArray(actual) ? actual : flatten(actual as RecursiveArray<number>);\n const expectedFlat =\n isTypedArray(expected) ?\n expected :\n flatten(expected as RecursiveArray<number>);\n if (actualFlat.length !== expectedFlat.length) {\n throw new Error(\n `Arrays have different lengths actual: [${actualFlat.length}] vs ` +\n `expected: [${expectedFlat.length}].\n ` +\n `Actual: [${actualFlat}].\n ` +\n `Expected: [${expectedFlat}]`);\n }\n for (let i = 0; i < expectedFlat.length; ++i) {\n const a = actualFlat[i];\n const e = expectedFlat[i];\n if
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(!predicate(a, e)) {\n throw new Error(`\n `Arrays differ: actual[${i}] = ${a}, expected[${i}] = ${e}.\\n` + \n\n `Actual: ${actualFlat}.\\n` + \n `Expected: ${expectedFlat}`); \n }\n}\n\nexport interface DoneFn
\n(): void;\nfail?: (message?: Error|string) => void;\n\nexport function expectPromiseToFail(fn: () =>
Promise<{}>, done: DoneFn): void {\n fn().then(() => done.fail(), () => done());\n}\n\nexport function
expectArraysEqual(actual: TensorLike, expected: TensorLike) {\n const exp = typeof expected === 'string' || typeof
expected === 'number' ||
typeof expected === 'boolean' ? \n [expected] as number[] : \n expected as number[];\n if ((isString(actual) || isString((actual as string[]) [0])) || \n !isString(expected) || isString((expected as string []) [0])) {\n // tslint:disable-next-line: triple-equals\n return
expectArraysPredicate(actual, exp, (a, b) => a == b);\n } \n return expectArraysPredicate(\n actual, expected, (a,
b) => areClose(a as number, b as number, 0));\n}\n\nexport function expectNumbersClose(a: number, e: number,
epsilon?: number) {\n if (epsilon == null) {\n epsilon = testEpsilon();\n } \n if (!areClose(a, e, epsilon)) {\n throw new Error(` Numbers differ: actual === ${a}, expected === ${e} `);\n } \n}\n\nfunction areClose(a: number, e:
number, epsilon: number): boolean {\n if (!isFinite(a) && !isFinite(e)) {\n return true;\n } \n if (isNaN(a) ||
isNaN(e) || Math.abs(a - e) > epsilon) {\n return false;\n } \n return true;\n}\n\nexport function
expectValuesInRange(\n actual: TypedArray|number[], low: number,
high: number) {\n for (let i = 0; i < actual.length; i++) {\n if (actual[i] < low || actual[i] > high) {\n throw new
Error`\n Value out of range:${actual[i]} low: ${low}, high: ${high}`;\n }\n }\n}\n\nexport function
expectArrayBuffersEqual(\n actual: ArrayBuffer, expected: ArrayBuffer) {\n // Safari & Jasmine don't like
comparing ArrayBuffers directly. Wrapping in
// a Float32Array solves this issue.\n expect(new
Float32Array(actual)).toEqual(new Float32Array(expected));\n}\n\n/** Encodes strings into utf-8 bytes. */\nexport
function encodeStrings(a: RecursiveArray<{}>):\nRecursiveArray<Uint8Array> {\n for (let i = 0; i < (a as
Array<{}>).length; i++) {\n const val = a[i];\n if (Array.isArray(val)) {\n encodeStrings(val);\n } else {\n a[i] = encodeString(val as string);\n }\n }\n return a as RecursiveArray<Uint8Array>;\n}\n\n"/** @license See
the LICENSE file. *\n\n// This code is auto-generated, do not modify this file!\nconst
version = '3.1.0';\nexport { version }; \n","/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in
compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,\nsoftware\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.*\n\n=====*\n\nimport {KernelBackend} from './backends/backend';\nimport {ENGINE, Engine, MemoryInfo, ProfileInfo,
ScopeFn, TimingInfo} from './engine';\nimport {env} from './environment';\nimport {Platform} from
"./platforms/platform";\nimport

{setDeprecationWarningFn, Tensor} from './tensor';\nimport {TensorContainer} from './tensor_types';\nimport
{getTensorsInContainer} from './tensor_util';\n\n/**\n * Enables production mode which disables correctness checks
in favor of performance.\n *\n * @doc {heading: 'Environment'}\n */\nexport function enableProdMode(): void
{\n env.set('PROD', true);\n}\n\n/**\n * Enables debug mode which will log information about all executed
kernels:\n * the elapsed time of the kernel execution, as well as the rank, shape, and\n * size of the output tensor.\n *\n * Debug mode will significantly slow down your application as it will download the result of every
operation to the CPU. This should not be used in production. Debug mode does not affect the timing information
of the kernel execution as we do not measure download time in the kernel execution time.\n *\n * See also:
`tf.profile`, `tf.memory`. \n */\n * @doc {heading: 'Environment'}\n */\nexport function enableDebugMode():
void {\n env.set('DEBUG', true);\n}\n\n/** Globally disables deprecation warnings */\nexport function
disableDeprecationWarnings(): void {\n env.set('DEPRECATION_WARNINGS_ENABLED', false);\n}\nconsole.warn(`TensorFlow.js deprecation warnings have been disabled.`);\n\n/** Warn users about deprecated
functionality. */\nexport function deprecationWarn(msg: string) {\n if
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(env().getBool('DEPRECATION_WARNINGS_ENABLED')) {\n console.warn(\n msg + ' You can disable
deprecation warnings with ' +\n 'tf.disableDeprecationWarnings().');\n
}\n}\nsetDeprecationWarningFn(deprecationWarn);\n\n/**\n * Dispose all variables kept in backend engine.\n *\n *
@doc {heading: 'Environment'}\n */\nexport function disposeVariables(): void {\n
ENGINE.disposeVariables();\n}\n\n/**\n * It returns the global engine that keeps track of all tensors and
backends.\n *\n * @doc {heading: 'Environment'}\n */\nexport function engine(): Engine {\n return
ENGINE;\n}\n\n/**\n * Returns memory
info at the current time in the program. The result is an\n * object with the following properties:\n *\n * -
`numBytes`: Number of bytes allocated (undisposed) at this time.\n * - `numTensors`: Number of unique tensors
allocated.\n * - `numDataBuffers`: Number of unique data buffers allocated\n * (undisposed) at this time, which is
the number of tensors\n * (e.g. `a.reshape(newShape)` makes a new Tensor that shares the same\n * data buffer
with `a`).\n * - `unreliable`: True if the memory usage is unreliable. See `reasons` when\n * `unreliable` is true.\n *
- `reasons`: `string[]`, reasons why the memory is unreliable, present if\n * `unreliable` is true.\n *\n * WebGL
Properties:\n * - `numBytesInGPU`: Number of bytes allocated (undisposed) in the GPU only at\n * this time.\n
*\n * @doc {heading: 'Performance', subheading: 'Memory'}\n */\nexport function memory(): MemoryInfo {\n
return ENGINE.memory();\n}\n\n/**\n * Executes the provided function `f()` and returns
a promise that resolves\n * with information about the function's memory use:\n *\n * - `newBytes`: the number of new
bytes allocated\n * - `newTensors`: the number of new tensors created\n * - `peakBytes`: the peak number of bytes
allocated\n * - `kernels`: an array of objects for each kernel involved that reports\n * their input and output shapes,
number of bytes used, and number of new\n * tensors created.\n * - `kernelNames`: an array of unique strings with
just the names of the\n * kernels in the `kernels` array.\n *\n * ```js\n * const profile = await tf.profile() => {\n *
const x = tf.tensor1d([1, 2, 3]);\n * let x2 = x.square();\n * x2.dispose();\n * x2 = x.square();\n * x2.dispose();\n
* return x;\n * };\n *\n * console.log(`newBytes: ${profile.newBytes}`);\n * console.log(`newTensors:
${profile.newTensors}`);\n * console.log(`byte usage over all kernels: ${profile.kernels.map(k =>\n *
k.totalBytesSnapshot)`});\n * ```\n *\n * @doc {heading: 'Performance', subheading:
'Profile'}\n */\nexport function profile(f: () => (TensorContainer | Promise<TensorContainer>)):\n
Promise<ProfileInfo> {\n return ENGINE.profile(f);\n}\n\n/**\n * Executes the provided function `fn` and after it
is executed, cleans up all\n * intermediate tensors allocated by `fn` except those returned by `fn`. \n * `fn` must not
return a Promise (async functions not allowed). The returned\n * result can be a complex object.\n *\n * Using this
method helps avoid memory leaks. In general, wrap calls to\n * operations in `tf.tidy` for automatic memory
cleanup.\n *\n * NOTE: Variables do *not* get cleaned up when inside a tidy(). If you want to\n * dispose variables,
please use `tf.disposeVariables` or call `dispose()`\n * directly on variables.\n *\n * ```js\n * // y = 2 ^ 2 + 1\n * const
y = tf.tidy(() => {\n * // a, b, and one will be cleaned up when the tidy ends.\n * const one = tf.scalar(1);\n *
const a = tf.scalar(2);\n * const b = a.square();\n *\n * console.log('numTensors
(in tidy): ' + tf.memory().numTensors);\n *\n * // The value returned inside the tidy function will return\n * //
through the tidy, in this case to the variable y.\n * return b.add(one);\n * });\n *\n * console.log('numTensors
(outside tidy): ' + tf.memory().numTensors);\n * y.print();\n * ```\n *\n * @param nameOrFn The name of the
closure, or the function to execute.\n * If a name is provided, the 2nd argument should be the function.\n * If
debug mode is on, the timing and the memory usage of the function\n * will be tracked and displayed on the
console using the provided name.\n * @param fn The function to execute.\n *\n * @doc {heading: 'Performance',
subheading: 'Memory'}\n */\nexport function tidy<T extends TensorContainer>(\n nameOrFn: string|ScopeFn<T>,\n
fn?: ScopeFn<T>): T {\n return ENGINE.tidy(nameOrFn, fn);\n}\n\n/**\n * Disposes any `tf.Tensor`'s found within
the provided object.\n *\n * @param container an object that may be a `tf.Tensor`
or may directly\n * contain `tf.Tensor`'s, such as a `Tensor[]` or `{key: Tensor, ...}`. If\n * the object is not a
`tf.Tensor` or does not contain `Tensors`, nothing\n * happens. In general it is safe to pass any object here, except
that\n * `Promise`'s are not supported.\n *\n * @doc {heading: 'Performance', subheading: 'Memory'}\n */\nexport
function dispose(container: TensorContainer) {\n const tensors = getTensorsInContainer(container);\n
tensors.forEach(tensor => tensor.dispose());\n}\n\n/**\n * Keeps a `tf.Tensor` generated inside a `tf.tidy` from being
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disposed\n * automatically.\n *\n * ```js\n * let b;\n * const y = tf.tidy(() => {\n * const one = tf.scalar(1);\n * const a = tf.scalar(2);\n * // b will not be cleaned up by the tidy. a and one will be cleaned up\n * // when the tidy ends.\n * b = tf.keep(a.square());\n * console.log('numTensors (in tidy): ' + tf.memory().numTensors);\n * }\n * // The value returned inside the tidy function\n * will return\n * // through the tidy, in this case to the variable y.\n * return b.add(one);\n * });\n *\n * console.log('numTensors (outside tidy): ' + tf.memory().numTensors);\n * console.log('y:');\n * y.print();\n *\n * console.log('b:');\n * b.print();\n * ```\n *\n * @param result The tensor to keep from being disposed.\n *\n * @doc {heading: 'Performance', subheading: 'Memory'}\n */\nexport function keep<T extends Tensor>(result: T): T {\n return ENGINE.keep(result);\n}\n\n/**\n * Executes `f()` and returns a promise that resolves with timing\n * information.\n *\n * The result is an object with the following properties:\n *\n * - `wallMs`: Wall execution time.\n *\n * - `kernelMs`: Kernel execution time, ignoring data transfer. If using the\n * WebGL backend and the query timer extension is not available, this will\n * return an error object.\n *\n * - On `WebGL` The following additional properties exist:\n *\n * - `uploadWaitMs`: CPU blocking time on texture uploads.\n *\n * - `downloadWaitMs`: CPU blocking time on texture downloads (readPixels).\n *\n * ```js\n * const x = tf.randomNormal([20, 20]);\n * const time = await tf.time(() => x.matMul(x));\n * console.log(`kernelMs: ${time.kernelMs}, wallTimeMs: ${time.wallMs}`);\n * ```\n *\n * @param f The function to execute and time.\n *\n * @doc {heading: 'Performance', subheading: 'Timing'}\n */\nexport function time(f: () => void): Promise<TimingInfo> {\n return ENGINE.time(f);\n}\n\n/**\n * Sets the backend (cpu, webgl, wasm, etc) responsible for creating tensors and\n * executing operations on those tensors. Returns a promise that resolves\n * to a boolean if the backend initialization was successful.\n *\n * Note this disposes the current backend, if any, as well as any tensors\n * associated with it. A new backend is initialized, even if it is of the\n * same type as the previous one.\n *\n * @param backendName The name of the backend. Currently supports\n * `webgl`|`cpu` in the browser, `tensorflow` under node.js\n * (requires tfjs-node), and `wasm` (requires tfjs-backend-wasm).\n *\n * @doc {heading: 'Backends'}\n */\nexport function setBackend(backendName: string): Promise<boolean> {\n return ENGINE.setBackend(backendName);\n}\n\n/**\n * Returns a promise that resolves when the currently selected backend (or the\n * highest priority one) has initialized. Await this promise when you are using\n * a backend that has async initialization.\n *\n * @doc {heading: 'Backends'}\n */\nexport function ready(): Promise<void> {\n return ENGINE.ready();\n}\n\n/**\n * Returns the current backend name (cpu, webgl, etc). The backend is\n * responsible for creating tensors and executing operations on those tensors.\n *\n * @doc {heading: 'Backends'}\n */\nexport function getBackend(): string {\n return ENGINE.backendName;\n}\n\n/**\n * Removes a backend and the registered factory.\n *\n * @doc {heading: 'Backends'}\n */\nexport function removeBackend(name: string): void {\n ENGINE.removeBackend(name);\n}\n\n/**\n * Finds the backend registered under the provided name. Returns null if the\n * name is not in the registry, or the registration hasn't finished yet.\n *\n * @doc {heading: 'Backends'}\n */\nexport function findBackend(name: string): KernelBackend | null {\n return ENGINE.findBackend(name);\n}\n\n/**\n * Finds the backend factory registered under the provided name. Returns a\n * function that produces a new backend when called. Returns null if the name\n * is not in the registry.\n *\n * @doc {heading: 'Backends'}\n */\nexport function findBackendFactory(name: string): () => KernelBackend | Promise<KernelBackend> {\n return ENGINE.findBackendFactory(name);\n}\n\n/**\n * Registers a global backend. The registration should happen when importing\n * a module file (e.g. when importing `backend_webgl.ts`), and is used for\n * modular builds (e.g. custom tfjs bundle with only webgl support).\n *\n * @param factory The backend factory function. When called, it should\n * return a backend instance, or a promise of an instance.\n *\n * @param priority The priority of the backend (higher = more important).\n * In case multiple backends are registered, the priority is used to find\n * the best backend. Defaults to 1.\n * @return False if there is already a registered backend under this name,\n * true if not.\n *\n * @doc {heading: 'Backends'}\n */\nexport function registerBackend(\n name: string,\n factory: () => KernelBackend | Promise<KernelBackend>,\n priority = 1): boolean {\n return ENGINE.registerBackend(name, factory, priority);\n}\n\n/**\n * Gets the current backend. If no backends have been initialized, this will\n * attempt to initialize the best backend. Will throw an error if the\n * highest priority backend has async initialization, in which case, you should call\n * 'await tf.ready()' before

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running other code.\n *\n * @doc {heading: 'Backends'}\n */\nexport function backend(): KernelBackend {\n return
ENGINE.backend;\n}\n\n/**\n * Sets the global platform.\n *\n * @param platformName The
name of this platform.\n *\n * @param platform A platform implementation.\n */\nexport function
setPlatform(platformName: string, platform: Platform) {\n env().setPlatform(platformName, platform);\n}\n\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version
2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n */

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\n
*/\nimport {ENGINE} from '../engine';\nimport {Add, AddInputs} from '../kernel_names';\nimport
{Tensor} from '../tensor';\nimport {NamedTensorMap} from '../tensor_types';\nimport {makeTypesMatch} from
 '../tensor_util';\nimport {convertToTensor} from '../tensor_util_env';\nimport {TensorLike} from '../types';\nimport
{op} from '../operation';\n\n/**\n * Adds two `tf.Tensor`s element-wise, A + B. Supports broadcasting.\n *\n *\n * ``js\n * const a = tf.tensor1d([1, 2, 3, 4]);\n * const b = tf.tensor1d([10, 20, 30, 40]);\n *\n * a.add(b).print(); // or
tf.add(a, b)\n *\n * ``\n * ``js\n * // Broadcast add a with b.\n * const a = tf.scalar(5);\n * const b = tf.tensor1d([10,
20, 30, 40]);\n *\n * a.add(b).print(); // or tf.add(a, b)\n *\n * ``\n *\n * @param a The first `tf.Tensor` to add.\n * @param
b The second `tf.Tensor` to add. Must have the same type as `a`.\n *\n * @doc {heading: 'Operations', subheading:
'Arithmetic'}\n */\nfunction add_<T extends Tensor>(a: Tensor|TensorLike, b: Tensor|TensorLike): T {\n let $a =
convertToTensor(a, 'a', 'add');\n let $b =
convertToTensor(b, 'b', 'add');\n [$a, $b] = makeTypesMatch($a, $b);\n\n const inputs: AddInputs = {a: $a, b:
$b};\n\n return ENGINE.runKernel(Add, inputs as {} as NamedTensorMap);\n}\n\nexport const add =
op({add_});\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n */

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\n
*/\nimport {ENGINE} from '../engine';\nimport {FloorDiv,
FloorDivInputs} from '../kernel_names';\nimport {Tensor} from '../tensor';\nimport {NamedTensorMap} from
 '../tensor_types';\nimport {makeTypesMatch} from '../tensor_util';\nimport {convertToTensor} from
 '../tensor_util_env';\nimport {TensorLike} from '../types';\nimport {op} from '../operation';\n\n/**\n * Divides two
`tf.Tensor`s element-wise, A / B. Supports broadcasting.\n *\n * The result is rounded with floor function.\n *\n *\n * ``js\n * const a = tf.tensor1d([1, 4, 9, 16]);\n * const b = tf.tensor1d([1, 2, 3, 4]);\n *\n * a.floorDiv(b).print(); // or
tf.div(a, b)\n *\n * ``\n * ``js\n * // Broadcast div a with b.\n * const a = tf.tensor1d([2, 4, 6, 8]);\n * const b =
tf.scalar(2);\n *\n * a.floorDiv(b).print(); // or tf.floorDiv(a, b)\n *\n * ``\n *\n * @param a The first tensor as the
numerator.\n * @param b The second tensor as the denominator. Must have the same dtype as\n * `a`.\n *\n * @doc
{heading: 'Operations', subheading: 'Arithmetic'}\n */\nfunction floorDiv_<T extends
Tensor>(\n a: Tensor|TensorLike, b: Tensor|TensorLike): T {\n let $a = convertToTensor(a, 'a', 'floorDiv');\n let
$b = convertToTensor(b, 'b', 'floorDiv');\n [$a, $b] = makeTypesMatch($a, $b);\n\n const inputs: FloorDivInputs =
{a: $a, b: $b};\n\n return ENGINE.runKernel(FloorDiv, inputs as {} as NamedTensorMap);\n}\n\nexport const
floorDiv = op({floorDiv_});\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n *
Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in
compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,

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software\n \* distributed under the License is distributed on an \"AS IS\" BASIS,\n \* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*

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=====\\n
*\\n\\nimport {ENGINE} from '../engine';\\nimport {RealDiv, RealDivInputs} from '../kernel_names';\\nimport
{Tensor} from '../tensor';\\nimport {NamedTensorMap} from '../tensor_types';\\nimport {makeTypesMatch} from
 '../tensor_util';\\nimport {convertToTensor} from '../tensor_util_env';\\nimport {TensorLike} from '../types';\\n\\nimport
{floorDiv} from '../floorDiv';\\nimport {op} from '../operation';\\n\\n/**\\n * Divides two `tf.Tensor`s element-wise, A /
B. Supports broadcasting.\\n *\\n * ```js\\n * const a = tf.tensor1d([1, 4, 9, 16]);\\n * const b = tf.tensor1d([1, 2, 3, 4]);\\n
*\\n * a.div(b).print(); // or tf.div(a, b)\\n * ```\\n *\\n * // Broadcast div a with b.\\n * const a = tf.tensor1d([2,
4, 6, 8]);\\n * const b = tf.scalar(2);\\n *\\n * a.div(b).print(); // or tf.div(a, b)\\n * ```\\n *\\n * @param a The first tensor
as the numerator.\\n * @param b The second tensor as the denominator. Must have
the same dtype as `a`.\\n *\\n * @doc {heading: 'Operations', subheading: 'Arithmetic'}\\n */\\nfunction div_<T
extends Tensor>(a: Tensor|TensorLike, b: Tensor|TensorLike): T {\\n let $a = convertToTensor(a, 'a', 'div');\\n let $b
= convertToTensor(b, 'b', 'div');\\n [$a, $b] = makeTypesMatch($a, $b);\\n if ($a.dtype === 'int32' && $b.dtype
=== 'int32') {\\n return floorDiv($a, $b);\\n }\\n const inputs: RealDivInputs = {a: $a, b: $b};\\n const attrs =
{};\\n // tslint:disable-next-line: no-unnecessary-type-assertion\\n return ENGINE.runKernel(RealDiv, inputs as { }
as NamedTensorMap, attrs) as T;\\n}\\n\\nexport const div = op({div_});\\n", "/*\\n * @license\\n * Copyright 2020
Google LLC. All Rights Reserved.\\n * Licensed under the Apache License, Version 2.0 (the \"License\");\\n * you
may not use this file except in compliance with the License.\\n * You may obtain a copy of the License at\\n *\\n *
http://www.apache.org/licenses/LICENSE-2.0\\n *\\n * Unless required by applicable law
or agreed to in writing, software\\n * distributed under the License is distributed on an \"AS IS\" BASIS,\\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\\n * See the License for
the specific language governing permissions and\\n * limitations under the License.\\n *
```

```
=====\\n
*\\n\\nimport {ENGINE} from '../engine';\\nimport {Multiply, MultiplyInputs} from '../kernel_names';\\nimport
{Tensor} from '../tensor';\\nimport {NamedTensorMap} from '../tensor_types';\\nimport {makeTypesMatch} from
 '../tensor_util';\\nimport {convertToTensor} from '../tensor_util_env';\\nimport {TensorLike} from '../types';\\n\\nimport
{op} from '../operation';\\n\\n/**\\n * Multiplies two `tf.Tensor`s element-wise, A * B. Supports broadcasting.\\n *\\n *
We also expose `tf.mulStrict` which has the same signature as this op and\\n * asserts that `a` and `b` are the same
shape (does not broadcast).\\n *\\n * ```js\\n * const a = tf.tensor1d([1,
2, 3, 4]);\\n * const b = tf.tensor1d([2, 3, 4, 5]);\\n *\\n * a.mul(b).print(); // or tf.mul(a, b)\\n * ```\\n *\\n * //
Broadcast mul a with b.\\n * const a = tf.tensor1d([1, 2, 3, 4]);\\n * const b = tf.scalar(5);\\n *\\n * a.mul(b).print(); //
or tf.mul(a, b)\\n * ```\\n *\\n * @param a The first tensor to multiply.\\n * @param b The second tensor to multiply. Must
have the same dtype as `a`.\\n *\\n * @doc {heading: 'Operations', subheading: 'Arithmetic'}\\n */\\nfunction mul_<T
extends Tensor>(a: Tensor|TensorLike, b: Tensor|TensorLike): T {\\n let $a = convertToTensor(a, 'a', 'mul');\\n let
$b = convertToTensor(b, 'b', 'mul');\\n [$a, $b] = makeTypesMatch($a, $b);\\n const inputs: MultiplyInputs = {a:
$a, b: $b};\\n return ENGINE.runKernel(Multiply, inputs as { } as NamedTensorMap);\\n}\\n\\nexport const mul =
op({mul_});\\n", "/*\\n * @license\\n * Copyright 2018 Google LLC. All Rights Reserved.\\n * Licensed under the
Apache License, Version 2.0 (the \"License\");\\n * you may not use
this file except in compliance with the License.\\n * You may obtain a copy of the License at\\n *\\n *
http://www.apache.org/licenses/LICENSE-2.0\\n *\\n * Unless required by applicable law or agreed to in writing,
software\\n * distributed under the License is distributed on an \"AS IS\" BASIS,\\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\\n * See the License for the specific language
governing permissions and\\n * limitations under the License.\\n *
```

```
=====\\n
*\\n\\nimport {ENGINE} from '../engine';\\nimport {Abs, AbsInputs, ComplexAbs, ComplexAbsInputs} from
```

```

../kernel_names';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport
{convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\n\nimport {op} from
'/operation';\n\n/**\n * Computes absolute value element-wise: `abs(x)`\n * \n * ```js\n * const x = tf.tensor1d([-1, 2,
-3,
4]);\n * \n * x.abs().print(); // or tf.abs(x)\n * ```\n * @param x The input `tf.Tensor`.\n * \n * @doc {heading:
'Operations', subheading: 'Basic math'}\n */\nfunction abs_<T extends Tensor>(x: T|TensorLike): T {\n const $x =
convertToTensor(x, 'x', 'abs');\n\n if ($x.dtype === 'complex64') {\n const inputs: ComplexAbsInputs = {x: $x};\n\n
return ENGINE.runKernel(ComplexAbs, inputs as {} as NamedTensorMap);\n } else {\n const inputs:
AbsInputs = {x: $x};\n return ENGINE.runKernel(Abs, inputs as {} as NamedTensorMap);\n }\n}\n\nexport
const abs = op({abs_});\n\n"/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed
under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is
distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n */

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=====\\n
*\\n\\nimport {ENGINE} from './engine';\\nimport {Acosh, AcoshInputs} from './kernel_names';\\nimport {Tensor}
from './tensor';\\nimport {NamedTensorMap}
from './tensor_types';\\nimport {convertToTensor} from './tensor_util_env';\\nimport {TensorLike} from
'./types';\\n\\nimport {op} from './operation';\\n\\n/**\\n * Computes the inverse hyperbolic cos of the input `tf.Tensor`
element-wise:\\n * `acosh(x)`\\n * \\n * ``js\\n * const x = tf.tensor1d([10, 1, 3, 5.7]);\\n * \\n * x.acosh().print(); // or
tf.acosh(x)\\n * ``\\n * @param x The input tensor.\\n * \\n * @doc {heading: 'Operations', subheading: 'Basic math'}\\n
*/\\nfunction acosh_<T extends Tensor>(x: T|TensorLike): T {\\n const $x = convertToTensor(x, 'x', 'acosh');\\n
const inputs: AcoshInputs = {x: $x};\\n\\n return ENGINE.runKernel(Acosh, inputs as {} as
NamedTensorMap);\\n}\\n\\nexport const acosh = op({acosh_});\\n"/**\\n * @license\\n * Copyright 2020 Google LLC.
All Rights Reserved.\\n * Licensed under the Apache License, Version 2.0 (the "License");\\n * you may not use this
file except in compliance with the License.\\n * You may obtain a copy of the License at\\n * \\n *
http://www.apache.org/licenses/LICENSE-2.0\\n
*\\n * Unless required by applicable law or agreed to in writing, software\\n * distributed under the License is
distributed on an "AS IS" BASIS,\\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
express or implied.\\n * See the License for the specific language governing permissions and\\n * limitations under

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the License.\n \*

```
=====
*\nimport {ENGINE} from './engine';\nimport {AddN, AddNInputs} from './kernel_names';\nimport {Tensor}
from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from
'./tensor_util_env';\nimport {TensorLike} from './types';\nimport * as util from './util';\n\nimport {op} from
'./operation';\n\n/**\n * Adds a list of `tf.Tensor`s element-wise, each with the same shape and dtype.\n * \n * ```\n * const a = tf.tensor1d([1, 2]);\n * const b = tf.tensor1d([3, 4]);\n * const c = tf.tensor1d([5, 6]);\n * \n * tf.addN([a,
b, c]).print();\n * ```\n * @param tensors A list of tensors with the same shape and dtype.\n * @doc {heading:
'Operations', subheading: 'Arithmetic'}\n *\nfunction addN_<T extends Tensor>(tensors: Array<T|TensorLike>): T
{\n util.assert(\n Array.isArray(tensors),\n () => "The argument passed to tf.addN() must be a list of
tensors");\n util.assert(\n tensors.length >= 1,\n () => `Must pass at least one tensor to tf.addN(), but got ` +\n
`${tensors.length}`);\n\n const $tensors =\n tensors.map((t, i) => convertToTensor(t, `tensors${i}`),
'addN');\n\n const firstTensor = $tensors[0];\n $tensors.forEach(t => {\n if (t.dtype !== firstTensor.dtype) {\n
throw new Error(\n 'All tensors passed to tf.addN() must have the same dtype');\n }\n });\n\n $tensors.forEach(t => {\n if (!util.arraysEqual(t.shape, firstTensor.shape)) {\n
throw new Error(\n 'All
tensors passed to tf.addN() must have the same shape');\n }\n });\n\n const inputs: AddNInputs = $tensors;\n\n return ENGINE.runKernel(AddN, inputs as {} as
NamedTensorMap);\n}\n\nexport const addN = op({addN_});\n", "/**\n * @license\n * Copyright 2020 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not
use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
```

```
=====
*\n\nimport {ENGINE} from './engine';\nimport {All, AllAttrs, AllInputs} from './kernel_names';\nimport
{NamedAttrMap}
from './kernel_registry';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from
'./tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from
'./types';\n\nimport {op} from './operation';\n\n/**\n * Computes the logical and of elements across dimensions of a
`tf.Tensor`.\n * \n * Reduces the input along the dimensions given in `axes`. Unless `keepDims` \n * is true, the rank
of the `tf.Tensor` is reduced by 1 for each entry in \n * `axes`. If `keepDims` is true, the reduced dimensions are
retained with \n * length 1. If `axes` has no entries, all dimensions are reduced, and an \n * `tf.Tensor` with a single
element is returned.\n * \n * ```\n * const x = tf.tensor1d([1, 1, 1], 'bool');\n * \n * x.all().print(); // or tf.all(x)\n *
```\n * \n * ```\n * const x = tf.tensor2d([1, 1, 0, 0], [2, 2], 'bool');\n * \n * const axis = 1;\n * x.all(axis).print(); // or
tf.all(x, axis)\n * ```\n * \n * @param x The input tensor. Must be of dtype bool.\n * \n * @param axis The dimension(s) to reduce. By default it reduces \n * all dimensions.\n * \n * @param keepDims If
true, retains reduced dimensions with size 1.\n * \n * @doc {heading: 'Operations', subheading: 'Reduction'}\n *\nfunction all_<T extends Tensor>(\n  x: Tensor|TensorLike, axis: number|number[] = null, keepDims = false): T
{\n  const $x = convertToTensor(x, 'x', 'all', 'bool');\n\n  const inputs: AllInputs = {x: $x};\n  const attrs: AllAttrs =
{axis, keepDims};\n\n  return ENGINE.runKernel(\n    All, inputs as {} as NamedTensorMap, attrs as {} as
NamedAttrMap);\n}\n\nexport const all = op({all_});\n", "/**\n * @license\n * Copyright 2020 Google LLC. All
Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR
CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing
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permissions and\n * limitations under the License.\n *

```
=====\n
*\n\nimport {ENGINE} from '../engine';\nimport {Any, AnyAttrs, AnyInputs} from '../kernel_names';\nimport
{NamedAttrMap} from '../kernel_registry';\nimport {Tensor} from '../tensor';\nimport {NamedTensorMap} from
 '../tensor_types';\nimport {convertToTensor} from '../tensor_util_env';\nimport {TensorLike} from
 '../types';\n\nimport {op} from '../operation';\n\n/**\n * Computes the logical or of elements across dimensions of a
`tf.Tensor`.\n * \n * Reduces the input along the dimensions given in `axes`. Unless `keepDims`\n * is true, the rank
of the `tf.Tensor` is reduced by 1 for each entry in\n * `axes`. If `keepDims` is true, the reduced dimensions are
retained with\n * length 1. If `axes` has no entries, all dimensions are reduced, and an\n * `tf.Tensor` with a single
element is returned.\n * \n * ```\n * const x = tf.tensor1d([1, 1, 1], 'bool');\n * \n * x.any().print(); // or tf.any(x)\n *
```\n * \n * ```\n * const x = tf.tensor2d([1, 1, 0, 0], [2, 2], 'bool');\n * \n * const axis = 1;\n * \n * x.any(axis).print(); //
or tf.any(x, axis)\n * ```\n * \n * @param x The input tensor. Must be of dtype bool.\n * \n * @param axis The
dimension(s) to reduce. By default it reduces\n * all dimensions.\n * \n * @param keepDims If true, retains reduced
dimensions with size 1.\n * \n * @doc {heading: 'Operations', subheading: 'Reduction'}\n */\n\nfunction any_<T
extends Tensor>(\n x: Tensor|TensorLike, axis: number|number[] = null, keepDims = false): T {\n const $x =
convertToTensor(x, 'x', 'any', 'bool');\n \n const inputs: AnyInputs = {x: $x};\n const attrs: AnyAttrs = {axis,
keepDims};\n \n return ENGINE.runKernel(\n Any, inputs as { } as NamedTensorMap,\n attrs as { } as NamedAttrMap);\n }\n \n // tslint:disable-next-line:variable-name\n export const any =
op({any_});\n \n /**\n * \n * @license\n * Copyright 2020 Google Inc. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
```

```
=====\n
*\n\nimport {ENGINE} from '../engine';\nimport {ArgMax, ArgMaxAttrs, ArgMaxInputs} from
 '../kernel_names';\nimport {NamedAttrMap} from '../kernel_registry';\nimport
{Tensor} from '../tensor';\nimport {NamedTensorMap} from '../tensor_types';\nimport {convertToTensor} from
 '../tensor_util_env';\nimport {TensorLike} from '../types';\n\nimport {op} from '../operation';\n\n/**\n * Returns the
indices of the maximum values along an `axis`.\n * \n * The result has the same shape as `input` with the dimension
along `axis`\n * removed.\n * \n * ```\n * const x = tf.tensor1d([1, 2, 3]);\n * \n * x.argmax().print(); // or
tf.argmax(x)\n * ```\n * \n * ```\n * const x = tf.tensor2d([1, 2, 4, 3], [2, 2]);\n * \n * const axis = 1;\n *
x.argmax(axis).print(); // or tf.argmax(x, axis)\n * ```\n * \n * @param x The input tensor.\n * \n * @param axis The
dimension to reduce. Defaults to 0 (outer-most dimension).\n * \n * @doc {heading: 'Operations', subheading:
'Reduction'}\n */\n\nfunction argMax_<T extends Tensor>(\n x: Tensor|TensorLike, axis = 0): T {\n const $x =
convertToTensor(x, 'x', 'argMax');\n \n const inputs: ArgMaxInputs = {x: $x};\n const attrs: ArgMaxAttrs
= {axis};\n \n return ENGINE.runKernel(\n ArgMax, inputs as { } as NamedTensorMap, attrs as { } as
NamedAttrMap);\n }\n \n export const argMax = op({argMax_});\n \n /**\n * \n * @license\n * Copyright 2020 Google
Inc. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not
use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
```

```
=====\n
*\n\nimport {ENGINE} from '../engine';\nimport {ArgMin, ArgMinAttrs, ArgMinInputs} from
 '../kernel_names';\nimport
```

```
{NamedAttrMap} from './kernel_registry';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from
'./tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from
'./types';\n\nimport {op} from './operation';\n\n/**\n * Returns the indices of the minimum values along an `axis`.\n
*\n * The result has the same shape as `input` with the dimension along `axis` removed.\n
*\n * ``js\n * const x
= tf.tensor1d([1, 2, 3]);\n * x.argMin().print(); // or tf.argMin(x)\n * ``\n * ``js\n * const x = tf.tensor2d([1,
2, 4, 3], [2, 2]);\n * const axis = 1;\n * x.argMin(axis).print(); // or tf.argMin(x, axis)\n * ``\n * \n * @param x
The input tensor.\n * @param axis The dimension to reduce. Defaults to 0 (outer-most dimension).\n
*\n * @doc
{heading: 'Operations', subheading: 'Reduction'}\n
\nfunction argMin_<T extends Tensor>(x: Tensor|TensorLike,
axis = 0): T {\n const $x = convertToTensor(x, 'x', 'argMin');\n const inputs:
ArgMinInputs = {x: $x};\n const attrs: ArgMinAttrs = {axis};\n return ENGINE.runKernel(\n ArgMin,
inputs as {} as NamedTensorMap, attrs as {} as NamedAttrMap);\n}\n\nexport const argMin =
op({argMin_});\n", "/*\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * \n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
```

```
=====\n
*\n\nimport {ENGINE} from './engine';\nimport {Asin, AsinInputs}
from './kernel_names';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from
'./tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from
'./types';\n\nimport {op} from './operation';\n\n/**\n * Computes asin of the input `tf.Tensor` element-wise:
`asin(x)`\n
*\n * ``js\n * const x = tf.tensor1d([0, 1, -1, .7]);\n * x.asin().print(); // or tf.asin(x)\n * ``\n
*\n * @param x The input tensor.\n * @doc {heading: 'Operations', subheading: 'Basic math'}\n
\nfunction asin_<T
extends Tensor>(x: T|TensorLike): T {\n const $x = convertToTensor(x, 'x', 'asin');\n const inputs: AsinInputs =
{x: $x};\n return ENGINE.runKernel(Asin, inputs as {} as NamedTensorMap);\n}\n\nexport const asin =
op({asin_});\n", "/*\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy
of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n
*\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n
*\n\nimport {ENGINE} from './engine';\nimport {Asinh, AsinhInputs} from './kernel_names';\nimport {Tensor}
from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from
'./tensor_util_env';\nimport {TensorLike} from './types';\n\nimport {op} from './operation';\n\n/**\n * Computes
inverse hyperbolic sin of the input `tf.Tensor` element-wise:\n
*\n * `asinh(x)`\n
*\n * ``js\n * const x = tf.tensor1d([0,
1, -1, .7]);\n * x.asinh().print(); // or tf.asinh(x)\n * ``\n
*\n * @param x The input tensor.\n * \n * @doc {heading: 'Operations', subheading: 'Basic math'}\n
\nfunction
asinh_<T extends Tensor>(x: T|TensorLike): T {\n const $x = convertToTensor(x, 'x', 'asinh');\n const inputs:
AsinhInputs = {x: $x};\n return ENGINE.runKernel(Asinh, inputs as {} as NamedTensorMap);\n}\n\nexport const
asinh = op({asinh_});\n", "/*\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed
under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * \n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
```

implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*

```
=====\n
*\n\nimport {ENGINE} from '../engine';\nimport {Atan, AtanInputs} from '../kernel_names';\nimport {Tensor}
from '../tensor';\nimport {NamedTensorMap} from '../tensor_types';\nimport {convertToTensor} from
 '../tensor_util_env';\nimport {TensorLike} from '../types';\n\nimport {op} from './operation';\n\n/**\n * Computes
atan of the input `tf.Tensor` element-wise: `atan(x)`\n\n * ```\n * const x = tf.tensor1d([0, 1, -1, .7]);\n\n *
x.atan().print(); // or tf.atan(x)\n\n * ```\n * @param x The input tensor.\n\n * @doc {heading: 'Operations',
subheading: 'Basic math'}\n\n * \nfunction atan_<T extends Tensor>(x: T|TensorLike): T {\n const $x =
convertToTensor(x, 'x', 'atan');\n\n const inputs: AtanInputs = {x: $x};\n\n return ENGINE.runKernel(Atan, inputs
as { } as NamedTensorMap);\n}\n\nexport const atan = op({atan_});\n", "/*\n * @license\n * Copyright 2020 Google
LLC. All Rights Reserved.\n * Licensed under
the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n\n * http://www.apache.org/licenses/LICENSE-2.0\n\n * Unless
required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
```

```
=====\n
*\n\nimport {ENGINE} from '../engine';\nimport {Atan2, Atan2Inputs} from '../kernel_names';\nimport {Tensor}
from '../tensor';\nimport {NamedTensorMap} from '../tensor_types';\nimport {makeTypesMatch} from
 '../tensor_util';\nimport {convertToTensor} from '../tensor_util_env';\nimport {TensorLike} from '../types';\n\nimport
{op} from './operation';\n\n/**\n * Computes
arctangent of `tf.Tensor`s a / b element-wise: `atan2(a, b)`\n\n * Supports broadcasting.\n\n * ```\n * const a =
tf.tensor1d([1.0, 1.0, -1.0, .7]);\n\n * const b = tf.tensor1d([2.0, 13.0, 3.5, .21]);\n\n * \n * tf.atan2(a, b).print()\n\n * ```\n\n * @param a The first tensor.\n\n * @param b The second tensor. Must have the same dtype as `a`.\n\n * @doc
{heading: 'Operations', subheading: 'Basic math'}\n\n * \nfunction atan2_<T extends Tensor>(\n a:
Tensor|TensorLike, b: Tensor|TensorLike): T {\n let $a = convertToTensor(a, 'a', 'atan2');\n let $b =
convertToTensor(b, 'b', 'atan2');\n [$a, $b] = makeTypesMatch($a, $b);\n\n const inputs: Atan2Inputs = {a: $a, b:
$b};\n\n return ENGINE.runKernel(Atan2, inputs as { } as NamedTensorMap);\n}\n\nexport const atan2 =
op({atan2_});\n", "/*\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n\n * You may obtain a copy of the License at\n\n * http://www.apache.org/licenses/LICENSE-2.0\n\n * Unless
required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n\n * See the
License for the specific language governing permissions and\n * limitations under the License.\n *
```

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=====\n
*\n\nimport {ENGINE} from '../engine';\nimport {Atanh, AtanhInputs} from '../kernel_names';\nimport {Tensor}
from '../tensor';\nimport {NamedTensorMap} from '../tensor_types';\nimport {convertToTensor} from
 '../tensor_util_env';\nimport {TensorLike} from '../types';\n\nimport {op} from './operation';\n\n/**\n * Computes
inverse hyperbolic tan of the input `tf.Tensor` element-wise:\n\n * `atanh(x)`\n\n * ```\n * const x = tf.tensor1d([0,
.1, -.1, .7]);\n\n * \n * x.atanh().print();\n\n * // or tf.atanh(x)\n\n * ```\n * @param x The input tensor.\n\n * @doc {heading: 'Operations', subheading: 'Basic
math'}\n\n * \nfunction atanh_<T extends Tensor>(x: T|TensorLike): T {\n const $x = convertToTensor(x, 'x',
'atanh');\n\n const inputs: AtanhInputs = {x: $x};\n\n return ENGINE.runKernel(Atanh, inputs as { } as
NamedTensorMap);\n}\n\nexport const atanh = op({atanh_});\n", "/*\n * @license\n * Copyright 2020 Google LLC.
All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this
```

file except in compliance with the License.\n \* You may obtain a copy of the License at\n \*\n \*  
<http://www.apache.org/licenses/LICENSE-2.0>\n \*\n \* Unless required by applicable law or agreed to in writing,  
software\n \* distributed under the License is distributed on an \"AS IS\" BASIS,\n \* WITHOUT WARRANTIES  
OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language  
governing permissions and\n \* limitations  
under the License.\n \*

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*\n\ntype PadType = 'SAME'|'VALID'|'NUMBER'|'EXPLICIT';\n\n// For NHWC should be in the following
form:\n// [[0, 0], [pad_top,pad_bottom], [pad_left, pad_right], [0, 0]]\n// For NCHW should be in the following
form:\n// [[0, 0], [0, 0], [pad_top,pad_bottom], [pad_left, pad_right]]\n// Reference:
https://www.tensorflow.org/api_docs/python/tf/nn/conv2d\nexport type ExplicitPadding =\n [[number, number],
[number, number], [number, number], [number, number]];\n\nexport type PadInfo = {\n top: number,\n left:
number,\n right: number,\n bottom: number,\n type: PadType\n};\n\nexport type PadInfo3D = {\n top: number,\n
left: number,\n right: number,\n bottom: number,\n front: number,\n back: number,\n type: PadType\n};\n\n/**\n
* Information about the forward pass of a convolution/pooling operation.\n * It includes input and output shape,
strides, filter size and padding\n
* information.\n */\nexport type Conv2DInfo = {\n batchSize: number,\n inHeight: number,\n inWidth: number,\n
inChannels: number,\n outHeight: number,\n outWidth: number,\n outChannels: number,\n dataFormat:
'channelsFirst'|'channelsLast',\n strideHeight: number,\n strideWidth: number,\n dilationHeight: number,\n
dilationWidth: number,\n filterHeight: number,\n filterWidth: number,\n effectiveFilterHeight: number,\n
effectiveFilterWidth: number,\n padInfo: PadInfo,\n inShape: [number, number, number, number],\n outShape:
[number, number, number, number],\n filterShape: [number, number, number, number]\n};\n\n/**\n * @param
inputShape Input tensor shape is of the following dimensions:\n * `[batch, height, width, inChannels]`.\n *
@param filterShape The filter shape is of the following dimensions:\n * `[filterHeight, filterWidth, depth]`.\n *
@param strides The strides of the sliding window for each dimension of the\n * input tensor: `[strideHeight,
strideWidth]`.\n
* If `strides` is a single number,\n * then `strideHeight == strideWidth`.\n * @param pad The type of padding
algorithm.\n * - `same` and stride 1: output will be of same size as input,\n * regardless of filter size.\n * -
`valid`: output will be smaller than input if filter is larger\n * than 1*1x1.\n * - For more info, see this guide:\n
* [https://www.tensorflow.org/api_guides/python/nn#Convolution](\n *
https://www.tensorflow.org/api_guides/python/nn#Convolution))\n * @param dataFormat The data format of the
input and output data.\n * Defaults to 'NHWC'. \n * @param dilations The dilation rates: `[dilationHeight,
dilationWidth]`.\n * Defaults to `[1, 1]`. If `dilations` is a single number, then\n * `dilationHeight ==
dilationWidth`.\n */\nexport function computeDilation2DInfo(\n inputShape: [number, number, number,
number],\n filterShape: [number, number, number],\n strides: number|[number, number],\n pad:
'same'|'valid'|number,\n dataFormat: 'NHWC' = 'NHWC',\n dilations: number|[number, number]) {\n // `computerConv2DInfo` require
filterShape to be in the dimension of:\n // `[filterHeight, filterWidth, depth, outDepth]`, dilation2d doesn't have\n //
outDepth, it should have the same depth as the input.\n // Input shape: [batch, height, width, inChannels]\n const
inputChannels = inputShape[3];\n const $filterShape =\n [...filterShape, inputChannels] as [number, number,
number, number];\n const $dataFormat = convertConv2DDataFormat(dataFormat);\n\n return
computeConv2DInfo(\n inputShape, $filterShape, strides, dilations, pad,\n null /* roundingMode */, null /*
depthWise */, $dataFormat);\n }\n\nexport function computePool2DInfo(\n inShape: [number, number, number,
number],\n filterSize: [number, number]|number,\n strides: number|[number, number],\n dilations:
number|[number, number],\n pad: 'same'|'valid'|number,\n roundingMode?: 'floor'|'round'|'ceil',\n dataFormat:
'channelsFirst'|'channelsLast' = 'channelsLast'): Conv2DInfo {\n const [filterHeight, filterWidth] =
parseTupleParam(filterSize);\n\n let filterShape: [number, number, number, number];\n if (dataFormat ===
'channelsLast') {\n filterShape = [filterHeight, filterWidth, inShape[3], inShape[3]];\n } else if (dataFormat ===

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'channelsFirst') {\n filterShape = [filterHeight, filterWidth, inShape[1], inShape[1]];\n } else {\n throw new
Error(`Unknown dataFormat ${dataFormat}`);\n }\n\n return computeConv2DInfo(\n inShape, filterShape,
strides, dilations, pad, roundingMode, false,\n dataFormat);\n}\n\n/**\n * Computes the information for a
forward pass of a pooling3D operation.\n */\nexport function computePool3DInfo(\n inShape: [number, number,
number, number, number, number],\n filterSize: number|[number, number, number],\n strides: number|[number, number,
number],\n dilations: number|[number, number, number], pad: 'same'|'valid'|number,\n roundingMode?:
'floor'|'round'|'ceil',\n dataFormat: 'NDHWC'|'NCDHW' = 'NDHWC'): Conv3DInfo {\n const [filterDepth,
filterHeight, filterWidth] = parse3TupleParam(filterSize);\n\n let filterShape: [number, number, number, number,
number, number];\n let $dataFormat: 'channelsFirst'|'channelsLast';\n if (dataFormat === 'NDHWC') {\n $dataFormat =
'channelsLast';\n filterShape =\n [filterDepth, filterHeight, filterWidth, inShape[4], inShape[4]];\n } else if
(dataFormat === 'NCDHW') {\n $dataFormat = 'channelsFirst';\n filterShape =\n [filterDepth, filterHeight,
filterWidth, inShape[1], inShape[1]];\n } else {\n throw new Error(`Unknown dataFormat ${dataFormat}`);\n }\n\n return computeConv3DInfo(\n inShape, filterShape, strides, dilations, pad, false, $dataFormat,\n roundingMode);\n}\n\n/**\n * Computes the information for a forward pass of a convolution/pooling\n *
operation.\n */\nexport function computeConv2DInfo(\n inShape: [number, number, number, number],\n
 filterShape: [number, number, number, number],\n strides: number|[number, number], dilations:
number|[number, number],\n pad: 'same'|'valid'|number|ExplicitPadding,\n roundingMode?: 'floor'|'round'|'ceil',
depthwise = false,\n dataFormat: 'channelsFirst'|'channelsLast' = 'channelsLast'): Conv2DInfo {\n let [batchSize,
inHeight, inWidth, inChannels] = [-1, -1, -1, -1];\n if (dataFormat === 'channelsLast') {\n [batchSize, inHeight,
inWidth, inChannels] = inShape;\n } else if (dataFormat === 'channelsFirst') {\n [batchSize, inChannels,
inHeight, inWidth] = inShape;\n } else {\n throw new Error(`Unknown dataFormat ${dataFormat}`);\n }\n\n const [filterHeight, filterWidth, , filterChannels] = filterShape;\n const [strideHeight, strideWidth] =
parseTupleParam(strides);\n const [dilationHeight, dilationWidth] = parseTupleParam(dilations);\n\n const
effectiveFilterHeight =\n getEffectiveFilterSize(filterHeight, dilationHeight);\n const effectiveFilterWidth
=\n getEffectiveFilterSize(filterWidth, dilationWidth);\n const {padInfo, outHeight, outWidth} =
getPadAndOutInfo(\n pad, inHeight, inWidth, strideHeight, strideWidth, effectiveFilterHeight,\n effectiveFilterWidth, roundingMode, dataFormat);\n\n const outChannels = depthwise ? filterChannels *
inChannels : filterChannels;\n\n let outShape: [number, number, number, number];\n if (dataFormat ===
'channelsFirst') {\n outShape = [batchSize, outChannels, outHeight, outWidth];\n } else if (dataFormat ===
'channelsLast') {\n outShape = [batchSize, outHeight, outWidth, outChannels];\n }\n\n return {\n batchSize,\n dataFormat,\n inHeight,\n inWidth,\n inChannels,\n outHeight,\n outWidth,\n outChannels,\n padInfo,\n strideHeight,\n strideWidth,\n filterHeight,\n filterWidth,\n effectiveFilterHeight,\n effectiveFilterWidth,\n dilationHeight,\n dilationWidth,\n inShape,\n outShape,\n filterShape\n };\n}\n\n/**\n
* Information about the forward pass of a 3D convolution/pooling operation.\n * It includes input and output shape,
strides, filter size and padding\n * information.\n */\nexport type Conv3DInfo = {\n batchSize: number,\n inDepth:
number,\n inHeight: number,\n inWidth: number,\n inChannels: number,\n outDepth: number,\n outHeight:
number,\n outWidth: number,\n outChannels: number,\n dataFormat: 'channelsFirst'|'channelsLast',\n strideDepth:
number,\n strideHeight: number,\n strideWidth: number,\n dilationDepth: number,\n dilationHeight: number,\n
dilationWidth: number,\n filterDepth: number,\n filterHeight: number,\n filterWidth: number,\n
effectiveFilterDepth: number,\n effectiveFilterHeight: number,\n effectiveFilterWidth: number,\n padInfo:
PadInfo3D,\n inShape: [number, number, number, number, number, number],\n outShape: [number, number, number,
number, number, number],\n filterShape: [number, number, number, number, number, number]};\n\n/**\n * Computes the
information
for a forward pass of a 3D convolution/pooling\n * operation.\n */\nexport function computeConv3DInfo(\n
inShape: [number, number, number, number, number, number],\n filterShape: [number, number, number, number,
number, number],\n strides: number|[number, number, number],\n dilations: number|[number, number, number], pad:
'same'|'valid'|number,\n depthwise = false,\n dataFormat: 'channelsFirst'|'channelsLast' = 'channelsLast',\n

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roundingMode?: 'floor'|'round'|'ceil'): Conv3DInfo {\n let [batchSize, inDepth, inHeight, inWidth, inChannels] =\n
[-1, -1, -1, -1, -1];\n if (dataFormat === 'channelsLast') {\n [batchSize, inDepth, inHeight, inWidth, inChannels]
= inShape;\n } else if (dataFormat === 'channelsFirst') {\n [batchSize, inChannels, inDepth, inHeight, inWidth] =
inShape;\n } else {\n throw new Error(`Unknown dataFormat ${dataFormat}`);\n }\n\n const [filterDepth,
filterHeight, filterWidth, , filterChannels] =\n filterShape;\n const [strideDepth,
strideHeight, strideWidth] = parse3TupleParam(strides);\n const [dilationDepth, dilationHeight, dilationWidth] =\n
parse3TupleParam(dilations);\n\n const effectiveFilterDepth =\n getEffectiveFilterSize(filterDepth,
dilationDepth);\n const effectiveFilterHeight =\n getEffectiveFilterSize(filterHeight, dilationHeight);\n const
effectiveFilterWidth =\n getEffectiveFilterSize(filterWidth, dilationWidth);\n const {padInfo, outDepth,
outHeight, outWidth} = get3DPadAndOutInfo(\n pad, inDepth, inHeight, inWidth, strideDepth, strideHeight,
strideWidth,\n effectiveFilterDepth, effectiveFilterHeight, effectiveFilterWidth,\n roundingMode);\n\n const
outChannels = depthwise ? filterChannels * inChannels : filterChannels;\n\n let outShape: [number, number,
number, number, number, number];\n if (dataFormat === 'channelsFirst') {\n outShape = [batchSize, outChannels,
outDepth, outHeight, outWidth, outChannels];\n } else if (dataFormat === 'channelsLast') {\n outShape = [batchSize,
outDepth, outHeight, outWidth, outChannels];\n }\n\n return {\n batchSize,\n dataFormat,\n inDepth,\n
inHeight,\n inWidth,\n inChannels,\n outDepth,\n outHeight,\n outWidth,\n outChannels,\n padInfo,\n
strideDepth,\n strideHeight,\n strideWidth,\n filterDepth,\n filterHeight,\n filterWidth,\n
effectiveFilterDepth,\n effectiveFilterHeight,\n effectiveFilterWidth,\n dilationDepth,\n dilationHeight,\n
dilationWidth,\n inShape,\n outShape,\n filterShape\n };\n}\n\nfunction computeOutputShape2D(\n
inShape: [number, number], fieldSize: number, stride: number,\n zeroPad?: number, roundingMode?:
'floor'|'round'|'ceil'): [number, number] {\n if (zeroPad == null) {\n zeroPad = computeDefaultPad(inShape,
fieldSize, stride);\n }\n\n const inputRows = inShape[0];\n const inputCols = inShape[1];\n\n const outputRows =\n
round((inputRows - fieldSize + 2 * zeroPad) / stride + 1, roundingMode);\n
const outputCols =\n
round((inputCols - fieldSize + 2 * zeroPad) / stride + 1, roundingMode);\n\n return
[outputRows, outputCols];\n}\n\nfunction computeOutputShape4D(\n inShape: [number, number, number,
number], fieldSize: number,\n outChannels: number, stride: number, zeroPad?: number,\n roundingMode?:
'floor'|'round'|'ceil'): [number, number, number, number] {\n if (zeroPad == null) {\n zeroPad =
computeDefaultPad(inShape, fieldSize, stride);\n }\n\n const inputDepth = inShape[0];\n const inputRows =
inShape[1];\n const inputCols = inShape[2];\n\n const outputDepths =\n
round((inputDepth - fieldSize + 2 * zeroPad) / stride + 1, roundingMode);\n const outputRows =\n
round((inputRows - fieldSize + 2 * zeroPad) / stride + 1, roundingMode);\n const outputCols =\n
round((inputCols - fieldSize + 2 * zeroPad) / stride + 1,
roundingMode);\n\n return [outputDepths, outputRows, outputCols, outChannels];\n}\n\nexport function
computeDefaultPad(\n inputShape:
[number, number][[number, number, number, number],\n fieldSize: number, stride: number, dilation = 1): number
{\n const effectiveFieldSize = getEffectiveFilterSize(fieldSize, dilation);\n return Math.floor(\n (inputShape[0]
* (stride - 1) - stride + effectiveFieldSize) / 2);\n}\n\nfunction parseTupleParam(param: number|number[]):
[number, number, number] {\n if (typeof param === 'number') {\n return [param, param, param];\n }\n\n if
(param.length === 2) {\n return [param[0], param[1], 1];\n }\n\n return param as [number, number,
number];\n}\n\nfunction parse3TupleParam(param: number|[number, number, number]):\n [number, number,
number] {\n return typeof param === 'number' ? [param, param, param] : param;\n}\n\n/* See
https://www.tensorflow.org/api_docs/python/tf/nn/atrous_conv2d\n * Atrous convolution is equivalent to standard
convolution with upsamped\n * filters with effective_filter_height =\n * filter_height + (filter_height - 1) * (dilation
- 1)\n * and effective_filter_width =\n * filter_width + (filter_width - 1) * (dilation - 1),\n * produced by inserting dilation
- 1 zeros along consecutive elements across\n * the filters' spatial dimensions.\n * When there is a dilation, this
converts a filter dimension to the\n * effective filter dimension, so it can be used in a standard convolution.\n
*\n\nfunction getEffectiveFilterSize(filterSize: number, dilation: number) {\n if (dilation <= 1) {\n return
filterSize;\n }\n\n return filterSize + (filterSize - 1) * (dilation - 1);\n}\n\nfunction getPadAndOutInfo(\n pad:

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'same'|'valid'|number|ExplicitPadding, inHeight: number,\n inWidth: number, strideHeight: number, strideWidth:
number,\n filterHeight: number, filterWidth: number,\n roundingMode: 'floor'|'round'|'ceil',\n dataFormat:
'channelsFirst'|\n 'channelsLast'): {padInfo: PadInfo, outHeight: number, outWidth: number} {\n let padInfo:
PadInfo;\n let outHeight: number;\n let outWidth: number;\n if (typeof
pad === 'number') {\n const padType = (pad === 0) ? 'VALID' : 'NUMBER';\n padInfo = {top: pad, bottom:
pad, left: pad, right: pad, type: padType};\n const outShape = computeOutputShape2D(\n [inHeight, inWidth],
filterHeight, strideHeight, pad, roundingMode);\n outHeight = outShape[0];\n outWidth = outShape[1];\n } else
if (pad === 'same') {\n outHeight = Math.ceil(inHeight / strideHeight);\n outWidth = Math.ceil(inWidth /
strideWidth);\n const padAlongHeight =\n Math.max(0, (outHeight - 1) * strideHeight + filterHeight -
inHeight);\n const padAlongWidth =\n Math.max(0, (outWidth - 1) * strideWidth + filterWidth - inWidth);\n const top = Math.floor(padAlongHeight / 2);\n const bottom = padAlongHeight - top;\n const left =
Math.floor(padAlongWidth / 2);\n const right = padAlongWidth - left;\n padInfo = {top, bottom, left, right, type:
'SAME'};\n } else if (pad === 'valid') {\n padInfo = {top: 0, bottom: 0, left: 0, right:
0, type: 'VALID'};\n outHeight = Math.ceil((inHeight - filterHeight + 1) / strideHeight);\n outWidth =
Math.ceil((inWidth - filterWidth + 1) / strideWidth);\n } else if (typeof pad === 'object') {\n const top =
dataFormat === 'channelsLast' ? pad[1][0] : pad[2][0];\n const bottom = dataFormat === 'channelsLast' ?
pad[1][1] : pad[2][1];\n const left = dataFormat === 'channelsLast' ? pad[2][0] : pad[3][0];\n const right =
dataFormat === 'channelsLast' ? pad[2][1] : pad[3][1];\n const padType = (top === 0 && bottom === 0 && left
=== 0 && right === 0) ?\n 'VALID' : 'EXPLICIT';\n padInfo = {top, bottom, left, right, type:
padType};\n outHeight = round(\n (inHeight - filterHeight + top + bottom) / strideHeight + 1,\n roundingMode);\n outWidth = round(\n (inWidth - filterWidth + left + right) / strideWidth + 1,\n roundingMode);\n } else {\n throw Error(`Unknown padding parameter: ${pad}`);\n }\n return {padInfo,
outHeight,
outWidth};\n}\n\nfunction get3DPadAndOutInfo(\n pad: 'same'|'valid'|number, inDepth: number, inHeight:
number,\n inWidth: number, strideDepth: number, strideHeight: number,\n strideWidth: number, filterDepth:
number, filterHeight: number,\n filterWidth: number, roundingMode?: 'floor'|'round'|'ceil'): {\n padInfo:
PadInfo3D,\n outDepth: number,\n outHeight: number,\n outWidth: number}\n {\n let padInfo: PadInfo3D;\n let
outDepth: number;\n let outHeight: number;\n let outWidth: number;\n if (typeof pad === 'number') {\n const
padType = (pad === 0) ? 'VALID' : 'NUMBER';\n padInfo = {\n top: pad,\n bottom: pad,\n left: pad,\n
 right: pad,\n front: pad,\n back: pad,\n type: padType\n };\n const outShape =
computeOutputShape4D(\n [inDepth, inHeight, inWidth, 1], filterDepth, 1, strideDepth, pad,\n roundingMode);\n outDepth = outShape[0];\n outHeight = outShape[1];\n outWidth = outShape[2];\n }
else if (pad === 'same') {\n outDepth = Math.ceil(inDepth / strideDepth);\n outHeight = Math.ceil(inHeight /
strideHeight);\n outWidth = Math.ceil(inWidth / strideWidth);\n const padAlongDepth = (outDepth - 1) *
strideDepth + filterDepth - inDepth;\n const padAlongHeight =\n (outHeight - 1) * strideHeight + filterHeight -
inHeight;\n const padAlongWidth = (outWidth - 1) * strideWidth + filterWidth - inWidth;\n const front =
Math.floor(padAlongDepth / 2);\n const back = padAlongDepth - front;\n const top =
Math.floor(padAlongHeight / 2);\n const bottom = padAlongHeight - top;\n const left =
Math.floor(padAlongWidth / 2);\n const right = padAlongWidth - left;\n padInfo = {top, bottom, left, right,
front, back, type: 'SAME'};\n } else if (pad === 'valid') {\n padInfo = {\n top: 0,\n bottom: 0,\n
 left: 0,\n right: 0,\n front: 0,\n back: 0,\n type: 'VALID'\n };\n outDepth =
Math.ceil((inDepth - filterDepth + 1) / strideDepth);\n outHeight = Math.ceil((inHeight - filterHeight + 1) /
strideHeight);\n outWidth = Math.ceil((inWidth - filterWidth + 1) / strideWidth);\n } else {\n throw
Error(`Unknown padding parameter: ${pad}`);\n }\n return {padInfo, outDepth, outHeight, outWidth};\n}\n\n\n*
Rounds a value depending on the
rounding mode\n * @param value\n * @param roundingMode A string from: 'ceil', 'round', 'floor'. If none is\n *
provided, it will default to truncate.\n *\nfunction round(value: number, roundingMode?: 'floor'|'round'|'ceil') {\n if
(!roundingMode) {\n return Math.trunc(value);\n }\n switch (roundingMode) {\n case 'round':\n // used for
Caffe Conv\n return Math.round(value);\n case 'ceil':\n // used for Caffe Pool\n return Math.ceil(value);\n }

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 case 'floor':\n return Math.floor(value);\n default:\n throw new Error(`Unknown roundingMode
${roundingMode}`);\n }\n}\n\nexport function tupleValuesAreOne(param:
 number|number[]): boolean {\n const [dimA, dimB, dimC] = parseTupleParam(param);\n return dimA === 1 &&
dimB === 1 && dimC === 1;\n}\n\nexport function eitherStridesOrDilationsAreOne(\n strides: number|number[],
dilations: number|number[]): boolean {\n return tupleValuesAreOne(strides) ||
tupleValuesAreOne(dilations);\n}\n\n/**\n * Convert Conv2D dataFormat from 'NHWC'|'NCHW' to\n *
'channelsLast'|'channelsFirst'\n * @param dataFormat in 'NHWC'|'NCHW' mode\n * @return dataFormat in
'channelsLast'|'channelsFirst' mode\n * @throws unknown dataFormat\n */\nexport function
convertConv2DDataFormat(dataFormat: 'NHWC'|'NCHW'):\n 'channelsLast'|'channelsFirst' {\n if (dataFormat
=== 'NHWC') {\n return 'channelsLast';\n } else if (dataFormat === 'NCHW') {\n return 'channelsFirst';\n }
else {\n throw new Error(`Unknown dataFormat ${dataFormat}`);\n }\n}\n\n"/**\n * @license\n * Copyright
2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License,
Version 2.0 (the `License`);\n * you may not use this file except in compliance with the License.\n * You may
obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by
applicable law or agreed to in writing, software\n * distributed under the License is distributed on an `AS IS`
BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the
License for the specific language governing permissions and\n * limitations under the License.\n *
=====
\n
*/\n\nimport {ENGINE} from '../engine';\nimport {Reshape, ReshapeAttrs, ReshapeInputs} from
'../kernel_names';\nimport {NamedAttrMap} from '../kernel_registry';\nimport {Tensor} from '../tensor';\nimport
{NamedTensorMap} from '../tensor_types';\nimport {convertToTensor} from '../tensor_util_env';\nimport {Rank,
ShapeMap, TensorLike} from '../types';\nimport {op} from '../operation';\n\n/**\n * Reshapes a `tf.Tensor` to a given shape.\n * Given an input tensor, returns a new tensor with the same values
as the\n * input tensor with shape `shape`.\n * If one component of shape is the special value -1, the size of
that\n * dimension is computed so that the total size remains constant. In\n * particular, a shape of [-1] flattens into
1-D. At most one component of\n * shape can be -1.\n * If shape is 1-D or higher, then the operation returns a
tensor with shape\n * shape filled with the values of tensor. In this case, the number of\n * elements implied by
shape must be the same as the number of elements in\n * tensor.\n * ```\n * const x = tf.tensor1d([1, 2, 3, 4]);\n * x.reshape([2, 2]).print();\n * ```\n * @param x The input tensor to be reshaped.\n * @param shape An array of
integers defining the output tensor shape.\n * @doc {heading: 'Tensors', subheading: 'Transformations'}\n
\nfunction reshape_<R extends Rank>(\n x: Tensor|TensorLike,\n shape: ShapeMap[R]): Tensor<R> {\n const $x = convertToTensor(x, 'x', 'reshape', 'string_or_numeric');\n const
inputs: ReshapeInputs = {x: $x};\n const attrs: ReshapeAttrs = {shape};\n return ENGINE.runKernel(\n
Reshape, inputs as {} as NamedTensorMap, attrs as {} as NamedAttrMap);\n}\n\nexport const reshape =
op({reshape_});\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the `License`);\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an `AS IS` BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
=====
\n
*/\n\nimport {ENGINE} from '../engine';\nimport {AvgPool, AvgPoolAttrs, AvgPoolInputs} from
'../kernel_names';\nimport {NamedAttrMap} from '../kernel_registry';\nimport {Tensor3D, Tensor4D} from
'../tensor';\nimport {NamedTensorMap} from '../tensor_types';\nimport {convertToTensor} from
'../tensor_util_env';\nimport {TensorLike} from '../types';\nimport * as util from '../util';\n\nimport {cast} from
'../cast';\nimport * as conv_util from '../conv_util';\nimport {op} from '../operation';\nimport {reshape} from
'../reshape';\n\n/**\n * Computes the 2D average pooling of an image.\n * @param x The input tensor, of rank 4

```

```

or rank 3 of shape`[batch, height, width, inChannels]`. If rank 3, batch of 1 is assumed.`@param filterSize`
The filter size: `[filterHeight, filterWidth]`. If`filterSize` is a single number, then`filterHeight ==
filterWidth`. `@param strides` The strides of the pooling: `[strideHeight,
strideWidth]`. If`strides` is a single number, then`strideHeight == strideWidth`. `@param pad` The type
of padding algorithm:
- `same` and stride 1: output will be of same size as input, regardless of filter
size.
- `valid`: output will be smaller than input if filter is larger than 1x1.
- For more info, see
this guide: [https://www.tensorflow.org/api_guides/python/nn#Convolution]
`@param dimRoundingMode` A string from:
'ceil', 'round', 'floor'. If none is provided, it will default to truncate.
Tensor3D|Tensor4D>(\n x: T|TensorLike, filterSize: [number, number]|number,\n strides: [number,
number]|number, pad: 'valid'|'same'|number,\n dimRoundingMode?: 'floor'|'round'|'ceil'): T {\n const $x =
convertToTensor(x, 'x', 'avgPool', 'float32');\n const dilations = 1;\n\n util.assert(\n
conv_util.eitherStridesOrDilationsAreOne(strides,
dilations),\n () => `Error in avgPool: Either strides or dilations must be 1. ` +\n `Got strides ${strides} and
dilations ${dilations}`);\n\n let x4D = $x as Tensor4D;\n let reshapedTo4D = false;\n if ($x.rank === 3) {\n
reshapedTo4D = true;\n x4D = reshape($x, [1, $x.shape[0], $x.shape[1], $x.shape[2]]);\n }\n\n util.assert(\n
x4D.rank === 4,\n () => `Error in avgPool: x must be rank 4 but got rank ${x4D.rank}`);\n\n if
(dimRoundingMode != null) {\n util.assert(\n util.isInt(pad as number),\n () => `Error in avgPool: pad
must be an integer when using, ` +\n `dimRoundingMode ${dimRoundingMode} but got pad ${pad}`);\n }\n\n
const inputs: AvgPoolInputs = {x: x4D};\n const attrs: AvgPoolAttrs = {filterSize, strides, pad,
dimRoundingMode};\n\n // tslint:disable-next-line: no-unnecessary-type-assertion\n let res =
ENGINE.runKernel(\n AvgPool, inputs as {} as NamedTensorMap,\n attrs as {} as NamedAttrMap) as T;\n\n res = cast(res, $x.dtype);\n\n if (reshapedTo4D) {\n return
reshape(res, [res.shape[1], res.shape[2], res.shape[3]]) as T;\n }\n\n return res;\n}\n\nexport const avgPool =
op({avgPool_});\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under
the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless
required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
=====
*\n\nimport {ENGINE}
from './engine';\nimport {AvgPool3D, AvgPool3DAttrs, AvgPool3DInputs} from './kernel_names';\nimport
{NamedAttrMap} from './kernel_registry';\nimport {Tensor4D, Tensor5D} from './tensor';\nimport
{NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport
{TensorLike} from './types';\nimport * as util from './util';\n\nimport {cast} from './cast';\nimport {op} from
'./operation';\nimport {reshape} from './reshape';\n\n/*\n * Computes the 3D average pooling.\n *\n * ``js\n * const
x = tf.tensor5d([1, 2, 3, 4, 5, 6, 7, 8], [1, 2, 2, 2, 1]);\n * const result = tf.avgPool3d(x, 2, 1, 'valid');\n *
result.print();\n * ``\n *\n * @param x The input tensor, of rank 5 or rank 4 of shape`[batch, depth, height,
width, inChannels]`. `@param filterSize` The filter size: `[filterDepth, filterHeight, filterWidth]`. If
`filterSize` is a single number, then`filterDepth == filterHeight == filterWidth`. `@param
strides` The strides of the pooling: `[strideDepth, strideHeight, strideWidth]`. If`strides` is a single
number, then`strideDepth == strideHeight == strideWidth`. `@param pad` The type of padding
algorithm.
- `same` and stride 1: output will be of same size as input, regardless of filter size.
- `valid`: output will be smaller than input if filter is larger than 1*1x1.
- For more info, see this guide:
[https://www.tensorflow.org/api_guides/python/nn#Convolution]
`@param dimRoundingMode` A string from:
https://www.tensorflow.org/api_guides/python/nn#Convolution)
`@param dimRoundingMode` A string from:

```

```

'ceil', 'round', 'floor'. If none is provided, it will default to truncate.
@param dataFormat An optional string from: "NDHWC", "NCDHW". Defaults to "NDHWC". Specify the data format of the input and output data. With the default format "NDHWC", the data is stored in the order of: [batch, depth, height, width, channels]. Only "NDHWC" is currently supported.
@doc {heading: 'Operations', subheading: 'Convolution'}
function avgPool3d<T extends Tensor4D|Tensor5D>(x: T|TensorLike, filterSize: [number, number, number]|number, strides: [number, number, number]|number, pad: 'valid'|'same'|number, dimRoundingMode?: 'floor'|'round'|'ceil', dataFormat: 'NDHWC'|'NCDHW' = 'NDHWC'): T {
 const $x = convertToTensor(x, 'x', 'avgPool3d', 'float32');
 let x5D = $x as Tensor5D;
 let reshapedTo5D = false;
 if ($x.rank === 4) {
 reshapedTo5D = true;
 x5D = reshape($x, [1, $x.shape[0], $x.shape[1], $x.shape[2], $x.shape[3]]);
 }
 util.assert(x5D.rank === 5, () => `Error in avgPool3d: x must be rank 5 but got rank ${x5D.rank}.`);
 util.assert(dataFormat === 'NDHWC', () => `Error in avgPool3d: Only NDHWC is currently supported, ` + `but got dataFormat of ${dataFormat}`);
 if (dimRoundingMode != null) {
 util.assert(util.isInt(pad as number), () => `Error in avgPool3d: pad must be an integer when using, ` + `dimRoundingMode ${dimRoundingMode} but got pad ${pad}.`);
 }
 const inputs: AvgPool3DInputs = {x: x5D};
 const attrs: AvgPool3DAttrs = {filterSize, strides, pad, dimRoundingMode, dataFormat};
 // tslint:disable-next-line: no-unnecessary-type-assertion
 let res = ENGINE.runKernel(AvgPool3D, inputs as {} as NamedTensorMap, attrs as {} as NamedAttrMap) as T;
 res = cast(res, x5D.dtype);
 if (reshapedTo5D) {
 return reshape(res, [res.shape[1], res.shape[2], res.shape[3], res.shape[4]] as T);
 }
 return res;
}
export const avgPool3d = op({avgPool3d});
"/**
 * @license
 * Copyright 2020 Google LLC. All Rights Reserved.
 * Licensed under the Apache License, Version 2.0 (the "License");
 * you may not use this file except in compliance with the License.
 * You may obtain a copy of the License at
 * http://www.apache.org/licenses/LICENSE-2.0
 * Unless required by applicable law or agreed to in writing, software
 * distributed under the License is distributed on an "AS IS" BASIS,
 * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.
 * See the License for the specific language governing permissions and
 * limitations under the License.
 */
=====
*/
import {ENGINE} from '../engine';
import {Concat, ConcatAttrs, ConcatInputs} from '../kernel_names';
import {NamedAttrMap} from '../kernel_registry';
import {Tensor} from '../tensor';
import {NamedTensorMap} from '../tensor_types';
import {convertToTensorArray} from '../tensor_util_env';
import {TensorLike} from '../types';
import {assert} from '../util';
import {clone} from './clone';
import {op} from './operation';
/**
 * Concatenates a list of `tf.Tensor`s along a given axis.
 * The tensors ranks and types must match, and their sizes must match in all dimensions except `axis`.
 * Also available are stricter rank-specific methods that assert that tensors are of the given rank:
 * - `tf.concat1d`
 * - `tf.concat2d`
 * - `tf.concat3d`
 * - `tf.concat4d`
 * Except `tf.concat1d` (which does not have axis param), all methods have same signature as this method.
 * ```js
 * const a = tf.tensor1d([1, 2]);
 * const b = tf.tensor1d([3, 4]);
 * a.concat(b).print(); // or a.concat(b)
 * ```
 * ```js
 * const a = tf.tensor1d([1, 2]);
 * const b = tf.tensor1d([3, 4]);
 * const c = tf.tensor1d([5, 6]);
 * tf.concat([a, b, c]).print();
 * ```
 * ```js
 * const a = tf.tensor2d([[1, 2], [10, 20]]);
 * const b = tf.tensor2d([[3, 4], [30, 40]]);
 * const axis = 1;
 * tf.concat([a, b], axis).print();
 * ```
 * @param tensors A list of tensors to concatenate.
 * @param axis The axis to concat along. Defaults to 0 (the first dim).
 * @doc {heading: 'Tensors', subheading: 'Slicing and Joining'}
 */
function concat<T extends Tensor>(tensors: Array<T|TensorLike>, axis = 0): T {
 assert(tensors.length >= 1, () => 'Pass at least one tensor to concat');
 const $tensors = convertToTensorArray(tensors, 'tensors', 'concat', 'string_or_numeric');
 if ($tensors[0].dtype === 'complex64') {
 $tensors.forEach(tensor => {
 if (tensor.dtype !== 'complex64') {
 throw new Error(`Cannot concatenate complex64 tensors with a tensor with dtype ${tensor.dtype}.`);
 }
 });
 }
 if

```

```

($tensors.length === 1) {\n return clone($tensors[0]);\n }\n\n const inputs: ConcatInputs = $tensors;\n const attr:
ConcatAttrs = {axis};\n\n return ENGINE.runKernel(\n Concat, inputs as {} as NamedTensorMap, attr as {} as
NamedAttrMap);\n}\n\nexport const concat = op({concat_});\n", "/*\n * @license\n * Copyright 2018
Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you
may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
\n
*\n\nimport {ENGINE} from '../engine';\nimport {Sigmoid, SigmoidInputs} from '../kernel_names';\nimport
{Tensor} from '../tensor';\nimport {NamedTensorMap} from '../tensor_types';\nimport {convertToTensor} from
'../tensor_util_env';\nimport {TensorLike} from '../types';\n\nimport {op} from './operation';\n\n/**\n
 * Computes sigmoid element-wise, $1 / (1 + \exp(-x))$ \n * \n * ``js\n * const x = tf.tensor1d([0, -1, 2, -3]);\n * \n *
x.sigmoid().print(); // or tf.sigmoid(x)\n * ``\n * @param x The input tensor.\n * \n * @doc {heading: 'Operations',
subheading: 'Basic math'}\n */\nfunction sigmoid_<T extends Tensor>(x: T|TensorLike): T {\n const $x =
convertToTensor(x, 'x', 'sigmoid');\n\n const inputs: SigmoidInputs = {x: $x};\n\n return
ENGINE.runKernel(Sigmoid, inputs as {} as NamedTensorMap);\n}\n\nexport const sigmoid =
op({sigmoid_});\n", "/*\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under
the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\n * WITHOUT
WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific
language governing permissions and\n * limitations under the License.\n *
=====
\n
*\n\nimport {ENGINE} from '../engine';\nimport {Slice, SliceAttrs, SliceInputs} from '../kernel_names';\nimport
{NamedAttrMap} from '../kernel_registry';\nimport {Tensor} from '../tensor';\nimport {NamedTensorMap} from
'../tensor_types';\nimport {convertToTensor} from '../tensor_util_env';\nimport {Rank, TensorLike} from
'../types';\n\nimport {op} from './operation';\n\n/**\n * Extracts a slice from a `tf.Tensor` starting at coordinates
`begin`\n * and is of size `size`.\n * \n * Also available are stricter rank-specific methods with the same signature\n *
as this method that assert that `x` is of the given rank:\n * - `tf.slice1d`\n * - `tf.slice2d`\n * - `tf.slice3d`\n * -
`tf.slice4d`\n * \n * ``js\n * const x = tf.tensor1d([1,
2, 3, 4]);\n * \n * x.slice([1], [2]).print();\n * ``\n * \n * ``js\n * const x = tf.tensor2d([1, 2, 3, 4], [2, 2]);\n * \n *
x.slice([1, 0], [1, 2]).print();\n * ``\n * @param x The input `tf.Tensor` to slice from.\n * @param begin The
coordinates to start the slice from. The length can be\n * less than the rank of x - the rest of the axes will have
implicit 0 as\n * start. Can also be a single number, in which case it specifies the\n * first axis.\n * @param size
The size of the slice. The length can be less than the rank of\n * x - the rest of the axes will have implicit -1. A
value of -1 requests\n * the rest of the dimensions in the axis. Can also be a single number,\n * in which case it
specifies the size of the first axis.\n * \n * @doc {heading: 'Tensors', subheading: 'Slicing and Joining'}\n */\n
function slice_<R extends Rank, T extends Tensor<R>>(\n x: T|TensorLike, begin: number|number[], size?:
number|number[]): T {\n const $x = convertToTensor(x,
'x', 'slice', 'string_or_numeric');\n\n if ($x.rank === 0) {\n throw new Error('Slicing scalar is not possible');\n
}\n\n const inputs: SliceInputs = {x: $x};\n const attrs: SliceAttrs = {begin, size};\n\n return
ENGINE.runKernel(\n Slice, inputs as {} as NamedTensorMap, attrs as {} as NamedAttrMap);\n}\n\n\nexport
const slice = op({slice_});\n", "/*\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed
under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n *

```

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License.

```
* =====\n*\n* \n\nimport {ENGINE} from '../engine';\nimport {Tanh, TanhInputs} from '../kernel_names';\nimport {Tensor}\nfrom '../tensor';\nimport {NamedTensorMap} from '../tensor_types';\nimport {convertToTensor} from\n '../tensor_util_env';\nimport {TensorLike} from '../types';\n\nimport {op} from './operation';\n\n/**\n * Computes\n hyperbolic tangent of the input `tf.Tensor` element-wise: `tanh(x)`\n *\n * `js`\n *\n * const x = tf.tensor1d([0, 1, -1,\n 70]);\n *\n * x.tanh().print(); // or tf.tanh(x)\n *\n * @param x The input tensor.\n *\n * @doc {heading:\n 'Operations', subheading: 'Basic math'}\n *\n * \n\nfunction tanh_<T extends Tensor>(x: T|TensorLike): T {\n const $x =\n convertToTensor(x, 'x', 'tanh');\n \n const inputs: TanhInputs = {x: $x};\n \n return ENGINE.runKernel(Tanh, inputs\n as { } as NamedTensorMap);\n}\n\nexport const tanh = op({tanh_});\n\n"/**\n * @license\n * Copyright 2020 Google\n LLC. All Rights Reserved.\n
```

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software distributed under the License is distributed on an "AS IS" BASIS, WITHOUT WARRANTIES  
OR CONDITIONS OF ANY KIND, either express or implied. See the License for the specific language  
governing permissions and limitations under the License.

```
===== \n*\n* \n\nimport {Scalar, Tensor1D, Tensor2D} from '../tensor';\nimport {convertToTensor} from\n '../tensor_util_env';\nimport {TensorLike} from '../types';\n\nimport {add} from './add';\nimport {concat} from\n './concat';\nimport {matMul} from './mat_mul';\nimport {mul} from './mul';\nimport {op} from './operation';\nimport\n {sigmoid} from './sigmoid';\nimport\n {slice} from './slice';\nimport {tanh} from './tanh';\n\n/**\n * Computes the next state and output of a\n BasicLSTMCell.\n *\n * Returns `[newC, newH]`\n *\n * Derived from tf.contrib.rnn.BasicLSTMCell.\n *\n * @param forgetBias Forget bias for the cell.\n * @param lstmKernel The weights for the cell.\n * @param lstmBias The bias for the cell.\n * @param data The input to the cell.\n * @param c Previous cell state.\n * @param h Previous cell output.\n *\n * @doc {heading: 'Operations', subheading: 'RNN'}\n *\n * \n\nfunction basicLSTMCell_(\n forgetBias: Scalar|TensorLike, lstmKernel: Tensor2D|TensorLike,\n lstmBias: Tensor1D|TensorLike, data:\n Tensor2D|TensorLike,\n c: Tensor2D|TensorLike, h: Tensor2D|TensorLike): [Tensor2D, Tensor2D] {\n const\n $forgetBias =\n convertToTensor(forgetBias, 'forgetBias', 'basicLSTMCell');\n const $lstmKernel =\n convertToTensor(lstmKernel, 'lstmKernel', 'basicLSTMCell');\n const $lstmBias = convertToTensor(lstmBias,\n 'lstmBias',\n 'basicLSTMCell');\n const $data = convertToTensor(data, 'data', 'basicLSTMCell');\n const $c =\n convertToTensor(c, 'c', 'basicLSTMCell');\n const $h = convertToTensor(h, 'h', 'basicLSTMCell');\n \n const\n combined = concat([$data, $h], 1);\n const weighted = matMul(combined, $lstmKernel);\n const res: Tensor2D =\n add(weighted, $lstmBias);\n \n // i = input_gate, j = new_input, f = forget_gate, o = output_gate\n const batchSize =\n res.shape[0];\n const sliceCols = res.shape[1] / 4;\n const sliceSize: [number, number] = [batchSize, sliceCols];\n const i = slice(res, [0, 0], sliceSize);\n const j = slice(res, [0, sliceCols], sliceSize);\n const f = slice(res, [0,\n sliceCols * 2], sliceSize);\n const o = slice(res, [0, sliceCols * 3], sliceSize);\n \n const newC: Tensor2D =\n add(mul(sigmoid(i), tanh(j)),\n mul($c, sigmoid(add($forgetBias, f) as Tensor2D)));\n const newH: Tensor2D\n = mul(tanh(newC), sigmoid(o));\n \n return [newC, newH];\n}\n\nexport const basicLSTMCell\n = op({basicLSTMCell_});\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n *\n * Licensed under the Apache License, Version 2.0 (the "License"); you may not use this file except in\n compliance with the License. You may obtain a copy of the License at
http://www.apache.org/licenses/LICENSE-2.0
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```

software\n \* distributed under the License is distributed on an \"AS IS\" BASIS,\n \* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*

```
=====
*\n\nimport {ENGINE} from '../engine';\nimport {BatchToSpaceND, BatchToSpaceNDAttrs,\nBatchToSpaceNDInputs} from '../kernel_names';\nimport {NamedAttrMap} from '../kernel_registry';\nimport\n{Tensor} from '../tensor';\nimport {NamedTensorMap} from '../tensor_types';\nimport\n{convertToTensor} from '../tensor_util_env';\nimport {TensorLike} from '../types';\nimport * as util from\n'../util';\n\nimport {op} from './operation';\n\n/**\n * This operation reshapes the \"batch\" dimension 0 into `M + 1`\ndimensions of\n * shape `blockShape + [batch]`, interleaves these blocks back into the grid\n * defined by the spatial dimensions `[1, ..., M]`, to obtain a result with\n * the same rank as the input. The spatial dimensions of this\nintermediate\n * result are then optionally cropped according to `crops` to produce the\n * output. This is the reverse of `tf.spaceToBatchND`. See below for a precise\n * description.\n *\n * ```js\n * const x = tf.tensor4d([1, 2, 3, 4],\n [4, 1, 1, 1]);\n * const blockShape = [2, 2];\n * const crops = [[0, 0], [0, 0]];\n *\n * x.batchToSpaceND(blockShape,\ncrops).print();\n *\n * @param x A `tf.Tensor`. N-D with `x.shape` = `[batch] + spatialShape +`\nremainingShape`, where spatialShape has `M` dimensions.\n *\n * @param blockShape A 1-D array. Must have shape `[M]`, all values must\n * be ≥ 1 . \n * @param crops A 2-D array. Must have shape `[M, 2]`, all values must be ≥ 0 . \n * `crops[i] = [cropStart, cropEnd]` specifies the amount to crop from input\n * dimension `i + 1`, which corresponds to spatial dimension `i`. It is required\n * that\n * `cropStart[i] + cropEnd[i] <= blockShape[i] * inputShape[i + 1]`\n *\n * This operation is equivalent to the following steps:\n *\n * 1. Reshape `x` to `reshaped` of shape: `[blockShape[0], ..., blockShape[M-1], batch /\nprod(blockShape), x.shape[1], ..., x.shape[N-1]]`\n *\n * 2. Permute dimensions of `reshaped` to produce\n * `permuted` of shape `[batch /\nprod(blockShape), x.shape[1], blockShape[0], ..., x.shape[M],\n * blockShape[M-1], x.shape[M+1], ..., x.shape[N-1]]`\n *\n * 3. Reshape `permuted` to produce `reshapedPermuted` of shape `[batch /\n * prod(blockShape), x.shape[1] * blockShape[0], ..., x.shape[M] * blockShape[M-1], x.shape[M+1],\n ..., x.shape[N-1]]`\n *\n * 4. Crop the start and end of dimensions `[1, ..., M]` of `reshapedPermuted`\n * according to `crops` to produce the output of shape: `[batch /\n * prod(blockShape), x.shape[1] * blockShape[0] - crops[0,0] - crops[0,1],\n * ..., x.shape[M] * blockShape[M-1] - crops[M-1,0] - crops[M-1,1], x.shape[M+1], ..., x.shape[N-1]]`\n *\n * @doc {heading: 'Tensors', subheading: 'Transformations'}\n */\nfunction batchToSpaceND<T extends\nTensor>(\n x: T|TensorLike, blockShape: number[], crops: number[][]): T {\n const $x = convertToTensor(x, 'x',\n'batchToSpaceND');\n const prod = blockShape.reduce((a, b) => a * b);\n util.assert($x.rank >= 1 +\nblockShape.length,\n () => `input rank is ${$x.rank} but should be > than blockShape.length ${\nblockShape.length}`);\n util.assert(crops.length === blockShape.length,\n () => `crops.length is ${\ncrops.length} but should be equal to blockShape.length ${\nblockShape.length}`);\n util.assert($x.shape[0] % prod === 0,\n () => `input tensor batch is ${\n$x.shape[0]} but is not divisible by the product of ` +\n `the elements of blockShape ${blockShape.join(' *')} === ${prod}`);\n const inputs: BatchToSpaceNDInputs = {x: $x};\n const attrs: BatchToSpaceNDAttrs = {blockShape, crops};\n return ENGINE.runKernel(\n BatchToSpaceND, inputs as { } as NamedTensorMap,\n attrs as { } as NamedAttrMap);\n}\n\nexport const batchToSpaceND = op({batchToSpaceND_});\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n=====
```

```
*\nimport {Tensor, Tensor4D} from '../tensor';\nimport {Rank} from '../types';\nimport {reshape} from\n'./reshape';\n\nexport function xAs4D<R extends Rank>(x: Tensor<R>) {\n let x4D: Tensor4D;\n if (x.rank === 0
```



```

|| x.rank === 1) {\n x4D = reshape(x, [1, 1, 1, x.size]);\n } else if (x.rank === 2) {\n x4D = reshape(x, [1, 1,
x.shape[0], x.shape[1]]);\n } else if (x.rank === 3) {\n x4D = reshape(x, [1, x.shape[0], x.shape[1], x.shape[2]]);\n
} else {\n x4D = x as Tensor4D;\n }\n\n return x4D;\n}\n"/**\n * @license\n * Copyright 2020 Google LLC.
All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this
file except in compliance with the License.\n
 * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless
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"AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n
 * See the License for the specific language governing permissions and\n * limitations under the License.\n
=====
*\n\nimport {ENGINE} from '../engine';\nimport {FusedBatchNorm, FusedBatchNormAttrs,
FusedBatchNormInputs} from '../kernel_names';\nimport {NamedAttrMap} from '../kernel_registry';\nimport
{Tensor, Tensor1D, Tensor4D} from '../tensor';\nimport {NamedTensorMap} from '../tensor_types';\nimport
{convertToTensor} from '../tensor_util_env';\nimport {Rank, TensorLike} from '../types';\nimport * as util from
'../util';\n\nimport {xAs4D} from './batchnorm_util';\nimport {op} from './operation';\nimport
{reshape} from './reshape';\n\n/**\n * Batch normalization.\n * As described in\n *
http://arxiv.org/abs/1502.03167.\n *\n * Mean, variance, scale, and offset can be
of two shapes:\n * - The same shape as the input.\n * - In the common case, the depth dimension is the last
dimension of x, so\n * the values would be an `tf.Tensor1D` of shape [depth].\n *\n * Also available are stricter
rank-specific methods with the same signature\n * as this method that assert that parameters passed are of given
rank\n * - `tf.batchNorm2d`\n * - `tf.batchNorm3d`\n * - `tf.batchNorm4d`\n *\n * @param x The input
Tensor.\n * @param mean A mean Tensor.\n * @param variance A variance Tensor.\n * @param offset An offset
Tensor.\n * @param scale A scale Tensor.\n * @param varianceEpsilon A small float number to avoid dividing by
0.\n *\n * @doc {heading: 'Operations', subheading: 'Normalization'}\n */\nfunction batchNorm<R extends
Rank>(\n
 x: Tensor<R>|TensorLike, mean: Tensor<R>|Tensor1D|TensorLike,\n variance:
Tensor<R>|Tensor1D|TensorLike,\n offset?: Tensor<R>|Tensor1D|TensorLike,\n scale?:
Tensor<R>|Tensor1D|TensorLike,\n varianceEpsilon?: number): Tensor<R> {\n if (varianceEpsilon == null) {\n
varianceEpsilon = 0.001;\n }\n const $x = convertToTensor(x, 'x', 'batchNorm');\n const $mean =
convertToTensor(mean, 'mean', 'batchNorm');\n const $variance = convertToTensor(variance, 'variance',
'batchNorm');\n let $scale: Tensor<R>|Tensor1D;\n if (scale != null) {\n $scale = convertToTensor(scale, 'scale',
'batchNorm');\n }\n let $offset: Tensor<R>|Tensor1D;\n if (offset != null) {\n $offset = convertToTensor(offset,
'offset', 'batchNorm');\n }\n util.assert(\n $mean.rank === $variance.rank,\n () => 'Batch normalization
gradient requires mean and variance to have ' +\n 'equal ranks.);\n util.assert(\n $offset == null ||
$mean.rank === $offset.rank,\n () =>
'Batch normalization gradient requires mean and offset to have ' +\n 'equal ranks.);\n util.assert(\n $scale
== null || $mean.rank === $scale.rank,\n () => 'Batch normalization gradient requires mean and scale to have '
+ \n 'equal ranks.);\n const x4D: Tensor4D = xAs4D($x);\n const inputs: FusedBatchNormInputs = {\n
x: x4D,\n scale: $scale,\n offset: $offset,\n mean: $mean,\n variance: $variance\n }; \n const attrs:
FusedBatchNormAttrs = {varianceEpsilon};\n // tslint:disable-next-line: no-unnecessary-type-assertion\n const
res = ENGINE.runKernel(\n FusedBatchNorm, inputs as { } as NamedTensorMap,\n attrs as { }
as NamedAttrMap) as Tensor<R>;\n return reshape(res, $x.shape);\n}\n\nexport const batchNorm =
op({batchNorm_});\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under
the Apache License, Version 2.0 (the "License");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language

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governing permissions and\n \* limitations under the License.\n \*

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=====
*\nimport {Tensor1D, Tensor2D} from './tensor';\nimport {convertToTensor} from './tensor_util_env';\nimport
{TensorLike} from './types';\nimport * as util from './util';\n\nimport {batchNorm} from './batchnorm';\nimport
{op} from './operation';\n\n/**\n * Batch normalization, strictly for 2D. For the more relaxed version, see\n *
`tf.batchNorm`.\n *\n * @param x The input Tensor.\n * @param mean A mean Tensor.\n * @param variance A
variance
Tensor.\n * @param offset An offset Tensor.\n * @param scale A scale Tensor.\n * @param varianceEpsilon A
small float
number to avoid dividing by 0.\n */\nfunction batchNorm2d_(\n x: Tensor2D|TensorLike, mean:
Tensor2D|Tensor1D|TensorLike,\n variance: Tensor2D|Tensor1D|TensorLike,\n offset?:
Tensor2D|Tensor1D|TensorLike, scale?: Tensor2D|Tensor1D|TensorLike,\n varianceEpsilon?: number):
Tensor2D {\n const $x = convertToTensor(x, 'x', 'batchNorm');\n const $mean = convertToTensor(mean, 'mean',
'batchNorm');\n const $variance = convertToTensor(variance, 'variance', 'batchNorm');\n let $scale:
Tensor2D|Tensor1D;\n if (scale != null) {\n $scale = convertToTensor(scale, 'scale', 'batchNorm');\n }\n let
$offset: Tensor2D|Tensor1D;\n if (offset != null) {\n $offset = convertToTensor(offset, 'offset', 'batchNorm');\n
}\n util.assert(\n $x.rank === 2,\n () => `Error in batchNorm2D: x must be rank 2 but got rank ` +\n
`${$x.rank}`);\n util.assert(\n $mean.rank === 2 || $mean.rank === 1,\n () => `Error in batchNorm2D: mean must be rank 2 or rank 1 but `
+ \n
`got rank `${$mean.rank}`);\n util.assert(\n $variance.rank === 2 || $variance.rank === 1,\n () =>
`Error in batchNorm2D: variance must be rank 2 or rank 1 ` + \n
`but got rank `${$variance.rank}`);\n if
($scale != null) {\n util.assert(\n $scale.rank === 2 || $scale.rank === 1,\n () => `Error in batchNorm2D:
scale must be rank 2 or rank 1 ` + \n
`but got rank `${$scale.rank}`);\n }\n if ($offset != null) {\n util.assert(\n $offset.rank === 2 || $offset.rank === 1,\n () => `Error in batchNorm2D: offset must be rank 2
or rank 1 ` + \n
`but got rank `${$offset.rank}`);\n }\n return batchNorm($x, $mean, $variance, $offset,
$scale, varianceEpsilon);\n}\n\nexport const batchNorm2d = op({batchNorm2d_});\n", "/*\n * @license\n *
Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed
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the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n
*\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is
distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n */
=====
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```
*\nimport {Tensor1D, Tensor3D} from './tensor';\nimport {convertToTensor} from './tensor_util_env';\nimport
{TensorLike} from './types';\nimport * as util from './util';\n\nimport {batchNorm} from './batchnorm';\nimport
{op} from './operation';\n\n/**\n * Batch normalization, strictly for 3D. For the more relaxed version, see\n *
`tf.batchNorm`.\n *\n * @param x The input Tensor.\n * @param mean A mean Tensor.\n * @param variance A variance Tensor.\n *
@param offset An offset Tensor.\n * @param scale A scale Tensor.\n * @param varianceEpsilon A small float
number to avoid dividing by 0.\n */\nfunction batchNorm3d_(\n x: Tensor3D|TensorLike, mean:
Tensor3D|Tensor1D|TensorLike,\n variance: Tensor3D|Tensor1D|TensorLike,\n offset?:
Tensor3D|Tensor1D|TensorLike, scale?: Tensor3D|Tensor1D|TensorLike,\n varianceEpsilon?: number):
Tensor3D {\n const $x = convertToTensor(x, 'x', 'batchNorm');\n const $mean = convertToTensor(mean, 'mean',
'batchNorm');\n const $variance = convertToTensor(variance, 'variance', 'batchNorm');\n let $scale:
Tensor3D|Tensor1D;\n if (scale != null) {\n $scale = convertToTensor(scale, 'scale', 'batchNorm');\n }\n let
$offset: Tensor3D|Tensor1D;\n if (offset != null) {\n $offset = convertToTensor(offset, 'offset', 'batchNorm');\n
}\n util.assert(\n $x.rank === 3,\n () => `Error
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in batchNorm3D: x must be rank 3 but got rank ` +\n `${$x.rank}.`);\n util.assert(\n $mean.rank === 3 ||
$mean.rank === 1,\n () => `Error in batchNorm3D: mean must be rank 3 or rank 1 but ` +\n `got rank
`${$mean.rank}.`);\n util.assert(\n $variance.rank === 3 || $variance.rank === 1,\n () => `Error in
batchNorm3D: variance must be rank 3 or rank 1 ` +\n `but got rank `${$variance.rank}.`);\n if ($scale != null)
{\n util.assert(\n $scale.rank === 3 || $scale.rank === 1,\n () => `Error in batchNorm3D: scale must be
rank 3 or rank 1 ` +\n `but got rank `${$scale.rank}.`);\n } \n if ($offset != null) {\n util.assert(\n
$offset.rank === 3 || $offset.rank === 1,\n () => `Error in batchNorm3D: offset must be rank 3 or rank 1 ` +\n
 `but got rank `${$offset.rank}.`);\n } \n\n return batchNorm($x, $mean, $variance, $offset, $scale,
varianceEpsilon);\n}\n\nexport const batchNorm3d = op({batchNorm3d_});\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version
2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
===== \n
*/\nimport {Tensor1D, Tensor4D} from './tensor';\nimport {convertToTensor} from './tensor_util_env';\nimport
{TensorLike} from './types';\nimport * as util from './util';\nimport {batchNorm} from './batchnorm';\nimport
{op} from './operation';\n\n/**\n * Batch
normalization, strictly for 4D. For the more relaxed version, see\n * `tf.batchNorm`. \n\n * @param x The input
Tensor.\n * @param mean A mean Tensor.\n * @param variance A variance Tensor.\n * @param offset An offset
Tensor.\n * @param scale A scale Tensor.\n * @param varianceEpsilon A small float number to avoid dividing by
0.\n\n * @function batchNorm4d_\n * x: Tensor4D|TensorLike, mean: Tensor4D|Tensor1D|TensorLike,\n * variance:
Tensor4D|Tensor1D|TensorLike,\n * offset?: Tensor4D|Tensor1D|TensorLike, scale?:
Tensor4D|Tensor1D|TensorLike,\n * varianceEpsilon?: number): Tensor4D {\n const $x = convertToTensor(x, 'x',
'batchNorm');\n const $mean = convertToTensor(mean, 'mean', 'batchNorm');\n const $variance =
convertToTensor(variance, 'variance', 'batchNorm');\n let $scale: Tensor4D|Tensor1D;\n if (scale != null) {\n
$scale = convertToTensor(scale, 'scale', 'batchNorm');\n }\n let $offset: Tensor4D|Tensor1D;\n if (offset != null)
{\n $offset = convertToTensor(offset,
'offset', 'batchNorm');\n }\n util.assert(\n $x.rank === 4,\n () => `Error in batchNorm4D: x must be rank 4
but got rank ` +\n `${$x.rank}.`);\n util.assert(\n $mean.rank === 4 || $mean.rank === 1,\n () => `Error
in batchNorm4D: mean must be rank 4 or rank 1 but ` +\n `got rank `${$mean.rank}.`);\n util.assert(\n
$variance.rank === 4 || $variance.rank === 1,\n () => `Error in batchNorm4D: variance must be rank 4 or rank 1
` +\n `but got rank `${$variance.rank}.`);\n if ($scale != null) {\n util.assert(\n $scale.rank === 4 ||
$scale.rank === 1,\n () => `Error in batchNorm4D: scale must be rank 4 or rank 1 ` +\n `but got rank
`${$scale.rank}.`);\n }\n if ($offset != null) {\n util.assert(\n $offset.rank === 4 || $offset.rank === 1,\n ()
=> `Error in batchNorm4D: offset must be rank 4 or rank 1 ` +\n `but got rank `${$offset.rank}.`);\n }\n \n
return batchNorm($x, $mean,
$variance, $offset, $scale, varianceEpsilon);\n}\n\nexport const batchNorm4d = op({batchNorm4d_});\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version
2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
===== \n
*/\nimport {ENGINE} from './engine';\nimport {Bincount, BincountAttrs, BincountInputs} from
'./kernel_names';\nimport {NamedAttrMap} from './kernel_registry';\nimport {Tensor1D}

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from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from
'./tensor_util_env';\nimport {TensorLike} from './types';\nimport * as util from './util';\n\nimport {op} from
'./operation';\n\n/**\n * Outputs a vector with length `size` and the same dtype as `weights`.\n * If `weights` are
empty, then index `i` stores the number of times the value\n * `i` is counted in `x`. If `weights` are non-empty, then
index `i` stores the\n * sum of the value in `weights` at each index where the corresponding value in\n * `x` is `i`.\n * Values in `x` outside of the range [0, size) are ignored.\n * @param x The input int tensor, rank 1.\n *
@param weights The weights tensor, must have the same shape as x, or a\n * length-0 Tensor, in which case it
acts as all weights equal to 1.\n * @param size Non-negative integer.\n * @doc {heading: 'Operations',
subheading: 'Reduction'}\n */\nfunction bincount_<T extends Tensor1D>(\n x: T|TensorLike,
 weights: T|TensorLike, size: number): T {\n const $x = convertToTensor(x, 'x', 'bincount');\n const $weights =
convertToTensor(weights, 'weights', 'bincount');\n util.assert(\n $x.dtype === 'int32',\n () => `Error in
bincount: input ` +\n `dtype must be int32, but got ${$x.dtype}`);\n util.assert(size >= 0, () => `size must be
non-negative, but got ${size}.`);\n util.assert(\n $weights.size === $x.size || $weights.size === 0,\n () =>
`Error in bincount: weights must have the same size as input or ` +\n `0-length, but got input shape:
${$x.shape}, weights shape: ` +\n `${$weights.shape}.`);\n const inputs: BincountInputs = {x: $x, weights:
$weights};\n const attrs: BincountAttrs = {size};\n return ENGINE.runKernel(\n Bincount, inputs as {} as
NamedTensorMap, attrs as {} as NamedAttrMap);\n}\n\nexport const bincount = op({bincount_});\n\n"/**\n *
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distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n */
=====
\n\nimport {ENGINE} from './engine';\nimport {Tile, TileAttrs, TileInputs} from './kernel_names';\nimport
{NamedAttrMap} from './kernel_registry';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from
'./tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport {Rank, ShapeMap, TensorLike}
from './types';\nimport {clone} from
'./clone';\nimport {op} from './operation';\nimport {reshape} from './reshape';\n\n/**\n * Broadcast an array to a
compatible shape NumPy-style.\n * The tensor's shape is compared to the broadcast shape from end to
beginning.\n * Ones are prepended to the tensor's shape until it has the same length as\n * the broadcast
shape. If input.shape[i]==shape[i], the (i+1)-th axis is\n * already broadcast-compatible. If input.shape[i]==1 and
shape[i]==N, then\n * the input tensor is tiled N times along that axis (using tf.tile).\n * @param input The
tensor that is to be broadcasted.\n * @param shape The input is to be broadcast to this shape.\n * @doc
{heading: 'Tensors', subheading: 'Transformations'}\n */\nfunction broadcastTo_<R extends Rank>(\n x:
Tensor|TensorLike, shape: ShapeMap[R]): Tensor<R> {\n let input = convertToTensor(x, 'broadcastTo', 'x');\n const xShape = input.shape;\n if (shape.some(d => !(d > 0) || d % 1 !== 0)) {\n throw new Error(`broadcastTo():
Invalid
broadcast shape ${shape}.`);\n }\n if (shape.length < input.rank) {\n throw new Error(`broadcastTo():
shape.length=${shape.length} < input.rank=${\n input.rank}.`);\n }\n if (shape.length > input.rank) {\n
const newShape = input.shape.slice();\n while (newShape.length < shape.length) {\n newShape.unshift(1);\n
 }\n input = reshape(input, newShape);\n }\n const inputShape = input.shape;\n const reps: number[] =
Array.from(shape);\n for (let i = shape.length - 1; i >= 0; i--) {\n if (inputShape[i] === shape[i]) {\n
reps[i] = 1;\n } else if (inputShape[i] !== 1) {\n throw new Error(\n `broadcastTo(): ${xShape} cannot be
broadcast to ${shape}.`);\n }\n }\n const axes = reps.map((n, i) => n > 1 ? i : -1).filter(i => i >= 0);\n if
(axes.length === 0) {\n return clone(input) as Tensor<R>;\n }\n // TODO call broadcastTo kernel directly once
backends implement broadcastTo\n const inputs: TileInputs = {x:

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input});\n const attrs: TileAttrs = {reps};\n return ENGINE.runKernel(\n Tile, inputs as { } as
NamedTensorMap, attrs as unknown as NamedAttrMap);\n}\n\nexport const broadcastTo =
op({broadcastTo_});\n", "/*\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed
under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * \n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
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=====\n
*\n\nimport {ENGINE} from '../engine';\nimport {Ceil, CeilInputs} from
'../kernel_names';\nimport {Tensor} from '../tensor';\nimport {NamedTensorMap} from '../tensor_types';\nimport
{convertToTensor} from '../tensor_util_env';\nimport {TensorLike} from '../types';\n\nimport {op} from
'../operation';\n\n/*\n * Computes ceiling of input `tf.Tensor` element-wise: `ceil(x)`\n * \n * ```\n * const x =
tf.tensor1d([.6, 1.1, -3.3]);\n * \n * x.ceil().print(); // or tf.ceil(x)\n * ```\n * @param x The input Tensor.\n * \n *
@doc {heading: 'Operations', subheading: 'Basic math'}\n *\nfunction ceil_<T extends Tensor>(x: T|TensorLike):
T {\n const $x = convertToTensor(x, 'x', 'ceil');\n \n const inputs: CeilInputs = {x: $x};\n return
ENGINE.runKernel(Ceil, inputs as { } as NamedTensorMap);\n}\n\nexport const ceil = op({ceil_});\n", "/*\n *
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2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
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=====\n
*\n\nimport {ENGINE} from '../engine';\nimport {ClipByValue, ClipByValueAttrs, ClipByValueInputs} from
'../kernel_names';\nimport {NamedAttrMap} from '../kernel_registry';\nimport {Tensor} from '../tensor';\nimport
{NamedTensorMap} from '../tensor_types';\nimport {convertToTensor} from '../tensor_util_env';\nimport
{TensorLike} from '../types';\n\nimport * as util from '../util';\n\nimport {op} from '../operation';\n\n/*\n * Clips
values element-wise. `max(min(x, clipValueMax), clipValueMin)`\n * \n * ```\n * const
x = tf.tensor1d([-1, 2, -3, 4]);\n * \n * x.clipByValue(-2, 3).print(); // or tf.clipByValue(x, -2, 3)\n * ```\n * @param
x The input tensor.\n * @param clipValueMin Lower-bound of range to be clipped to.\n * @param clipValueMax
Upper-bound of range to be clipped to.\n * \n * @doc {heading: 'Operations', subheading: 'Basic math'}\n *\nfunction clipByValue_<T extends Tensor>(\n x: T|TensorLike, clipValueMin: number, clipValueMax:
number): T {\n const $x = convertToTensor(x, 'x', 'clipByValue');\n util.assert(\n (clipValueMin <=
clipValueMax),\n () => `Error in clip: min (${clipValueMin}) must be ` +\n `less than or equal to max
(${clipValueMax}).`);\n \n const inputs: ClipByValueInputs = {x: $x};\n const attrs: ClipByValueAttrs =
{clipValueMin, clipValueMax};\n \n return ENGINE.runKernel(\n ClipByValue, inputs as { } as
NamedTensorMap, attrs as { } as NamedAttrMap);\n}\n\nexport const clipByValue = op({clipByValue_});\n", "/*\n *
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software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
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*\\nimport {Tensor1D} from './tensor';\\nimport {TensorLike} from './types';\\n\\nimport {concat} from
'./concat';\\nimport {op} from './operation';\\n\\n/**\\n * Concatenates a list of tf.Tensor1D`s along an axis. See
`concat` for details.\\n *\\n * For example, if:\\n * A: shape(3) = |r1, g1, b1|\\n * B: shape(2) = |r2,
g2|\\n * C = tf.concat1d([A, B]) == |r1, g1, b1, r2, g2|\\n *\\n * @param tensors A list of tf.Tensor`s to concatenate.\\n
* @return The concatenated array.\\n */\\nfunction concat1d_(tensors: Array<Tensor1D|TensorLike>): Tensor1D {\\n
return concat(tensors, 0 /* axis */);\\n}\\n\\nexport const concat1d = op({concat1d_});\\n", "/*\\n * @license\\n *
Copyright 2020 Google LLC. All Rights Reserved.\\n * Licensed under the Apache License, Version 2.0 (the
`License`);\\n * you may not use this file except in compliance with the License.\\n * You may obtain a copy of the
License at\\n *\\n * http://www.apache.org/licenses/LICENSE-2.0\\n *\\n * Unless required by applicable law or
agreed to in writing, software\\n * distributed under the License is distributed on an `AS IS` BASIS,\\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\\n * See the License for
the specific language governing permissions and\\n * limitations under the License.\\n */

```

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=====\\n
*\\nimport {Tensor2D} from './tensor';\\nimport {TensorLike} from './types';\\n\\nimport {concat} from
'./concat';\\nimport {op} from './operation';\\n\\n/**\\n * Concatenates a list of tf.Tensor2D`s along an axis. See
`concat` for details.\\n *\\n * For example, if:\\n * A: shape(2, 3) = | r1, g1, b1 |\\n * | r2, g2, b2 |\\n * B:
shape(2, 3) = | r3, g3, b3 |\\n * | r4, g4, b4 |\\n *\\n * C = tf.concat2d([A, B], axis)\\n *\\n * if axis = 0:\\n * C:
shape(4, 3) = | r1, g1, b1 |\\n * | r2, g2, b2 |\\n * | r3, g3, b3 |\\n * | r4, g4, b4 |\\n *\\n * if
axis = 1:\\n * C = shape(2, 6) = | r1, g1, b1, r3, g3, b3 |\\n * | r2, g2, b2, r4, g4, b4 |\\n *\\n * @param
tensors A list of `tf.Tensor`s to concatenate.\\n * @param axis The axis to concatenate along.\\n * @return The
concatenated array.\\n */\\nfunction concat2d_(\\n tensors: Array<Tensor2D|TensorLike>, axis: number):
Tensor2D {\\n return concat(tensors, axis);\\n}\\n\\nexport const concat2d = op({concat2d_});\\n", "/*\\n * @license\\n *
Copyright 2020 Google LLC. All Rights Reserved.\\n * Licensed under the Apache License, Version 2.0 (the
`License`);\\n * you may not use this file except in compliance with the License.\\n * You may obtain a copy of the
License at\\n *\\n * http://www.apache.org/licenses/LICENSE-2.0\\n *\\n * Unless required by applicable law or
agreed to in writing, software\\n * distributed under the License is distributed on an `AS IS` BASIS,\\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\\n * See the License for
the specific language governing permissions and\\n * limitations under the License.\\n */

```

```

=====\\n
*\\nimport {Tensor3D} from './tensor';\\nimport {TensorLike} from './types';\\n\\nimport {concat} from
'./concat';\\nimport {op} from './operation';\\n\\n/**\\n * Concatenates a list of `tf.Tensor3D`s
along an axis.\\n * See `concat` for details.\\n *\\n * For example, if:\\n * A: shape(2, 1, 3) = | r1, g1, b1 |\\n *
 | r2, g2, b2 |\\n * B: shape(2, 1, 3) = | r3, g3, b3 |\\n * | r4, g4, b4 |\\n *\\n * C = tf.concat3d([A, B],
axis)\\n *\\n * if axis = 0:\\n * C: shape(4, 1, 3) = | r1, g1, b1 |\\n * | r2, g2, b2 |\\n * | r3, g3, b3 |\\n *
 | r4, g4, b4 |\\n *\\n * if axis = 1:\\n * C: shape(2, 2, 3) = | r1, g1, b1, r3, g3, b3 |\\n * | r2,
g2, b2, r4, g4, b4 |\\n *\\n * if axis = 2:\\n * C = shape(2, 1, 6) = | r1, g1, b1, r3, g3, b3 |\\n * | r2, g2, b2,
r4, g4, b4 |\\n *\\n * @param tensors A list of tf.Tensor`s to concatenate.\\n * @param axis The axis to concate
along.\\n * @return The concatenated array.\\n */\\nfunction concat3d_(\\n tensors: Array<Tensor3D|TensorLike>,
axis: number): Tensor3D {\\n return concat(tensors, axis);\\n}\\n\\nexport const concat3d =
op({concat3d_});\\n", "/*\\n * @license\\n * Copyright 2020 Google LLC. All Rights Reserved.\\n * Licensed under
the Apache License, Version 2.0 (the `License`);\\n * you may not use this file except in compliance with the
License.\\n * You may obtain a copy of the License at\\n *\\n * http://www.apache.org/licenses/LICENSE-2.0\\n *\\n *
Unless required by applicable law or agreed to in writing, software\\n * distributed under the License is distributed
on an `AS IS` BASIS,\\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\\n * See the License for the specific language governing permissions and\\n * limitations under the
License.\\n */

```

```

=====\\n
*\\nimport {Tensor4D} from './tensor';\\nimport {TensorLike} from './types';\\n\\nimport {concat} from

```



```
Conv2DInputs = {x: x4D, filter: $filter};\n const attrs:\n\n const conv2dAttrs = {\n strides,\n pad,\n dataFormat,\n dilations,\n dimRoundingMode\n };\n\n // tslint:disable-next-line: no-unnecessary-type-assertion\n const res = ENGINE.runKernel(\n Conv2D, inputs as {} as NamedTensorMap,\n attrs as {} as NamedAttrMap) as T;\n\n if (reshapedTo4D) {\n return reshape(res, [res.shape[1], res.shape[2], res.shape[3]]);\n }\n\n return res;\n }\n}\n\nexport const conv2d = op({conv2d});\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n\n=====\n\nimport {Tensor2D, Tensor3D, Tensor4D} from '../tensor';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from '../types';\nimport * as util from './util';\nimport {conv2d} from './conv2d';\nimport * as conv_util from './conv_util';\nimport {op} from './operation';\nimport {reshape} from './reshape';\n\n/**\n * Computes a 1D convolution over the input x.\n *\n * @param x The input tensor, of rank 3 or rank 2, of shape\n * `[batch, width, inChannels]`. If rank 2, batch of 1 is assumed.\n *\n * @param filter The filter, rank 3, of shape\n * `[filterWidth, inDepth, outDepth]`.\n *\n * @param stride The number of entries by which the filter is moved right at\n * each step.\n *\n * @param pad The type of padding algorithm. - `same` and stride 1: output will be of same size as input, regardless of filter size. - `valid`: output will be smaller than input if filter is larger than 1x1.\n *\n * - For more info, see this guide: https://www.tensorflow.org/api_guides/python/nn#Convolution\n *\n * @param dataFormat An optional string from 'NWC', 'NCW'. Defaults to 'NWC'. the data is stored in the order of [batch, in_width, in_channels]. Only 'NWC' is currently supported.\n *\n * @param dilation The dilation rate in which we sample input values across convolution. Defaults to 1. If it is greater than 1, then stride must be 1.\n *\n * @param dimRoundingMode A string from: 'ceil', 'round', 'floor'. If none is provided, it will default to truncate.\n *\n * @doc {heading: 'Operations', subheading: 'Convolution'}\n */\nfunction conv1d<T>(extends Tensor2D|Tensor3D)(\n x: T|TensorLike, filter: Tensor3D|TensorLike, stride: number, pad: 'valid'|'same'|number|conv_util.ExplicitPadding, dataFormat: 'NWC'|'NCW' = 'NWC', dilation = 1, dimRoundingMode?: 'floor'|'round'|'ceil'): T {\n const $x = convertToTensor(x, 'x', 'conv1d');\n const $filter = convertToTensor(filter, 'filter', 'conv1d');\n let x3D = $x as Tensor3D;\n let reshapedTo3D = false;\n if ($x.rank === 2) {\n reshapedTo3D = true;\n x3D = reshape($x, [1, $x.shape[0], $x.shape[1]]);\n }\n util.assert(x3D.rank === 3, () => `Error in conv1d: input must be rank 3, but got rank ${x3D.rank}.`);\n util.assert($filter.rank === 3, () => `Error in conv1d: filter must be rank 3, but got rank ` + $filter.rank);`\n if (dimRoundingMode != null) {\n util.assert(util.isInt(pad as number), () => `Error in conv1d: pad must be an integer when using, ` + dimRoundingMode + ` but got pad ${pad}.`);\n }\n util.assert(x3D.shape[2] === $filter.shape[1], () => `Error in conv1d: depth of input (${x3D.shape[2]}) must match ` + `input depth for filter (${filter.shape[1]}.`);\n util.assert(conv_util.eitherStridesOrDilationsAreOne(stride, dilation), () => `Error in conv1D: Either stride or dilation must be 1. ` + `Got stride ${stride} and dilation '${dilation}'`);\n util.assert(dataFormat === 'NWC', () => `Error in conv1d: got dataFormat of ${dataFormat} but only NWC is currently supported.`);\n const filter4D = reshape($filter, [1, $filter.shape[0], $filter.shape[1], $filter.shape[2]]);\n const input4D = reshape(x3D, [x3D.shape[0], 1, x3D.shape[1], x3D.shape[2]]);\n const strides: [number, number] = [1, stride];\n const dilations: [number, number] = [1, dilation];\n const conv2dDataFormat = 'NHWC';\n const res = conv2d(input4D as Tensor4D, (filter4D as Tensor4D), strides, pad, conv2dDataFormat, dilations, dimRoundingMode);\n if (reshapedTo3D) {\n return reshape(res, [res.shape[2],
```



```

res.shape[3])) as T;\n }\n\n return reshape(res, [res.shape[0],
res.shape[2], res.shape[3]]) as T;\n }\n\nexport const conv1d = op({conv1d_});\n"/**\n * @license\n * Copyright
2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n *
you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*\nimport {ENGINE} from '../engine';\nimport {Conv2DBackpropInput, Conv2DBackpropInputAttrs,
Conv2DBackpropInputInputs} from '../kernel_names';\nimport {NamedAttrMap} from '../kernel_registry';\nimport
{Tensor3D, Tensor4D} from '../tensor';\nimport {NamedTensorMap} from '../tensor_types';\nimport * as util from
'../util';\nimport * as conv_util from './conv_util';\nimport {op} from './operation';\nimport {reshape} from
'./reshape';\n\n/**\n * Computes the derivative of the input of a 2D convolution.\n * @param xShape The shape
of the input: [batch, height, width, inDepth].\n * If length of 3, batch of 1 is assumed.\n * @param dy The derivative
of the output, of rank 4 or rank 3 of shape\n * `[batch, outHeight, outWidth, outDepth]`. If rank 3, batch of 1 is\n *
assumed.\n * @param filter The filter, rank 4, of shape\n * `[filterHeight, filterWidth, inDepth, outDepth]`.\n *
@param strides The strides of the convolution: `[strideHeight,\n * strideWidth]`.\n * @param pad The type of
padding algorithm used:\n * - `same` and stride 1: output will be of same size as input,\n * regardless of filter
size.\n * - `valid`: output will be smaller than input if
filter is larger\n * than 1x1.\n * @param dataFormat: An optional string from: "NHWC", "NCHW". Defaults
to\n * "NHWC". Specify the data format of the input and output data. With the\n * default format "NHWC",
the data is stored in the order of: [batch,\n * height, width, channels].\n * @param dimRoundingMode A string
from: 'ceil', 'round', 'floor'. If none is\n * provided, it will default to truncate.\n */\nfunction
conv2DBackpropInput_<T extends Tensor3D|Tensor4D>(\n xShape: [number, number, number,
number]|[number, number, number], dy: T,\n filter: Tensor4D, strides: [number, number]|[number,\n pad:
'valid'|'same'|number|conv_util.ExplicitPadding,\n dataFormat: 'NHWC'|'NCHW' = 'NHWC',\n dimRoundingMode?: 'floor'|'round'|'ceil'): T {\n util.assert(\n xShape.length === dy.rank,\n () => `Length of
inShape ` +\n `${xShape.length}` and rank of dy (${dy.rank}) must match`);\n\n let xShape4D = xShape as
[number, number, number,
number];\n let dy4D = dy as Tensor4D;\n let reshapedTo4D = false;\n if (dy.rank === 3) {\n reshapedTo4D =
true;\n dy4D = reshape(dy, [1, dy.shape[0], dy.shape[1], dy.shape[2]]);\n xShape4D = [1, xShape[0], xShape[1],
xShape[2]];\n }\n\n util.assert(\n xShape4D.length === 4,\n () => `Error in conv2dDerInput: inShape
must be length 4, but got length ` +\n `${xShape4D.length}`);\n\n util.assert(\n dy4D.rank === 4,\n () =>
`Error in conv2dDerInput: dy must be rank 4, but got ` +\n `rank ${dy4D.rank}`);\n\n util.assert(\n filter.rank
=== 4,\n () => `Error in conv2dDerInput: filter must be rank 4, but got ` +\n `rank ${filter.rank}`);\n const
inDepth = dataFormat === 'NHWC' ? xShape4D[3] : xShape4D[1];\n const outDepth = dataFormat === 'NHWC' ?
dy4D.shape[3] : dy4D.shape[1];\n util.assert(\n inDepth === filter.shape[2],\n () => `Error in
conv2dDerInput: depth of input (${inDepth}) must ` +\n `match input depth for filter ${filter.shape[2]}`);\n util.assert(\n outDepth === filter.shape[3],\n () =>
`Error in conv2dDerInput: depth of output (${outDepth}) must ` +\n `match output depth for filter
${filter.shape[3]}`);\n if (dimRoundingMode != null) {\n util.assert(\n util.isInt(pad as number),\n () =>
`Error in conv2dDerInput: pad must be an integer when using, ` +\n `dimRoundingMode
${dimRoundingMode} but got pad ${pad}`);\n }\n\n const inputs: Conv2DBackpropInputInputs = {dy: dy4D,
filter};\n const attrs: Conv2DBackpropInputAttrs = {\n strides, pad, dataFormat, dimRoundingMode,\n inputShape: xShape4D;\n }\n // tslint:disable-next-line: no-unnecessary-type-assertion\n const res =
ENGINE.runKernel(\n Conv2DBackpropInput, inputs as { } as NamedTensorMap,\n attrs as { }
as NamedAttrMap) as T;\n\n if (reshapedTo4D) {\n return reshape(res, [res.shape[1], res.shape[2], res.shape[3]])

```

as T;\n } \n return res;\n } \n\nexport const conv2DBackpropInput = op({conv2DBackpropInput\_});\n", "/\*\n \* @license\n \* Copyright 2020 Google LLC. All Rights Reserved.\n \* Licensed under the Apache License, Version 2.0 (the \"License\");\n \* you may not use this file except in compliance with the License.\n \* You may obtain a copy of the License at\n \* \n \* http://www.apache.org/licenses/LICENSE-2.0\n \* \n \* Unless required by applicable law or agreed to in writing, software\n \* distributed under the License is distributed on an \"AS IS\" BASIS,\n \* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*/

```
=====
\n
*\nimport {Tensor3D, Tensor4D} from './tensor';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\nimport {conv2DBackpropInput} from './conv2d_backprop_input';\nimport {op} from './operation';\n\n/**\n * Computes the transposed 2D convolution of an image, also known as a\n * deconvolution.\n * \n * @param x The input image, of rank 4 or rank 3, of shape\n * `[batch, height, width, inDepth]`. If rank 3, batch of 1 is assumed.\n * \n * @param filter The filter, rank 4, of shape\n * `[filterHeight, filterWidth, outDepth, inDepth]`. \n * `inDepth` must match `inDepth` in `x`.\n * \n * @param outputShape Output shape, of rank 4 or rank 3:\n * `[batch, height, width, outDepth]`. If rank 3, batch of 1 is assumed.\n * \n * @param strides The strides of the original convolution:\n * `[strideHeight, strideWidth]`.\n * \n * @param pad The type of padding algorithm used in the non-transpose version\n * of the op.\n * \n * @param dimRoundingMode A string from: 'ceil', 'round', 'floor'. If none is\n * provided, it will default to truncate.\n * \n * @doc {heading: 'Operations', subheading: 'Convolution'}\n */\nfunction conv2dTranspose_<T extends Tensor3D|Tensor4D>(\n x: T|TensorLike, filter: Tensor4D|TensorLike,\n outputShape: [number, number, number, number]|[number, number, number],\n strides: [number, number]|number, pad: 'valid'|'same'|number,\n dimRoundingMode?: 'floor'|'round'|'ceil'): T {\n const $x = convertToTensor(x, 'x', 'conv2dTranspose');\n const $filter = convertToTensor(filter, 'filter', 'conv2dTranspose');\n return conv2DBackpropInput(\n outputShape, $x, $filter, strides, pad, 'NHWC', dimRoundingMode);\n}\n\nexport const conv2dTranspose = op({conv2dTranspose_});\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed\n * on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */
```

```
=====
\n
*\nimport {ENGINE} from './engine';\nimport {Conv3D, Conv3DAttrs, Conv3DInputs} from './kernel_names';\nimport {NamedAttrMap} from './kernel_registry';\nimport {Tensor4D, Tensor5D} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\nimport * as util from './util';\nimport {eitherStridesOrDilationsAreOne} from './conv_util';\nimport {op} from './operation';\nimport {reshape} from './reshape';\n\n/**\n * Computes a 3D convolution over the input x.\n * \n * @param x The input tensor, of rank 5 or rank 4, of shape\n * `[batch, depth, height, width, channels]`. If rank 4, \n * batch of 1 is assumed.\n * \n * @param filter The filter, rank 5, of shape\n * `[filterDepth, filterHeight, filterWidth, inChannels, outChannels]`. \n * `inChannels` must match between input and filter.\n * \n * @param strides The strides of the convolution: `[strideDepth, strideHeight,\n * strideWidth]`.\n * \n * @param pad The type of padding algorithm.\n * \n * - `same` and stride 1: output will be of same size as input,\n * regardless of filter size.\n * \n * - `valid`: output will be smaller than input if filter is larger\n * than 1x1.\n * \n * - For more info, see this guide:\n * [https://www.tensorflow.org/api_guides/python/nn#Convolution](\n * https://www.tensorflow.org/api_guides/python/nn#Convolution)\n */\nfunction conv3d(\n x: TensorLike, filter: Tensor5D, strides: [number, number, number, number, number],\n pad: 'valid'|'same', dataFormat: 'NDHWC'|'NCDHW') {\n const $x = convertToTensor(x, 'x', 'conv3d');\n const $filter = convertToTensor(filter, 'filter', 'conv3d');\n return op({conv3d_}, $x, $filter, strides, pad, dataFormat);\n}\n\nexport const conv3d = op({conv3d_});\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed\n * on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */
```

With the default format `"NDHWC"`, the data is stored in the order of: [batch, depth, height, width, channels].

Only `"NDHWC"` is currently supported.

**@param dilations** The dilation rates: `[dilationDepth, dilationHeight, dilationWidth]` in which we sample input values across the height and width dimensions in atrous convolution. Defaults to `[1, 1, 1]`.

If `dilations` is a single number, then `dilationDepth == dilationHeight == dilationWidth`. If it is greater than 1, then all values of `strides` must be 1.

**@doc {heading: 'Operations', subheading: 'Convolution'}**

```
function conv3d<T extends Tensor4D|Tensor5D>(
 x: T|TensorLike, filter: Tensor5D|TensorLike,
 strides: [number, number, number]|number, pad: 'valid'|'same',
 dataFormat: 'NDHWC'|'NCDHW' = 'NDHWC',
 dilations: [number, number, number]|number = [1, 1, 1]): T {
 const $x = convertToTensor(x, 'x', 'conv3d');
 const $filter = convertToTensor(filter, 'filter', 'conv3d');
 let x5D = $x as Tensor5D;
 let reshapedTo5D = false;
 if ($x.rank === 4) {
 reshapedTo5D = true;
 x5D = reshape($x, [1, $x.shape[0], $x.shape[1], $x.shape[2], $x.shape[3]]);
 }
 util.assert(x5D.rank === 5, () => `Error in conv3d: input must be rank 5, but got rank ${x5D.rank}.`);
 util.assert($filter.rank === 5, () => `Error in conv3d: filter must be rank 5, but got rank ` +
 `${$filter.rank}.`);
 util.assert(x5D.shape[4] === $filter.shape[3], () => `Error in conv3d: depth of input
 (${x5D.shape[4]}) must match ` +
 `input depth for filter ${$filter.shape[3]}.`);
 util.assert(
 eitherStridesOrDilationsAreOne(strides, dilations),
 () => `Error in conv3D: Either strides or dilations must be 1.
 ` +
 `Got strides ${strides} and dilations ${dilations}`);
 util.assert(dataFormat === 'NDHWC',
 () => `Error in conv3d: got dataFormat of ${
 dataFormat} but only NDHWC is currently supported.`);
 const inputs: Conv3DInputs = {x: x5D, filter:
 $filter};
 const attrs: Conv3DAttrs = {strides, pad, dataFormat, dilations};
 // tslint:disable-next-line: no-unnecessary-type-assertion
 const res = ENGINE.runKernel(
 Conv3D, inputs as {} as
 NamedTensorMap,
 attrs as {} as NamedAttrMap) as T;
 if (reshapedTo5D) {
 return reshape(
 res, [res.shape[1], res.shape[2], res.shape[3], res.shape[4]]) as
 T;
 }
 return res;
}

export const
conv3d = op({conv3d_});

/**
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 * you may not use this file except in compliance with the
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 * distributed under the License is distributed
 * on an "AS IS" BASIS,
 * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND,
 * either express or implied.
 * See the License for the specific language governing permissions and
 * limitations
 * under the License.
 */
```

```
=====
* \nimport {ENGINE} from '../engine';
import {Conv3DBackpropInputV2, Conv3DBackpropInputV2Attrs,
Conv3DBackpropInputV2Inputs} from '../kernel_names';
import {NamedAttrMap} from
'../kernel_registry';
import {Tensor4D, Tensor5D} from '../tensor';
import {NamedTensorMap} from
'../tensor_types';
import * as util from '../util';
import {op} from './operation';
import {reshape} from
'./reshape';

/**
 * Computes the derivative of the input of a 3D convolution.
 *
 * @param xShape The shape
 * of the input: [batch, depth, height, width,
 * in_channels]. If length of 4, batch of 1 is assumed.
 *
 * @param dy The
 * derivative of the output, of rank 5 or rank 4 of shape
 * [batch, outDepth, outHeight, outWidth, in_channels]
 *
 * If rank 4, batch of 1 is assumed.
 *
 * @param filter The filter, rank 5, of shape
 * [filterDepth, filterHeight, filterWidth, inDepth, outDepth]
 *
 * @param strides The strides of the convolution:
 * [strideDepth, strideHeight, strideWidth]
 *
 * @param pad The
 * type of padding algorithm used:
 * - `same` and stride 1: output will be of same size as input,
 * regardless
 * of filter size.
 * - `valid`: output will be smaller than input if filter is larger
 * than 1x1.
 *
 * @function
 * conv3DBackpropInput<T extends Tensor4D|Tensor5D>(
 * xShape: [number, number, number, number,
 * number]|
 * [number, number, number, number],
 * dy: T, filter: Tensor5D, strides: [number, number,
 * number]|
 * number,
 * pad: 'valid'|'same'): T {
 * util.assert(xShape.length === dy.rank, () => `Length of
```

```

inShape` +\n `(${xShape.length}) and rank of dy (${dy.rank}) must match`);\n\n let xShape5D = xShape as
[number, number, number, number, number];\n let dy5D = dy as Tensor5D;\n
let reshapedTo5D = false;\n if (dy.rank === 4) {\n reshapedTo5D = true;\n dy5D = reshape(dy, [1,
dy.shape[0], dy.shape[1], dy.shape[2], dy.shape[3]]);\n xShape5D = [1, xShape[0], xShape[1], xShape[2],
xShape[3]];\n }\n\n const inDepth = xShape5D[4];\n const outDepth = dy5D.shape[4];\n util.assert(\n
xShape5D.length === 5,\n () =>\n `Error in conv3dDerInput: inShape must be length 5, but got length ` +\n
` ${xShape5D.length}.`);\n util.assert(\n dy5D.rank === 5,\n () => `Error in conv3dDerInput: dy must be
rank 5, but got ` +\n `rank ${dy5D.rank}`);\n util.assert(\n filter.rank === 5,\n () => `Error in
conv3dDerInput: filter must be rank 5, but got ` +\n `rank ${filter.rank}`);\n util.assert(\n inDepth ===
filter.shape[3],\n () => `Error in conv3dDerInput: depth of input (${inDepth}) must ` +\n `match input
depth for filter ${filter.shape[3]}.`);\n util.assert(\n outDepth === filter.shape[4],\n
() => `Error in conv3dDerInput: depth of output (${outDepth}) must ` +\n `match output depth for filter
${filter.shape[4]}.`);\n\n const inputs: Conv3DBackpropInputV2Inputs = {dy: dy5D, filter};\n\n const attrs:\n
Conv3DBackpropInputV2Attrs = {pad, strides, inputShape: xShape5D};\n\n // tslint:disable-next-line: no-
unnecessary-type-assertion\n const res = ENGINE.runKernel(\n Conv3DBackpropInputV2, inputs as { }\n
as NamedTensorMap,\n attrs as { } as NamedAttrMap as T);\n\n if (reshapedTo5D) {\n return
reshape(\n res, [res.shape[1], res.shape[2], res.shape[3], res.shape[4]] as\n T);\n }\n return
res;\n}\n\nexport const conv3DBackpropInput = op({conv3DBackpropInput_});\n\n"/**\n * @license\n * Copyright
2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n *
you may not use this file except in compliance with the License.\n * You may obtain
a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by
applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS"
BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the
License for the specific language governing permissions and\n * limitations under the License.\n *
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\n
*/\nimport {Tensor4D, Tensor5D} from '../tensor';\nimport {convertToTensor} from '../tensor_util_env';\nimport
{TensorLike} from '../types';\nimport {conv3DBackpropInput} from './conv3d_backprop_input';\nimport {op}
from './operation';\n\n/**\n * Computes the transposed 3D convolution of a volume, also known as a\n *
deconvolution.\n * \n * @param x The input image, of rank 5 or rank 4, of shape\n * `[batch, depth, height, width,
inDepth]`. If rank 4, batch of 1 is assumed.\n * \n * @param filter The
filter, rank 4, of shape\n * `[depth, filterHeight, filterWidth, outDepth, inDepth]`. \n * `inDepth` must match
`inDepth` in `x`.\n * \n * @param outputShape Output shape, of rank 5 or rank 4:\n * `[batch, depth, height, width,
outDepth]`. If rank 3, batch of 1 is\n * assumed.\n * \n * @param strides The strides of the original convolution:\n *
`[strideDepth, strideHeight, strideWidth]`.\n * \n * @param pad The type of padding algorithm used in the non-
transpose version\n * of the op.\n * \n * @doc {heading: 'Operations', subheading: 'Convolution'}\n */\nfunction
conv3dTranspose_<T extends Tensor4D|Tensor5D>(\n x: T|TensorLike, filter: Tensor5D|TensorLike,\n
outputShape:\n [number, number, number, number, number][number, number, number, number],\n
strides: [number, number, number]number, pad: 'valid'|'same'): T {\n const $x = convertToTensor(x, 'x',
'conv3dTranspose');\n const $filter = convertToTensor(filter, 'filter', 'conv3dTranspose');\n\n return
conv3DBackpropInput(outputShape, $x, $filter, strides, pad);\n}\n\nexport const conv3dTranspose =
op({conv3dTranspose_});\n\n"/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed
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License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless
required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
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*\\n\\nimport {ENGINE} from './engine';\\nimport {Cos, CosInputs} from './kernel_names';\\nimport {Tensor} from
'./tensor';\\nimport {NamedTensorMap} from
'./tensor_types';\\nimport {convertToTensor} from './tensor_util_env';\\nimport {TensorLike} from
'./types';\\n\\nimport {op} from './operation';\\n\\n/**\\n * Computes cos of the input `tf.Tensor` element-wise:
`cos(x)`\\n *\\n * ``js\\n * const x = tf.tensor1d([0, Math.PI / 2, Math.PI * 3 / 4]);\\n *\\n * x.cos().print(); // or
tf.cos(x)\\n * ``\\n * @param x The input tensor.\\n *\\n * @doc {heading: 'Operations', subheading: 'Basic math'}\\n
*\\n\\nfunction cos_<T extends Tensor>(x: T|TensorLike): T {\\n const $x = convertToTensor(x, 'x', 'cos');\\n\\n const
inputs: CosInputs = {x: $x};\\n\\n return ENGINE.runKernel(Cos, inputs as { } as NamedTensorMap);\\n}\\n\\nexport
const cos = op({cos_});\\n"/**\\n * @license\\n * Copyright 2018 Google LLC. All Rights Reserved.\\n * Licensed
under the Apache License, Version 2.0 (the "License");\\n * you may not use this file except in compliance with the
License.\\n * You may obtain a copy of the License at\\n *\\n * http://www.apache.org/licenses/LICENSE-2.0\\n *\\n *
Unless required by applicable law or agreed to in writing, software\\n * distributed under the License is distributed
on an "AS IS" BASIS,\\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\\n * See the License for the specific language governing permissions and\\n * limitations under the
License.\\n *
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*\\n\\nimport {ENGINE} from './engine';\\nimport {Cosh, CoshInputs} from './kernel_names';\\nimport {Tensor}
from './tensor';\\nimport {NamedTensorMap} from './tensor_types';\\nimport {convertToTensor} from
'./tensor_util_env';\\nimport {TensorLike} from './types';\\n\\nimport {op} from './operation';\\n\\n/**\\n * Computes
hyperbolic cos of the input `tf.Tensor` element-wise: `cosh(x)`\\n *\\n * ``js\\n * const x = tf.tensor1d([0, 1, -1, .7]);\\n
*\\n * x.cosh().print(); // or tf.cosh(x)\\n * ``\\n * @param x The input tensor.\\n *\\n * @doc {heading: 'Operations',
subheading: 'Basic math'}\\n
*\\n\\nfunction
cosh_<T extends Tensor>(x: T|TensorLike): T {\\n const $x = convertToTensor(x, 'x', 'cosh');\\n const inputs:
CoshInputs = {x: $x};\\n\\n return ENGINE.runKernel(Cosh, inputs as { } as NamedTensorMap);\\n}\\n\\nexport const
cosh = op({cosh_});\\n"/**\\n * @license\\n * Copyright 2018 Google LLC. All Rights Reserved.\\n * Licensed
under the Apache License, Version 2.0 (the "License");\\n * you may not use this file except in compliance with the
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Unless required by applicable law or agreed to in writing, software\\n * distributed under the License is distributed
on an "AS IS" BASIS,\\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\\n * See the License for the specific language governing permissions and\\n * limitations under the
License.\\n *
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*\\n\\nimport {ENGINE} from './engine';\\nimport
{Cumsum, CumsumAttrs, CumsumInputs} from './kernel_names';\\nimport {NamedAttrMap} from
'./kernel_registry';\\nimport {Tensor} from './tensor';\\nimport {NamedTensorMap} from './tensor_types';\\nimport
{convertToTensor} from './tensor_util_env';\\nimport {TensorLike} from './types';\\n\\nimport {op} from
'./operation';\\n\\n/**\\n * Computes the cumulative sum of a `tf.Tensor` along `axis`.\\n *\\n * ``js\\n * const x =
tf.tensor([1, 2, 3, 4]);\\n * x.cumsum().print();\\n * ``\\n * ``js\\n * const x = tf.tensor([[1, 2], [3, 4]]);\\n *
x.cumsum().print();\\n * ``\\n *\\n * @param x The input tensor to be summed.\\n * @param axis The axis along
which to sum. Optional. Defaults to 0.\\n * @param exclusive Whether to perform exclusive cumulative sum.
Optional.\\n * Defaults to false. If set to true then the sum of each tensor entry\\n * does not include its own
value, but only the values previous to it\\n * along the specified axis.\\n * @param reverse Whether to sum in the
opposite direction. Optional.\\n * Defaults to false.\\n *\\n * @doc {heading: 'Operations', subheading: 'Scan'}\\n
*\\n\\nfunction cumsum_<T extends Tensor>(\\n x: Tensor|TensorLike, axis = 0, exclusive = false, reverse = false): T
{\\n const $x = convertToTensor(x, 'x', 'cumsum');\\n\\n const inputs: CumsumInputs = {x: $x};\\n const attrs:
CumsumAttrs = {axis, exclusive, reverse};\\n\\n return ENGINE.runKernel(\\n Cumsum, inputs as { } as
NamedTensorMap, attrs as { } as NamedAttrMap);\\n}\\n\\n\\nexport const cumsum = op({cumsum_});\\n"/**\\n *
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WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied. See the License for the specific language governing permissions and limitations under the License.

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*/\n\nimport {ENGINE} from '../engine';\nimport {DenseBincount, DenseBincountAttrs, DenseBincountInputs}
from '../kernel_names';\nimport {NamedAttrMap} from '../kernel_registry';\nimport {Tensor1D, Tensor2D} from
 '../tensor';\nimport {NamedTensorMap} from '../tensor_types';\nimport {convertToTensor} from
 '../tensor_util_env';\nimport {TensorLike} from '../types';\nimport * as util from '../util';\n\nimport {op} from
 '../operation';\n\n/**\n * Outputs a vector with length `size` and the same dtype as `weights`. If `weights` are
empty, then index `i` stores the number of times the value `i` is counted in `x`. If `weights` are non-empty, then
index `i` stores the sum of the value in `weights` at each index where the corresponding
value in `x` is `i`. Values in `x` outside of the range [0, size) are ignored.\n * @param x The input
int tensor, rank 1 or rank 2.\n * @param weights The weights tensor, must have the same shape as x, or a
length-0 Tensor, in which case it acts as all weights equal to 1.\n * @param size Non-negative integer.\n * @param
binaryOutput Optional. Whether the kernel should count the appearance or number of occurrences. Defaults to
False.\n * @doc {heading: 'Operations', subheading: 'Reduction'}\n */\nfunction denseBincount<T extends
Tensor1D|Tensor2D>(\n x: T|TensorLike, weights: T|TensorLike, size: number,\n binaryOutput = false): T {\n
const $x = convertToTensor(x, 'x', 'denseBincount');\n const $weights = convertToTensor(weights, 'weights',
'denseBincount');\n\n util.assert(\n $x.dtype === 'int32',\n () => `Error in denseBincount: input ` +\n
`dtype must be int32, but got ${$x.dtype}`);\n util.assert(\n $x.rank
<= 2,\n () => `Error in denseBincount: input must be at most rank 2, but got ` +\n
`rank ${$x.rank}.`);\n\n util.assert(size >= 0, () => `size must be non-negative, but got ${size}.`);\n
util.assert(\n $weights.size ===
$x.size || $weights.size === 0,\n () => `Error in denseBincount: weights must have the same shape as x or
` +\n
`0-length, but got x shape: ${$x.shape}, weights shape: ` +\n
`${$weights.shape}.`);\n\n const
inputs: DenseBincountInputs = {x: $x, weights: $weights};\n const attrs: DenseBincountAttrs = {size,
binaryOutput};\n\n return ENGINE.runKernel(\n DenseBincount, inputs as { } as NamedTensorMap,\n attrs
as { } as NamedAttrMap);\n}\n\nexport const denseBincount = op({denseBincount_});\n\n/**\n * @license\n *
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obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by
applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS"\n
BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the
License for the specific language governing permissions and\n * limitations under the License.\n *
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=====
*/\n\nimport {ENGINE} from '../engine';\nimport {DepthToSpace, DepthToSpaceAttrs, DepthToSpaceInputs} from
 '../kernel_names';\nimport {NamedAttrMap} from '../kernel_registry';\nimport {Tensor4D} from '../tensor';\nimport
{NamedTensorMap} from '../tensor_types';\nimport {convertToTensor} from '../tensor_util_env';\nimport
{TensorLike4D} from '../types';\nimport * as util from '../util';\n\nimport {op} from '../operation';\n\n/**\n *
Rearranges data from depth into blocks of spatial data. More specifically,\n
* this op outputs a copy of the input tensor where values from the `depth` dimension are moved in spatial blocks
to the `height` and `width` dimensions.\n * The attr `blockSize` indicates the input block size and how the data is
moved.\n * - Chunks of data of size `blockSize * blockSize` from depth are rearranged into non-overlapping
blocks of size `blockSize x blockSize`\n * - The width the output tensor is `inputWidth * blockSize`, whereas
the height is `inputHeight * blockSize`\n * - The Y, X coordinates within each block of the output image are
determined by the high order component of the input channel index\n * - The depth of the input tensor must
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be divisible by `blockSize * \n * blockSize` \n * \n * The `dataFormat` attr specifies the layout of the input and output
tensors \n * with the following options: `\"NHWC\"`: [`batch, height, width, channels`] \n * `\"NCHW\"`: [`batch,
channels, height, width`] \n * \n * ``js\n * const x =
tf.tensor4d([1, 2, 3, 4], [1, 1, 1, 4]); \n * const blockSize = 2; \n * const dataFormat = \"NHWC\"; \n * \n *
tf.depthToSpace(x, blockSize, dataFormat).print(); \n * ``\n * \n * @param x The input tensor of rank 4 \n * @param
blockSize An `int` that is `>= 2`. The size of the spatial block \n * @param dataFormat An optional string from:
`\"NHWC\"`, `\"NCHW\"`. Defaults to `\"NHWC\"` \n * @doc {heading: 'Tensors', subheading: 'Transformations'} \n
*/\nfunction depthToSpace_(\n x: Tensor4D|TensorLike4D, blockSize: number, \n dataFormat: 'NHWC'|'NCHW'
= 'NHWC'): Tensor4D {\n const $x = convertToTensor(x, 'x', 'depthToSpace') as Tensor4D; \n const inputHeight
= (dataFormat === 'NHWC') ? $x.shape[1] : $x.shape[2]; \n const inputWidth = (dataFormat === 'NHWC') ?
$x.shape[2] : $x.shape[3]; \n const inputDepth = (dataFormat === 'NHWC') ? $x.shape[3] : $x.shape[1]; \n
 util.assert(\n inputHeight * blockSize >= 0, \n () => `Negative dimension size caused by overflow when
multiplying\n
 ${inputHeight} and ${blockSize} for depthToSpace with input shape\n ${$x.shape}`); \n util.assert(\n
inputWidth * blockSize >= 0, \n () => `Negative dimension size caused by overflow when multiplying\n
 ${inputWidth} and ${blockSize} for depthToSpace with input shape\n ${$x.shape}`); \n util.assert(\n
(inputDepth % (blockSize * blockSize) === 0), \n () => `Dimension size must be evenly divisible by ${\n
 blockSize * blockSize} but is ${\n inputDepth} for depthToSpace with input shape ${$x.shape}`); \n const
inputs: DepthToSpaceInputs = {x: $x}; \n const attrs: DepthToSpaceAttrs = {blockSize, dataFormat}; \n return
ENGINE.runKernel(\n DepthToSpace, inputs as {} as NamedTensorMap, \n attrs as {} as
NamedAttrMap); \n} \n\nexport const depthToSpace = op({depthToSpace_}); \n\n/*\n * @license\n * Copyright
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and \n * limitations under the License.\n *
===== \n
*/\nimport {ENGINE} from '../engine'; \nimport {DepthwiseConv2dNative, DepthwiseConv2dNativeAttrs,
DepthwiseConv2dNativeInputs} from '../kernel_names'; \nimport {NamedAttrMap} from
'../kernel_registry'; \nimport {Tensor3D, Tensor4D} from '../tensor'; \nimport {NamedTensorMap} from
'../tensor_types'; \nimport {convertToTensor} from '../tensor_util_env'; \nimport {TensorLike} from '../types'; \nimport
* as util from '../util'; \nimport {op}
from './operation'; \nimport {reshape} from './reshape'; \n\n/*\n * Depthwise 2D convolution. \n * \n * Given a 4D
`input` array and a `filter` array of shape \n * `[filterHeight, filterWidth, inChannels, channelMultiplier]`
containing \n * `inChannels` convolutional filters of depth 1, this op applies a \n * different filter to each input
channel (expanding from 1 channel to \n * `channelMultiplier` channels for each), then concatenates the results \n *
together. The output has `inChannels * channelMultiplier` channels. \n * \n * See \n *
https://www.tensorflow.org/api_docs/python/tf/nn/depthwise_conv2d \n *
for more details. \n * \n * @param x The
input tensor, of rank 4 or rank 3, of shape \n * `[batch, height, width, inChannels]`. If rank 3, batch of 1 is \n *
assumed. \n * @param filter The filter tensor, rank 4, of shape \n * `[filterHeight, filterWidth, inChannels,
channelMultiplier]`. \n * @param strides The
strides of the convolution: `[strideHeight, \n * strideWidth]`. If strides is a single number, then `strideHeight == \n *
strideWidth`. \n * @param pad The type of padding algorithm. \n * - `same`: output will be of same size
as input, \n * regardless of filter size. \n * - `valid`: output will be smaller than input if filter is larger \n *
than 1x1. \n * - For more info, see this guide: \n * https://www.tensorflow.org/api_guides/python/nn#Convolution \n

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* https://www.tensorflow.org/api_guides/python/nn#Convolution)\n * @param dilations The dilation rates:
`[dilationHeight, dilationWidth]`\n * in which we sample input values across the height and width dimensions\n *
in atrous convolution. Defaults to `[1, 1]`. If `rate` is a single\n * number, then `dilationHeight ==
dilationWidth`. If it is greater than\n * 1, then all values of `strides` must be 1.\n * @param dataFormat: An
optional string from: `"NHWC"`, `"NCHW"`. Defaults to\n
* `"NHWC"`. Specify the data format of the input and output data. With the\n * default format `"NHWC"`, the
data is stored in the order of: [batch,\n * height, width, channels]. Only `"NHWC"` is currently supported.\n *
@param dimRoundingMode A string from: 'ceil', 'round', 'floor'. If none is\n * provided, it will default to
truncate.\n * \n * @doc {heading: 'Operations', subheading: 'Convolution'}\n *\nfunction depthwiseConv2d<T
extends Tensor3D|Tensor4D>(\n x: T|TensorLike, filter: Tensor4D|TensorLike,\n strides: [number,
number]|number, pad: 'valid'|'same'|number,\n dataFormat: 'NHWC'|'NCHW' = 'NHWC',\n dilations: [number,
number]|number = [1, 1],\n dimRoundingMode?: 'floor'|'round'|'ceil'): T {\n const $x = convertToTensor(x, 'x',
'depthwiseConv2d');\n const $filter = convertToTensor(filter, 'filter', 'depthwiseConv2d');\n let x4D = $x as
Tensor4D;\n let reshapedTo4D = false;\n if ($x.rank === 3) {\n reshapedTo4D = true;\n x4D = reshape($x,
[1, $x.shape[0], $x.shape[1], $x.shape[2]]);\n }\n util.assert(\n x4D.rank === 4,\n () => `Error in
depthwiseConv2d: input must be rank 4, but got ` +\n `rank ${x4D.rank}.`);\n util.assert(\n $filter.rank
=== 4,\n () => `Error in depthwiseConv2d: filter must be rank 4, but got rank ` +\n `${$filter.rank}.`);\n
util.assert(\n x4D.shape[3] === $filter.shape[2],\n () => `Error in depthwiseConv2d: number of input channels
` +\n `(${x4D.shape[3]}) must match the inChannels dimension in ` +\n `filter ${$filter.shape[2]}.`);\n\n
if (dimRoundingMode != null) {\n util.assert(\n util.isInt(pad as number),\n () => `Error in
depthwiseConv2d: pad must be an integer when using, ` +\n `dimRoundingMode ${dimRoundingMode} but
got pad ${pad}.`);\n }\n\n const inputs: DepthwiseConv2dNativeInputs = {x: x4D, filter: $filter};\n const attrs:
DepthwiseConv2dNativeAttrs =\n {strides, pad, dataFormat,
dilations, dimRoundingMode};\n\n // tslint:disable-next-line: no-unnecessary-type-assertion\n const res =
ENGINE.runKernel(\n DepthwiseConv2dNative, inputs as {} as NamedTensorMap,\n attrs as
{} as NamedAttrMap) as T;\n\n if (reshapedTo4D) {\n return reshape(res, [res.shape[1], res.shape[2],
res.shape[3]]) as T;\n }\n\n return res;\n}\n\nexport const depthwiseConv2d = op({depthwiseConv2d_});\n"/**\n *
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2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific
language governing permissions and\n * limitations under the License.\n *
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\n
*\n\nimport {ENGINE} from '../engine';\nimport {Diag, DiagInputs} from '../kernel_names';\nimport {Tensor}
from '../tensor';\nimport {NamedTensorMap} from '../tensor_types';\nimport {convertToTensor} from
'../tensor_util_env';\nimport {op} from '../operation';\n\n/**\n * Returns a diagonal tensor with a given diagonal
values.\n *\n * Given a diagonal, this operation returns a tensor with the diagonal and\n * everything else padded
with zeros.\n *\n * Assume the input has dimensions `[D1,..., Dk]`, then the output is a tensor\n * of rank 2k with
dimensions `[D1,..., Dk, D1,..., Dk]`\n *\n * ```\n * const x = tf.tensor1d([1, 2, 3, 4]);\n * const y = tf.diag(x).print()\n * ```\n *\n * ```\n * const x = tf.tensor1d([1, 2, 3, 4, 5, 6, 6, 8], [4, 2]);\n * const y = tf.diag(x).print()\n * ```\n * @param x The
input tensor.\n *\nfunction diag_(x:
Tensor): Tensor {\n const $x = convertToTensor(x, 'x', 'diag');\n\n const inputs: DiagInputs = {x: $x};\n\n return
ENGINE.runKernel(Diag, inputs as {} as NamedTensorMap);\n}\n\nexport const diag = op({diag_});\n"/**\n *
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*\n\nimport {ENGINE} from '../engine';\nimport {Dilation2D, Dilation2DAttrs,\nDilation2DInputs} from '../kernel_names';\nimport {NamedAttrMap} from '../kernel_registry';\nimport {Tensor3D,\nTensor4D} from '../tensor';\nimport {NamedTensorMap} from '../tensor_types';\nimport {convertToTensor} from\n '../tensor_util_env';\nimport {TensorLike} from '../types';\nimport * as util from '../util';\n\nimport {op} from\n '../operation';\nimport {reshape} from './reshape';\n\n/**\n * Computes the grayscale dilation over the input `x`.\n * @param x The input tensor, rank 3 or rank 4 of shape\n * `[batch, height, width, inChannels]`. If rank 3, batch\n * of 1 is assumed.\n * @param filter The filter tensor, rank 3, of shape\n * `[filterHeight, filterWidth, depth]`.\n * @param strides The strides of the sliding window for each dimension of the\n * input tensor: `[strideHeight,\n * strideWidth]`. If `strides` is a single number,\n * then `strideHeight == strideWidth`.\n * @param pad The type of padding algorithm.\n * - `same` and stride 1: output\n * will be of same size as input,\n * regardless of filter size.\n * - `valid`: output will be smaller than input if\n * filter is larger\n * than 1x1x1.\n * - For more info, see this guide:\n * [https://www.tensorflow.org/api_guides/python/nn#Convolution](\n * https://www.tensorflow.org/api_guides/python/nn#Convolution)\n * @param dataFormat Specify the data format of\n * the input and output data.\n * Defaults to 'NHWC'. Only 'NHWC' is currently supported. With the\n * default\n * format \"NHWC\", the data is stored in the order of: [batch,\n * height, width, channels].\n * @param dilations\n * The dilation rates: `[dilationHeight, dilationWidth]`\n * in which we sample input values across the height and\n * width dimensions\n * for atrous morphological dilation. Defaults to `[1, 1]`. If `dilations`\n * is a single\n * number, then `dilationHeight == dilationWidth`. If it is\n * greater than 1, then all values of `strides` must be 1.\n * @doc
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{heading: 'Operations', subheading: 'Convolution'}\n\nfunction dilation2d<T extends Tensor3D|Tensor4D>(\n x: T|TensorLike, filter: Tensor3D|TensorLike,\n strides: [number, number]|number, pad: 'valid'|'same',\n dilations: [number, number]|number = [1, 1],\n dataFormat: 'NHWC' = 'NHWC'): T {\n const $x =\n convertToTensor(x, 'x', 'dilation2d');\n const $filter = convertToTensor(filter, 'filter', 'dilation2d');\n util.assert(\n $x.rank === 3 || $x.rank === 4,\n () => `Error in dilation2d: input must be rank 3 or 4, but got rank ` +\n `${$x.rank}`);\n util.assert(\n $filter.rank === 3,\n () => `Error in dilation2d: filter must be rank 3, but got\n rank ` +\n `${$filter.rank}`);\n util.assert(\n dataFormat === 'NHWC',\n () => `Error in dilation2d:\n Only NHWC is currently supported, ` +\n `but got dataFormat of ${dataFormat}`);\n let x4D = $x as\n Tensor4D;\n let reshapedTo4D = false;\n if ($x.rank === 3) {\n x4D = reshape($x, [1, $x.shape[0], $x.shape[1], $x.shape[2]]);\n reshapedTo4D = true;\n }\n const inputs:\n Dilation2DInputs = {x: x4D, filter: $filter};\n const attrs: Dilation2DAttrs = {strides, pad, dilations};\n //\n tslint:disable-next-line: no-unnecessary-type-assertion\n const res = ENGINE.runKernel(\n Dilation2D,\n inputs as {} as NamedTensorMap,\n attrs as {} as NamedAttrMap) as T;\n if (reshapedTo4D) {\n return reshape(res, [res.shape[1], res.shape[2], res.shape[3]]) as T;\n }\n return res;\n}\n\nexport const dilation2d\n = op({dilation2d});\n\n", /**\n * Copyright 2017 Google LLC. All Rights Reserved.\n * Licensed\n * under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the\n * License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed\n * under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF\n * ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
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*\n\n/**\n * Returns the dimensions in the input shape that are broadcasted to\n * produce the provided output\n * shape.\n * The returned dimensions are 0-indexed and sorted. An example:\n * inShape = [4, 1, 3]\n * outShape
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= [5, 4, 3, 3]\n * result = [1]. Dimension 1 (2nd dimension of input) gets broadcasted 1 => 3.\n */\n\nexport function\ngetBroadcastDims(\n inShape: number[], outShape: number[]): number[] {\n const inRank = inShape.length;\n const dims: number[] = [];\n for (let i = 0; i < inRank; i++) {\n const dim = inRank - 1 - i;\n const a =\ninShape[dim] || 1;\n const b = outShape[outShape.length - 1 - i] || 1;\n if (b > 1 && a === 1)\n {\n dims.unshift(dim);\n }\n }\n return dims;\n}\n\n/**\n * Returns the axes in the output space that should be\nreduced to produce\n * the input space.\n */\n\nexport function getReductionAxes(\n inShape: number[], outShape:\nnumber[]): number[] {\n const result: number[] = [];\n for (let i = 0; i < outShape.length; i++) {\n const inDim =\ninShape[inShape.length - i - 1];\n const outAxis = outShape.length - i - 1;\n const outDim =\noutShape[outAxis];\n if (inDim === null || (inDim === 1 && outDim > 1)) {\n result.unshift(outAxis);\n }\n }\n return result;\n}\n\n\nexport function assertAndGetBroadcastShape(\n shapeA: number[], shapeB: number[]):\nnumber[] {\n const result: number[] = [];\n const l = Math.max(shapeA.length, shapeB.length);\n for (let i = 0; i\n< l; i++) {\n let a = shapeA[shapeA.length - i - 1];\n if (a === null) {\n a = 1;\n }\n let b =\nshapeB[shapeB.length - i - 1];\n if (b === null) {\n b = 1;\n }\n if\n(a === 1) {\n result.unshift(b);\n } else if (b === 1) {\n result.unshift(a);\n } else if (a !== b) {\n const\nerrMsg = `Operands could not be broadcast together with shapes ` +\n `${shapeA} and ${shapeB}.`;\n throw Error(errMsg);\n } else {\n result.unshift(a);\n }\n }\n return result;\n}\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n\"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\nLicense at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or\nagreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\nthe specific language governing permissions and\n * limitations under the License.\n */

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=====\n\n*/\n\nimport {ENGINE} from './engine';\nimport {Equal, EqualInputs} from './kernel_names';\nimport {Tensor}\nfrom './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {makeTypesMatch} from\n './tensor_util';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\nimport\n{assertAndGetBroadcastShape} from './broadcast_util';\nimport {op} from './operation';\n\n/**\n * Returns the truth\nvalue of (a == b) element-wise. Supports broadcasting.\n */\n\nconst a = tf.tensor1d([1, 2, 3]);\nconst b =\ntf.tensor1d([2, 2, 2]);\na.equal(b).print();\n\n/*\n * @param a The first input tensor.\n * @param b The\nsecond input tensor. Must have the same dtype as `a`.\n */\n\n@doc {heading: 'Operations', subheading: 'Logical'}\n\nfunction equal_<T extends Tensor>(\n a: Tensor|TensorLike, b: Tensor|TensorLike): T {\n let $a =\nconvertToTensor(a, 'a', 'equal');\n let\n$b = convertToTensor(b, 'b', 'equal');\n [$a, $b] = makeTypesMatch($a, $b);\n assertAndGetBroadcastShape($a.shape, $b.shape);\n const inputs: EqualInputs = {a: $a, b: $b};\n return\nENGINE.runKernel(Equal, inputs as {} as NamedTensorMap);\n}\n\n\nexport const equal = op({equal_});\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version\n2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a\ncopy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable\nlaw or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\nthe specific language governing permissions and\n * limitations under the License.\n */

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=====\n\n*/\n\nimport {ENGINE} from './engine';\nimport {Select, SelectInputs} from './kernel_names';\nimport {Tensor}\nfrom './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from\n './tensor_util_env';\nimport {TensorLike} from './types';\nimport {assert, assertShapesMatch} from\n './util';\nimport {broadcastTo} from './broadcast_to';\nimport {assertAndGetBroadcastShape} from\n './broadcast_util';\nimport {op} from './operation';\n\n/**\n * Returns the elements, either `a` or `b` depending on the\n`condition`.\n */\n\nIf the condition is true, select from `a`, otherwise select from `b`.\n\nconst cond =

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tf.tensor1d([false, false, true], 'bool');\n * const a = tf.tensor1d([1, 2, 3]);\n * const b = tf.tensor1d([-1, -2, -3]);\n *\n * a.where(cond, b).print();\n * ```\n *\n * @param condition The input condition. Must be of dtype bool.\n *\n * @param a If `condition` is rank 1, `a` may have a higher rank but\n * its first dimension\n * must match the size of `condition`.\n *\n * @param b A tensor with the same dtype as `a` and with shape that is\n * compatible with `a`.\n *\n * @return A tensor with same dtype as `a` and `b`, and shape that is\n * broadcastable\n * from `a` and `b`.\n *\n * @doc {heading: 'Operations', subheading: 'Logical'}\n *\nfunction where_<T extends\nTensor>(\n condition: Tensor|TensorLike, a: T|TensorLike, b: T|TensorLike): T {\n const $a =\n convertToTensor(a, 'a', 'where');\n const $b = convertToTensor(b, 'b', 'where');\n const $condition =\n convertToTensor(condition, 'condition', 'where', 'bool');\n // TODO: move this logic to forward function when the\n broadcastTo op is\n // implemented in WASM.\n // Find the broadcastable shape for $a and $b.\n const\n broadcastShape = assertAndGetBroadcastShape($a.shape, $b.shape);\n const $broadcastedA = broadcastTo($a,\n broadcastShape);\n const $broadcastedB = broadcastTo($b, broadcastShape);\n if ($condition.rank === 1) {\n //\n If condition rank is\n 1, then the first dimension must match the size of\n // condition.\n assert(\n $condition.shape[0] ===\n $a.shape[0],\n () => 'The first dimension of `a` must match the size of `condition`.');\n }\n if ($condition.rank\n !== 1) {\n // A must have the same shape as condition.\n assertShapesMatch(\n $condition.shape,\n $broadcastedB.shape, 'Error in where: ');\n }\n const inputs: SelectInputs = {\n condition: $condition,\n t:\n $broadcastedA,\n e: $broadcastedB\n };\n return ENGINE.runKernel(Select, inputs as unknown as\n NamedTensorMap);\n}\n\nexport const where = op({ where_ });\n", "/*\n *\n * @license\n * Copyright 2018 Google\n * LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not\n * use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES\n * OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n * governing permissions and\n * limitations under the License.\n *\n *=====\n\n *\nimport {ENGINE} from '../engine';\nimport {ZerosLike, ZerosLikeInputs} from '../kernel_names';\nimport\n{Tensor} from '../tensor';\nimport {NamedTensorMap} from '../tensor_types';\nimport {convertToTensor} from\n '../tensor_util_env';\nimport {TensorLike} from '../types';\nimport {op} from './operation';\n\n/**\n * Creates a\n * `tf.Tensor` with all elements set to 0 with the same shape as the\n * given tensor.\n *\n * ``js\n * const x =\n * tf.tensor([1, 2]);\n * tf.zerosLike(x).print();\n * ```\n *\n * @param x The tensor of required shape.\n *\n * @doc\n * {heading: 'Tensors', subheading: 'Creation'}\n *\nfunction zerosLike_<T extends Tensor>(x:\nT|TensorLike): T {\n const $x = convertToTensor(x, 'x', 'zerosLike');\n const inputs: ZerosLikeInputs = {x: $x};\n return ENGINE.runKernel(ZerosLike, inputs as { } as NamedTensorMap);\n}\n\nexport const zerosLike =\n * op({zerosLike_});\n", "/*\n *\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under\n * the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the\n * License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed\n * on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or\n * implied.\n * See the License for the specific language governing permissions and\n * limitations under the\n * License.\n *\n *=====\n\n *\nimport {Tensor} from '../tensor';\nimport\n{makeTypesMatch} from '../tensor_util';\nimport {convertToTensor} from '../tensor_util_env';\nimport\n{TensorLike} from '../types';\nimport {div} from './div';\nimport {equal} from './equal';\nimport {op} from\n './operation';\nimport {where} from './where';\nimport {zerosLike} from './zeros_like';\n\n/**\n * Divides two\n * `tf.Tensor`s element-wise, A / B. Supports broadcasting. Return 0\n * if denominator is 0.\n *\n * ``js\n * const\n * a = tf.tensor1d([1, 4, 9, 16]);\n * const b = tf.tensor1d([1, 2, 3, 4]);\n * const c = tf.tensor1d([0, 0, 0, 0]);\n *\n
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a.divNoNaN(b).print(); // or tf.divNoNaN(a, b)\n * a.divNoNaN(c).print(); // or tf.divNoNaN(a, c)\n * ```\n *\n *
```\n * // Broadcast div a with b.\n * const a = tf.tensor1d([2, 4, 6, 8]);\n * const b = tf.scalar(2);\n * const c =
tf.scalar(0);\n *\n * a.divNoNaN(b).print(); // or tf.divNoNaN(a, b)\n * a.divNoNaN(c).print(); // or tf.divNoNaN(a,
c)\n * ```\n *\n * @param a The first tensor as the numerator.\n * @param b
The second tensor as the denominator. Must have the same dtype as\n * `a`.\n *\n * @doc {heading: 'Operations',
subheading: 'Arithmetic'}\n *\nfunction divNoNaN<T extends Tensor>(\n  a: Tensor|TensorLike, b:
Tensor|TensorLike): T {\n  // TODO: Make this into its own kernel.\n  let $a = convertToTensor(a, 'a', 'div');\n  let
$b = convertToTensor(b, 'b', 'div');\n  [$a, $b] = makeTypesMatch($a, $b);\n  \n  const divResult = div($a, $b);\n  \n
const zeros = zerosLike(divResult);\n  const bEqualsZero = equal($b, zeros);\n  return where(bEqualsZero, zeros,
divResult) as T;\n  }\n  \nexport const divNoNaN = op({divNoNaN_});\n  \n"/**\n *\n * @license\n * Copyright 2020
Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you
may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n
* distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR
CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing
permissions and\n * limitations under the License.\n *
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\n
*/\n\nimport {Tensor,} from '../tensor';\nimport {convertToTensor} from '../tensor_util_env';\nimport {TensorLike}
from '../types';\nimport * as util from '../util';\n\nimport {matMul} from '../mat_mul';\nimport {op} from
'/operation';\nimport {reshape} from '../reshape';\n\n/**\n *\n * Computes the dot product of two matrices and/or
vectors, `t1` and `t2`.\n *\n * ```\n *\n * const a = tf.tensor1d([1, 2]);\n * const b = tf.tensor2d([[1, 2], [3, 4]]);\n *
const c = tf.tensor2d([[1, 2, 3], [4, 5, 6]]);\n *\n * a.dot(b).print(); // or tf.dot(a, b)\n * b.dot(a).print();\n *
b.dot(c).print();\n *\n * @param t1 The first tensor in the dot operation.\n *\n *
@param t2 The second tensor in the dot operation.\n *\n * @doc {heading: 'Operations', subheading: 'Matrices'}\n
*\nfunction dot_(t1: Tensor|TensorLike, t2: Tensor|TensorLike): Tensor {\n  const $t1 = convertToTensor(t1, 't1',
'dot');\n  const $t2 = convertToTensor(t2, 't2', 'dot');\n  \n  util.assert(\n    ($t1.rank === 1 || $t1.rank === 2) &&
($t2.rank === 1 || $t2.rank === 2),\n    () => `Error in dot: inputs must all be rank 1 or 2, but got ranks ` +\n
`${$t1.rank} and `${$t2.rank}`.`);\n  \n  const t1Inner = ($t1.rank === 1 ? $t1.size : $t1.shape[1]);\n  const t2Inner =
($t2.rank === 1 ? $t2.size : $t2.shape[0]);\n  \n  util.assert(\n    t1Inner === t2Inner,\n    () => `Error in dot: inner
dimensions of inputs must match, but got ` +\n    `${t1Inner} and `${t2Inner}`.`);\n  \n  if ($t1.rank === 1 &&
$t2.rank === 1) {\n    const t12D = reshape($t1, [1, -1]);\n    const t22D = reshape($t2, [-1, 1]);\n    const t1t2 =
matMul(t12D, t22D);\n    return reshape(t1t2, []);\n  } else if ($t1.rank === 1 && $t2.rank === 2) {\n    const t12D =
reshape($t1, [1, -1]);\n    const t22D = reshape($t2, [1, -1]);\n    const t1t2 = matMul(t12D, t22D);\n    return
reshape(t1t2, [t1t2.size]);\n  } else if ($t1.rank === 2 && $t2.rank === 1) {\n    const t22D = reshape($t2, [-1, 1]);\n
const t1t2 = matMul($t1, t22D);\n    return reshape(t1t2, [t1t2.size]);\n  } else {\n    const t22D = reshape($t2, [$t2.shape[0],
$t2.shape[1]]);\n    const t1t2 = matMul($t1, t22D);\n    return t1t2;\n  }\n  \n}\n\nexport const dot = op({dot_});\n
\n"/**\n *\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
"License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or
agreed to in writing, software\n
* distributed under the License is distributed on
an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
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\n
*/\n\nimport {ENGINE} from '../engine';\nimport {Elu, EluInputs} from '../kernel_names';\nimport {Tensor} from
'/tensor';\nimport {NamedTensorMap} from '../tensor_types';\nimport {convertToTensor} from

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../tensor_util_env';\nimport {TensorLike} from '../types';\n\nimport {op} from './operation';\n\n/**\n * Computes exponential linear element-wise:  $x > 0 ? e^x - 1 : 0$ .  

    \n * const x = tf.tensor1d([-1, 1, -3, 2]);\n * x.elu().print(); // or tf.elu(x)\n * @param x The input tensor.  

    \n * @doc {heading: 'Operations', subheading: 'Basic math'}  

    \n */\nfunction elu<T extends Tensor>(x: T|TensorLike): T {\n  const $x = convertToTensor(x, 'x', 'elu');\n  const inputs: EluInputs = {x: $x};\n  return ENGINE.runKernel(Elu, inputs as {} as NamedTensorMap);\n}\n\nexport const elu = op({elu});\n", "/*\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n\n=====\n\n*/\n\nimport {ENGINE} from '../engine';\nimport {Erf, ErfInputs} from '../kernel_names';\nimport {Tensor} from '../tensor';\nimport {NamedTensorMap} from '../tensor_types';\nimport {convertToTensor} from '../tensor_util_env';\nimport {TensorLike} from '../types';\nimport * as util from '../util';\n\nimport {cast} from './cast';\nimport {op} from './operation';\n\n/**\n * Computes gauge error function of the input `tf.Tensor` element-wise:  

    \n * erf(x)  

    \n * const x = tf.tensor1d([0, .1, -.1, .7]);\n * x.erf().print(); // or tf.erf(x)\n * @param x The input tensor.  

    \n * @doc {heading: 'Operations', subheading: 'Basic math'}  

    \n */\nfunction erf<T extends Tensor>(x: T|TensorLike): T {\n  let $x = convertToTensor(x, 'x', 'erf');\n  util.assert($x.dtype === 'int32' || $x.dtype === 'float32', () => 'Input dtype must be `int32` or `float32`.');\n  if ($x.dtype === 'int32') {\n    $x = cast($x, 'float32');\n  }\n  const inputs: ErfInputs = {x: $x};\n  return ENGINE.runKernel(Erf, inputs as {} as NamedTensorMap);\n}\n\nexport const erf = op({erf});\n", "/*\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n\n=====\n\n*/\n\nimport {ENGINE} from '../engine';\nimport {Exp, ExpInputs} from '../kernel_names';\nimport {Tensor} from '../tensor';\nimport {NamedTensorMap} from '../tensor_types';\nimport {convertToTensor} from '../tensor_util_env';\nimport {TensorLike} from '../types';\nimport {op} from './operation';\n\n/**\n * Computes exponential of the input `tf.Tensor` element-wise:  

    \n * ex  

    \n * const x = tf.tensor1d([1, 2, -3]);\n * x.exp().print(); // or tf.exp(x)\n * @param x The input tensor.  

    \n * @doc {heading: 'Operations', subheading: 'Basic math'}  

    \n */\nfunction exp<T extends Tensor>(x: T|TensorLike): T {\n  const $x = convertToTensor(x, 'x', 'exp');\n  const inputs: ExpInputs = {x: $x};\n  return ENGINE.runKernel(Exp, inputs as {} as NamedTensorMap);\n}\n\nexport const exp = op({exp});\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either expressed or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */
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*/\n\nimport {ENGINE} from '../engine';\nimport {ExpandDims, ExpandDimsAttrs, ExpandDimsInputs} from
'./kernel_names';\nimport {NamedAttrMap} from './kernel_registry';\nimport {Tensor} from './tensor';\nimport
{NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport
{TensorLike} from './types';\nimport * as util from './util';\n\nimport {op} from './operation';\n\n/**\n * Returns a
`tf.Tensor` that has expanded rank, by inserting a dimension\n * into the tensor's shape.\n * \n * ``js\n * const x =
tf.tensor1d([1, 2, 3, 4]);\n * const axis = 1;\n * x.expandDims(axis).print();\n * ``\n * \n * @param x The input
tensor whose dimensions to be expanded.\n * @param axis The dimension index at which to insert shape of `1`.
Defaults\n *
to 0 (the first dimension).\n * \n * @doc {heading: 'Tensors', subheading: 'Transformations'}\n */\nfunction
expandDims_<T extends Tensor>(x: Tensor|TensorLike, axis = 0): T {\n  const $x = convertToTensor(x, 'x',
'expandDims', 'string_or_numeric');\n  util.assert(axis <= $x.rank, () => 'Axis must be <= rank of the tensor');\n  const inputs: ExpandDimsInputs = {input: $x};\n  const attrs: ExpandDimsAttrs = {dim: axis};\n  return
ENGINE.runKernel(\n    ExpandDims, inputs as { } as NamedTensorMap, attrs as { } as
NamedAttrMap);\n}\n\nexport const expandDims = op({expandDims_});\n"/**\n * @license\n * Copyright 2018
Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you
may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the
License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY
KIND, either express or implied.\n * See the License for the specific language governing permissions and\n *
limitations under the License.\n *
=====
*/\n\nimport {ENGINE} from '../engine';\nimport {Expm1, Expm1Inputs} from './kernel_names';\nimport {Tensor}
from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from
'./tensor_util_env';\nimport {TensorLike} from './types';\n\nimport {op} from './operation';\n\n/**\n * Computes
exponential of the input `tf.Tensor` minus one element-wise.\n * \n * `e ^ x - 1`\n * \n * ``js\n * const x = tf.tensor1d([1,
2, -3]);\n * x.expm1().print(); // or tf.expm1(x)\n * ``\n * \n * @param x The input tensor.\n * \n * @doc {heading:
'Operations', subheading: 'Basic math'}\n */\nfunction expm1_<T extends Tensor>(x: T|TensorLike): T {\n  const $x
= convertToTensor(x,
'x', 'expm1');\n  const inputs: Expm1Inputs = {x: $x};\n  return ENGINE.runKernel(Expm1, inputs as { } as
NamedTensorMap);\n}\n\nexport const expm1 = op({expm1_});\n"/**\n * @license\n * Copyright 2020 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not
use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*/\n\nimport {ENGINE} from '../engine';\nimport {Tile, TileAttrs, TileInputs} from './kernel_names';\nimport
{NamedAttrMap} from './kernel_registry';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from
'./tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\nimport
* as util from './util';\n\nimport {op} from './operation';\n\n/**\n * Construct a tensor by repeating it the number of
times given by reps.\n * \n * This operation creates a new tensor by replicating `input` `reps` \n * times. The output
tensor's i'th dimension has `input.shape[i] *` \n * `reps[i]` elements, and the values of `input` are replicated\n *
`reps[i]` times along the i'th dimension. For example, tiling\n * [a, b, c, d] by [2] produces [a, b, c, d, a, b, c,
d].\n * \n * ``js\n * const a = tf.tensor1d([1, 2]);\n * a.tile([2]).print(); // or a.tile([2])\n * ``\n * \n * ``js\n *
const a = tf.tensor2d([1, 2, 3, 4], [2, 2]);\n * a.tile([1, 2]).print(); // or a.tile([1, 2])\n * ``\n * \n * @param x The

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tensor to tile.\n * @param reps Determines
the number of replications per dimension.\n *\n * @doc {heading: 'Tensors', subheading: 'Slicing and Joining'}\n
*/\nfunction tile_<T extends Tensor>(x: T|TensorLike, reps: number[]): T {\n  const $x = convertToTensor(x, 'x',
'tile', 'string_or_numeric');\n  util.assert(\n    $x.rank === reps.length,\n    () => `Error in transpose: rank of input
${$x.rank}` +\n    `must match length of reps ${reps}.`);\n  const inputs: TileInputs = {x: $x};\n  const attrs:
TileAttrs = {reps};\n  return ENGINE.runKernel(\n    Tile, inputs as unknown as NamedTensorMap,\n    attrs as
unknown as NamedAttrMap);\n}\n\nexport const tile = op({tile_});\n", "/*\n * @license\n * Copyright 2020
Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you
may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====
\n
*/\n\nimport {Tensor2D} from '../tensor';\nimport {DataType} from '../types';\nimport {buffer} from
'/buffer';\nimport {expandDims} from './expand_dims';\nimport {op} from './operation';\nimport {reshape} from
'/reshape';\nimport {tile} from './tile';\n\n/**\n * Create an identity matrix.\n *\n * @param numRows Number of
rows.\n * @param numColumns Number of columns. Defaults to `numRows`.\n * @param batchSize If provided,
will add the batch shape to the beginning\n * of the shape of the returned `tf.Tensor` by repeating the identity\n *
matrix.\n * @param dtype Data type.\n * @returns Identity matrix of
the specified size and data type, possibly\n * with batch repetition if `batchShape` is specified.\n *\n * @doc
{heading: 'Tensors', subheading: 'Creation'}\n */\nfunction eye_(\n  numRows: number, numColumns?: number,\n  batchSize?:\n    [\n      number\n    ]|[number, \n      number]|[number, number, number]|[number,
number, number, number],\n  dtype: DataType = 'float32'): Tensor2D {\n  if (numColumns == null) {\n    numColumns = numRows;\n  }\n  const buff = buffer([numRows, numColumns], dtype);\n  const n = numRows <=
numColumns ? numRows : numColumns;\n  for (let i = 0; i < n; ++i) {\n    buff.set(1, i, i);\n  }\n  const out:
Tensor2D = reshape(buff.toTensor(), [numRows, numColumns]);\n  if (batchShape == null) {\n    return out;\n  }
else {\n    if (batchShape.length === 1) {\n      return tile(expandDims(out, 0), [batchShape[0], 1, 1]) as Tensor2D;\n    }
else if (batchShape.length === 2) {\n      // tslint:disable-next-line:no-unnecessary-type-assertion\n      return tile(\n        expandDims(expandDims(out, 0), 0),\n        [batchShape[0], batchShape[1], 1, 1])
as Tensor2D;\n    } else if (batchShape.length === 3) {\n      // tslint:disable-next-line:no-unnecessary-type-
assertion\n      return tile(expandDims(expandDims(expandDims(out, 0), 0), 0), [\n        batchShape[0],
batchShape[1], batchShape[2], 1, 1\n      ]) as Tensor2D;\n    } else {\n      throw new Error(\n        `eye()
currently supports only 1D and 2D` +\n        // tslint:disable-next-line:no-any\n        `batchShapes, but received
${(batchShape as any).length}D.`);\n    }\n  }\n}\n\nexport const eye = op({eye_});\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
"License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless
required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an
"AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License
for the specific language governing permissions and\n * limitations under the License.\n *
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\n
*/\n\nimport {ENGINE} from '../engine';\nimport {Fill, FillAttrs} from '../kernel_names';\nimport {NamedAttrMap}
from '../kernel_registry';\nimport {Tensor} from '../tensor';\nimport {DataType, Rank, ShapeMap} from
'/types';\n\n/**\n * Creates a `tf.Tensor` filled with a scalar value.\n *\n * ``js\n * tf.fill([2, 2], 4).print();\n * ``\n *\n * @param shape An array of integers defining the output tensor shape.\n * @param value The scalar value to fill
the tensor with.\n * @param dtype The type of an element in the resulting tensor. Defaults to\n * 'float'.\n *\n * @doc {heading: 'Tensors',

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subheading: 'Creation')\n *\nfunction fill<R extends Rank>(\n  shape: ShapeMap[R], value: number|string,\n  dtype?: DataType): Tensor<R> {\n  const attrs: FillAttrs = {shape, value, dtype};\n\n  return\nENGINE.runKernel(Fill, {}, attrs as {} as NamedAttrMap);\n}\n\n\nexport {fill};\n", "/*\n * @license\n * Copyright\n2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,\nsoftware\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\nOR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n governing permissions and\n * limitations under the License.\n *

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\n
 *\nimport {ENGINE} from '../engine';\nimport {Floor, FloorInputs} from './kernel_names';\nimport {Tensor}\nfrom './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from\n '../tensor_util_env';\nimport {TensorLike} from './types';\n\nimport {op} from './operation';\n\n\n/*\n * Computes\n floor of input `tf.Tensor` element-wise: `floor(x)`.\n *\n * ``js\n * const x = tf.tensor1d([1.6, 1.1, -3.3]);\n *\n * x.floor().print(); // or tf.floor(x)\n *\n * @param x The input tensor.\n *\n * @doc {heading: 'Operations',\n subheading: 'Basic math'}\n *\nfunction floor<T extends Tensor>(x: T|TensorLike): T {\n  const $x =\nconvertToTensor(x, 'x', 'floor');\n\n  const inputs: FloorInputs = {x: $x};\n  return ENGINE.runKernel(Floor, inputs\nas {} as NamedTensorMap);\n}\n\n\nexport const floor = op({floor_});\n", "/*\n * @license\n * Copyright 2018\nGoogle LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you\nmay\nnot use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,\nsoftware\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\nOR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n governing permissions and\n * limitations under the License.\n *

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 *\nimport {ENGINE} from '../engine';\nimport {GatherV2, GatherV2Attrs, GatherV2Inputs} from\n '../kernel_names';\nimport {NamedAttrMap} from './kernel_registry';\nimport {Tensor} from './tensor';\nimport\n{NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport\n{TensorLike} from './types';\n\nimport {op} from './operation';\n\n\n/*\n * Gather slices from tensor `x`'s axis `axis`\n according\n to `indices`.\n *\n * ``js\n * const x = tf.tensor1d([1, 2, 3, 4]);\n * const indices = tf.tensor1d([1, 3, 3], 'int32');\n *\n * x.gather(indices).print();\n *\n * ``js\n * const x = tf.tensor2d([1, 2, 3, 4], [2, 2]);\n * const indices =\ntf.tensor1d([1, 1, 0], 'int32');\n *\n * x.gather(indices).print();\n *\n * @param x The input tensor whose slices to\nbe gathered.\n * @param indices The indices of the values to extract.\n * @param axis The axis over which to select\nvalues. Defaults to 0.\n * @param batchDims Optional. The number of batch dimensions. It must be less\n * than\nor equal to rank(indices). Defaults to 0.\n * The output tensor will have shape of\n * `x.shape[:axis] +\nindices.shape[batchDims:] + x.shape[axis + 1:]`\n *\n * @doc {heading: 'Tensors', subheading: 'Slicing and\nJoining'}\n *\nfunction gather<T extends Tensor>(\n  x: T|TensorLike, indices: Tensor|TensorLike, axis = 0,\n  batchDims = 0): T {\n  const $x = convertToTensor(x, 'x',\n'gather');\n  const $indices = convertToTensor(indices, 'indices', 'gather', 'int32');\n\n  const inputs: GatherV2Inputs\n= {x: $x, indices: $indices};\n  const attrs: GatherV2Attrs = {axis, batchDims};\n\n  return ENGINE.runKernel(\nGatherV2, inputs as {} as NamedTensorMap, attrs as {} as NamedAttrMap);\n}\n\n\nexport const gather =\nop({gather_});\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the\nApache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the\nLicense.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed\non an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or

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implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *

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*/\nimport {ENGINE} from './engine';\nimport {Greater, GreaterInputs} from './kernel_names';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {makeTypesMatch} from './tensor_util';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\n\nimport {assertAndGetBroadcastShape} from './broadcast_util';\nimport {op} from './operation';\n\n/**\n * Returns the truth value of (a > b) element-wise. Supports broadcasting.\n *\n * @param a The first input tensor.\n * @param b The second input tensor. Must have the same dtype as `a`.\n *\n * @doc {heading: 'Operations', subheading: 'Logical'}\n */\nfunction greater_<T extends Tensor>(\n  a: Tensor|TensorLike, b: Tensor|TensorLike): T {\n  let $a = convertToTensor(a,\n    'a', 'greater');\n  let $b = convertToTensor(b, 'b', 'greater');\n  [$a, $b] = makeTypesMatch($a, $b);\n  assertAndGetBroadcastShape($a.shape, $b.shape);\n  const inputs: GreaterInputs = {a: $a, b: $b};\n  return ENGINE.runKernel(Greater, inputs as { } as NamedTensorMap);\n}\n\nexport const greater =\n  op({greater_});\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n
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*/\nimport {ENGINE} from './engine';\nimport {GreaterEqual, GreaterEqualInputs} from './kernel_names';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {makeTypesMatch} from './tensor_util';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\n\nimport {assertAndGetBroadcastShape} from './broadcast_util';\nimport {op} from './operation';\n\n/**\n * Returns the truth value of (a >= b) element-wise. Supports broadcasting.\n *\n * @param a The first input tensor.\n * @param b The second input tensor. Must have the same dtype as `a`.\n *\n * @doc {heading: 'Operations', subheading: 'Logical'}\n */\nfunction greaterEqual_<T extends Tensor>(\n  a: Tensor|TensorLike, b: Tensor|TensorLike): T {\n  let $a = convertToTensor(a, 'a',\n    'greaterEqual');\n  let $b = convertToTensor(b, 'b', 'greaterEqual');\n  [$a, $b] = makeTypesMatch($a, $b);\n  assertAndGetBroadcastShape($a.shape, $b.shape);\n  const inputs: GreaterEqualInputs = {a: $a, b: $b};\n  return ENGINE.runKernel(GreaterEqual, inputs as { } as NamedTensorMap);\n}\n\nexport const greaterEqual =\n  op({greaterEqual_});\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n
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*/\n\nimport {ENGINE} from './engine';\nimport {Imag, ImagInputs} from './kernel_names';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\nimport {op} from './operation';\n\n/**\n * Returns the imaginary part of a complex (or real) tensor.\n *\n * Given a tensor input, this operation returns a tensor of type float that is\n * the imaginary part of each element in input considered as a complex number.\n *\n * If input is real, a tensor\n */\n
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of all zeros is returned.\n * \n * ```\n * const x = tf.complex([-2.25, 3.25], [4.75, 5.75]);\n * tf.imag(x).print();\n * ```\n * \n * @doc {heading: 'Tensors', subheading: 'Creation'}\n * \nfunction imag_<T extends Tensor>(input: T|TensorLike): T {\n  const $input = convertToTensor(input, 'input', 'imag');\n  \n  const inputs: ImagInputs = {input: $input};\n  \n  return\n    ENGINE.runKernel(Imag, inputs as { } as NamedTensorMap);\n  \n}\n\nexport const imag = op({imag_});\n", "/*\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
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\n
*\n\nimport {ENGINE} from '../engine';\nimport {IsFinite, IsFiniteInputs} from '../kernel_names';\nimport {Tensor} from '../tensor';\nimport {NamedTensorMap} from '../tensor_types';\nimport {convertToTensor} from '../tensor_util_env';\nimport {TensorLike} from '../types';\n\nimport {op} from './operation';\n\n/*\n * Returns which elements of x are finite.\n * \n * ```\n * const x = tf.tensor1d([NaN, Infinity, -Infinity, 0, 1]);\n * \n * x.isFinite().print(); // or tf.isNaN(x)\n * ```\n * @param x The input Tensor.\n * \n * @doc {heading: 'Operations', subheading: 'Basic math'}\n * \nfunction isFinite_<T extends Tensor>(x: T|TensorLike): T {\n  const $x = convertToTensor(x, 'x', 'isFinite');\n  \n  const inputs: IsFiniteInputs = {x: $x};\n  \n  return\n    ENGINE.runKernel(IsFinite, inputs as { } as NamedTensorMap);\n  \n}\n\nexport const isFinite = op({isFinite_});\n", "/*\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless\n    required by applicable law or agreed to in writing, software\n    distributed under the License is distributed on an\n    "AS IS" BASIS,\n    WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n    \n * See the License for the specific language governing permissions and\n    limitations under the License.\n *
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\n
*\n\nimport {ENGINE} from '../engine';\nimport {IsInf, IsInfInputs} from '../kernel_names';\nimport {Tensor} from '../tensor';\nimport {NamedTensorMap} from '../tensor_types';\nimport {convertToTensor} from '../tensor_util_env';\nimport {TensorLike} from '../types';\n\nimport {op} from './operation';\n\n/*\n * Returns which elements of x are Infinity or -Infinity.\n * \n * ```\n * const x = tf.tensor1d([NaN, Infinity, -Infinity, 0, 1]);\n * \n * x.isInf().print(); // or tf.isNaN(x)\n * ```\n * @param x The input Tensor.\n * \n * @doc {heading: 'Operations', subheading: 'Basic math'}\n * \nfunction isInf_<T extends Tensor>(x: T|TensorLike): T {\n  const $x = convertToTensor(x, 'x', 'isInf');\n  \n  const inputs: IsInfInputs = {x: $x};\n  \n  return\n    ENGINE.runKernel(IsInf, inputs as { } as NamedTensorMap);\n  \n}\n\nexport const isInf = op({isInf_});\n", "/*\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
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\n
*\n\nimport {ENGINE}\nfrom '../engine';\nimport {IsNan, IsNanInputs} from '../kernel_names';\nimport {Tensor} from '../tensor';\nimport {NamedTensorMap} from '../tensor_types';\nimport {convertToTensor} from '../tensor_util_env';\nimport {TensorLike} from '../types';\n\nimport {op} from './operation';\n\n/*\n * Returns which elements of x are NaN.\n * \n * ```\n * const x = tf.tensor1d([NaN, NaN, NaN, NaN, NaN]);\n * \n * x.isNan().print(); // or tf.isNaN(x)\n * ```\n * @param x The input Tensor.\n * \n * @doc {heading: 'Operations', subheading: 'Basic math'}\n * \nfunction isNan_<T extends Tensor>(x: T|TensorLike): T {\n  const $x = convertToTensor(x, 'x', 'isNan');\n  \n  const inputs: IsNanInputs = {x: $x};\n  \n  return\n    ENGINE.runKernel(IsNan, inputs as { } as NamedTensorMap);\n  \n}\n\nexport const isNan = op({isNan_});\n", "/*\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
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*\n * ```\n * const x = tf.tensor1d([NaN, Infinity, -Infinity, 0, 1]);\n *\n * x.isNaN().print(); // or tf.isNaN(x)\n *
```\n * @param x The input Tensor.\n *\n * @doc {heading: 'Operations', subheading: 'Basic math'}\n *\nfunction
isNaN_<T extends Tensor>(x: T|TensorLike): T {\n const $x = convertToTensor(x, 'x', 'isNaN');\n const inputs:
IsNanInputs = {x: $x};\n\n return ENGINE.runKernel(IsNan, inputs as { } as NamedTensorMap);\n}\n\nexport const
isNaN = op({isNaN_});\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed
under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance
with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-
2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is
distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n *

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*\n\nimport {ENGINE} from '../engine';\nimport {LeakyRelu, LeakyReluAttrs, LeakyReluInputs} from
'../kernel_names';\nimport {NamedAttrMap} from '../kernel_registry';\nimport {Tensor} from '../tensor';\nimport
{NamedTensorMap} from '../tensor_types';\nimport {convertToTensor} from '../tensor_util_env';\nimport
{TensorLike} from '../types';\n\nimport {op} from './operation';\n\n/*\n * Computes leaky rectified linear element-
wise.\n *\n * See\n * [http://web.stanford.edu/~awni/papers/relu_hybrid_icml2013_final.pdf](\n
* http://web.stanford.edu/~awni/papers/relu_hybrid_icml2013_final.pdf)\n *\n * ```\n * const x = tf.tensor1d([-
1, 2, -3, 4]);\n *\n * x.leakyRelu(0.1).print(); // or tf.leakyRelu(x, 0.1)\n *
```\n * @param x The input tensor.\n *
@param alpha The scaling factor for negative values, defaults to 0.2.\n *\n * @doc {heading: 'Operations',
subheading: 'Basic math'}\n *\nfunction leakyRelu_<T extends Tensor>(x: T|TensorLike, alpha = 0.2): T {\n  const
$x = convertToTensor(x, 'x', 'leakyRelu');\n\n  const inputs: LeakyReluInputs = {x: $x};\n  const attrs:
LeakyReluAttrs = {alpha};\n\n  return ENGINE.runKernel(\n    LeakyRelu, inputs as { } as NamedTensorMap,
attrs as { } as NamedAttrMap);\n}\n\nexport const leakyRelu = op({leakyRelu_});\n", "/*\n * @license\n *
Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
"License");\n * you may not use this file except in compliance
with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-
2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is
distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n *

```

```

=====
*\n\nimport {ENGINE} from '../engine';\nimport {Less, LessInputs} from '../kernel_names';\nimport {Tensor} from
'../tensor';\nimport {NamedTensorMap} from '../tensor_types';\nimport {makeTypesMatch} from
'../tensor_util';\nimport {convertToTensor} from '../tensor_util_env';\nimport {TensorLike} from '../types';\n\nimport
{assertAndGetBroadcastShape} from './broadcast_util';\nimport {op} from './operation';\n\n/*\n * Returns the truth
value of (a < b) element-wise.
Supports broadcasting.\n *\n * ```\n * const a = tf.tensor1d([1, 2, 3]);\n *\n * const b = tf.tensor1d([2, 2, 2]);\n *\n *
a.less(b).print();\n *
```\n * @param a The first input tensor.\n * @param b The second input tensor. Must have the
same dtype as `a`.\n *\n * @doc {heading: 'Operations', subheading: 'Logical'}\n *\nfunction less_<T extends
Tensor>(\n a: Tensor|TensorLike, b: Tensor|TensorLike): T {\n let $a = convertToTensor(a, 'a', 'less');\n let $b =
convertToTensor(b, 'b', 'less');\n [$a, $b] = makeTypesMatch($a, $b);\n\n assertAndGetBroadcastShape($a.shape,
$b.shape);\n\n const inputs: LessInputs = {a: $a, b: $b};\n\n return ENGINE.runKernel(Less, inputs as { } as
NamedTensorMap);\n}\n\nexport const less = op({less_});\n", "/*\n * @license\n * Copyright 2020 Google LLC.
All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n
*\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in
writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT

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WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*

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=====
*\nimport {ENGINE} from './engine';\nimport {LessEqual, LessEqualInputs} from './kernel_names';\nimport
{Tensor} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {makeTypesMatch} from
'./tensor_util';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\n\nimport
{assertAndGetBroadcastShape} from './broadcast_util';\nimport {op} from './operation';\n\n/**\n * Returns the truth
value of (a <= b) element-wise. Supports broadcasting.\n *\n * ```js\n * const a =
tf.tensor1d([1, 2, 3]);\n * const b = tf.tensor1d([2, 2, 2]);\n *\n * a.lessEqual(b).print();\n * ```\n *\n * @param a
The first input tensor.\n * @param b The second input tensor. Must have the same dtype as `a`.\n *\n * @doc
{heading: 'Operations', subheading: 'Logical'}\n *\nfunction lessEqual_<T extends Tensor>(\n a:
Tensor|TensorLike, b: Tensor|TensorLike): T {\n let $a = convertToTensor(a, 'a', 'lessEqual');\n let $b =
convertToTensor(b, 'b', 'lessEqual');\n [$a, $b] = makeTypesMatch($a, $b);\n\n assertAndGetBroadcastShape($a.shape, $b.shape);\n\n const inputs: LessEqualInputs = {a: $a, b: $b};\n\n return
ENGINE.runKernel(LessEqual, inputs as { } as NamedTensorMap);\n}\n\nexport const lessEqual =
op({lessEqual_});\n", "/*\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under
the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
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=====
*\n\nimport {ENGINE} from './engine';\nimport {LinSpace, LinSpaceAttrs} from './kernel_names';\nimport
{NamedAttrMap} from './kernel_registry';\nimport {Tensor1D} from './tensor';\n\n/**\n * Return an evenly spaced
sequence of numbers over the given interval.\n *\n * ```js\n * tf.linspace(0, 9, 10).print();\n * ```\n *\n * @param start
The start value of the sequence.\n * @param stop The end value of the sequence.\n * @param num The number of
values to generate.\n *\n * @doc {heading: 'Tensors', subheading: 'Creation'}\n *\nfunction linspace(start: number, stop: number, num: number): Tensor1D {\n if (num <= 0) {\n throw new
Error("The number of values should be positive.");\n }\n\n const attrs: LinSpaceAttrs = {start, stop, num};\n return
ENGINE.runKernel(LinSpace, { }, attrs as { } as NamedAttrMap);\n}\n\n", "/*\n * @license\n * Copyright 2020
Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you
may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
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=====
*\n\nimport {ENGINE} from './engine';\nimport {LRN, LRNAttrs, LRNInputs} from './kernel_names';\nimport
{NamedAttrMap} from './kernel_registry';\nimport {Tensor3D, Tensor4D} from './tensor';\nimport
{NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport
{TensorLike} from './types';\n\nimport * as util from './util';\n\nimport {op} from './operation';\nimport {reshape}
from './reshape';\n\n/**\n * Normalizes the activation of a local neighborhood across or within\n * channels.\n *\n * @param x The input tensor. The 4-D input tensor is treated as a 3-D array\n * of 1D vectors (along the last
dimension), and each vector is\n * normalized independently.\n * @param depthRadius The number of adjacent
channels in the 1D normalization\n * window.\n * @param bias A constant bias term for the basis.\n * @param
alpha A scale factor, usually positive.\n * @param beta An exponent.\n *\n * @doc {heading: 'Operations',
subheading:
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'Normalization')}\n *\nfunction localResponseNormalization_<T extends Tensor3D|Tensor4D>(x:\n\n x:\n T|TensorLike, depthRadius = 5, bias = 1, alpha = 1, beta = 0.5): T {\n const $x = convertToTensor(x, 'x',\n 'localResponseNormalization');\n util.assert(\n $x.rank === 4 || $x.rank === 3,\n () => `Error in\n localResponseNormalization: x must be rank 3 or 4 but got`\n rank ${$x.rank}.`);\n util.assert(\n util.isInt(depthRadius),\n () => `Error in localResponseNormalization: depthRadius must be an `\n +\n `integer but got depthRadius ${depthRadius}.`);\n\n let x4D = $x as Tensor4D;\n let reshapedTo4D = false;\n if ($x.rank === 3) {\n reshapedTo4D = true;\n x4D = reshape($x, [1, $x.shape[0], $x.shape[1], $x.shape[2]]);\n }\n\n const inputs: LRNInputs = {x: x4D};\n\n const attrs: LRNAttrs = {depthRadius, bias, alpha, beta};\n\n // tslint:disable-next-line: no-unnecessary-type-assertion\n const res = ENGINE.runKernel(\n\n LRN, inputs as {} as NamedTensorMap,\n attrs as {} as NamedAttrMap) as T;\n\n if (reshapedTo4D)\n {\n return reshape(res, [res.shape[1], res.shape[2], res.shape[3]]) as T;\n } else {\n return res;\n }\n}\n\nexport\nconst localResponseNormalization = op({localResponseNormalization_});\n"/**\n * @license\n * Copyright 2018\n Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,\n software\n * distributed under the License is distributed on an "AS IS"\n BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n=====\n*\nimport {ENGINE} from '../engine';\nimport {Log, LogInputs} from './kernel_names';\nimport {Tensor} from\n '../tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from\n '../tensor_util_env';\nimport {TensorLike} from './types';\nimport {op} from './operation';\n\n/**\n * Computes natural logarithm of the input `tf.Tensor` element-wise: `ln(x)`\n *\n ```js\n * const x = tf.tensor1d([1, 2, Math.E]);\n *\n x.log().print(); // or tf.log(x)\n *\n @param x The input tensor.\n *\n @doc {heading: 'Operations', subheading: 'Basic math'}\n *\n function log<T extends Tensor>(x: T|TensorLike): T {\n const $x =\n convertToTensor(x, 'x', 'log');\n\n const inputs: LogInputs = {x: $x};\n return ENGINE.runKernel(Log, inputs as {} as NamedTensorMap);\n }\n\n export const log = op({log_});\n"/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n *\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS"\n BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n=====\n*\nimport {ENGINE} from '../engine';\nimport {Log1p, Log1pInputs} from './kernel_names';\nimport {Tensor} from\n '../tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from\n '../tensor_util_env';\nimport {TensorLike} from './types';\nimport {op} from './operation';\n\n/**\n * Computes natural logarithm of the input `tf.Tensor` plus one\n *\n element-wise: `ln(1 + x)`\n *\n ```js\n * const x = tf.tensor1d([1, 2, Math.E - 1]);\n *\n x.log1p().print(); // or tf.log1p(x)\n *\n @param x The input tensor.\n *\n @doc {heading: 'Operations', subheading: 'Basic math'}\n *\n function log1p<T extends Tensor>(x: T|TensorLike): T {\n const $x = convertToTensor(x, 'x', 'log1p');\n\n const inputs: Log1pInputs = {x: $x};\n return ENGINE.runKernel(Log1p, inputs as {} as NamedTensorMap);\n }\n\n export const log1p =\n op({log1p_});\n"/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n *\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS"\n BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See
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the License for the specific language governing permissions and limitations under the License.

```
=====
import { CustomGradientFunc, ENGINE } from './engine'; import { Scalar, Tensor, Variable } from
 './tensor'; import { NamedTensorMap } from './tensor_types'; import { convertToTensor, convertToTensorArray }
 from './tensor_util_env'; import { TensorLike } from './types'; import * as util from './util';

/**
 * Provided
 * `f(x)`, returns another function `g(x, dy?)`, which gives the
 * gradient of `f(x)` with respect to `x`. If `dy` is
 * provided, the gradient of `f(x).mul(dy).sum()` with respect to `x` is computed instead. `f(x)` must take a single
 * tensor `x` and return a single tensor `y`. If `f()` takes multiple inputs, use `tf.grads` instead.
 * // f(x) = x ^ 2
 * const f = x => x.square(); // f(x) = 2x
 * const g = tf.grad(f); // const x = tf.tensor1d([2,
 * 3]);
 * g(x).print(); // f(x) = x ^ 3
 * const f = x => x.pow(tf.scalar(3, 'int32')); // f(x) = 3x ^
 * 2
 * const g = tf.grad(f); // f'(x) = 6x
 * const gg = tf.grad(g); // const x = tf.tensor1d([2, 3]);
 * gg(x).print();
 * @param f The function f(x), to compute gradient for.
 * @doc {heading: 'Training',
 * subheading: 'Gradients'}
 * \nfunction grad(f: (x: Tensor) => Tensor): (x: TensorLike|Tensor, dy?:
 * TensorLike|Tensor) => Tensor {
 * util.assert(util.isFunction(f), () => 'The f passed in grad(f) must be a
 * function');
 * return (x: TensorLike|Tensor, dy?: TensorLike|Tensor): Tensor => {
 * // x can be of any dtype, thus
 * null as the last argument.
 * const $x = convertToTensor(x, 'x', 'tf.grad', 'string_or_numeric');
 * const $dy: Tensor
 * =
 * (dy != null) ? convertToTensor(dy, 'dy', 'tf.grad') : null;
 * return ENGINE.tidy(() => {
 * const {value,
 * grads} = ENGINE.gradients(() => f($x), [$x], $dy);
 * if ($dy != null) {
 * util.assertShapesMatch(value.shape, $dy.shape,
 * 'The shape of dy
 * passed in grad(f)(x, dy) must match the shape ' +
 * 'returned by f(x)');
 * checkGrads(grads);
 * return grads[0];
 * }
 * });
 * }
 * }
 * // Provided `f(x1, x2,...)`, returns another function `g([x1, x2,...], dy?)`
 * which gives an array of gradients of `f()` with respect to each input
 * `[x1, x2,...]`. If `dy` is passed when
 * calling `g()`, the gradient of `f(x1,...).mul(dy).sum()` with respect to each input is computed instead.
 * The
 * provided `f` must take one or more tensors and return a single tensor `y`. If `f()` takes a single input, we
 * recommend using `tf.grad` instead.
 * // f(a, b) = a * b
 * const f = (a, b) => a.mul(b); // df / da =
 * b, df / db = a
 * const g = tf.grads(f); // const a = tf.tensor1d([2, 3]);
 * const b = tf.tensor1d([-2, -3]);
 * const [da, db] = g([a,
 * b]);
 * console.log('da'); da.print(); console.log('db'); db.print();
 * @param f The function
 * `f(x1, x2,...)` to compute gradients for.
 * @doc {heading: 'Training', subheading: 'Gradients'}
 * \nfunction
 * grads(f: (...args: Tensor[]) => Tensor): (args: Array<Tensor|TensorLike>, dy?: Tensor|TensorLike) => Tensor[]
 * {
 * util.assert(util.isFunction(f), () => 'The f passed in grads(f) must be a function');
 * return (args:
 * Array<Tensor|TensorLike>, dy?: Tensor|TensorLike): Tensor[] => {
 * util.assert(Array.isArray(args),
 * () => 'The args passed in grads(f)(args) must be an array ' +
 * 'of `Tensor`s or `TensorLike`s');
 * // args can
 * be of any dtype, thus null as the last argument.
 * const $args =
 * convertToTensorArray(args, 'args', 'tf.grads',
 * 'string_or_numeric');
 * const $dy: Tensor
 * =
 * (dy != null) ? convertToTensor(dy, 'dy', 'tf.grads') : null;
 * return ENGINE.tidy(() => {
 * const {value, grads} = ENGINE.gradients(() => f(...$args), $args, $dy);
 * if ($dy != null) {
 * util.assertShapesMatch(value.shape, $dy.shape,
 * 'The shape of dy passed in grads(f)([x1,...], dy)
 * must ' +
 * 'match the shape returned by f([x1,...])');
 * checkGrads(grads);
 * return grads;
 * }
 * });
 * }
 * }
 * // Like `tf.grad`, but also returns the value of `f()`. Useful when `f()` returns a metric you
 * want to show.
 * The result is a rich object with the following properties:
 * - grad: The gradient of `f(x)` w.r.t
 * `x` (result of `tf.grad`).
 * - value: The value returned by `f(x)`.
 * // f(x) = x ^ 2
 * const f = x =>
 * x.square(); // f(x) = 2x
 * const g = tf.valueAndGrad(f); // const x = tf.tensor1d([2, 3]);
 * const {value,
 * grad} = g(x);
 * console.log('value'); value.print(); console.log('grad'); grad.print();
 * @doc {heading: 'Training', subheading:
 * 'Gradients'}
 * \nfunction valueAndGrad<I extends Tensor, O extends Tensor>(f: (x: I) => O): (x: I, dy?: O)
 * => {value: O; grad: I} {
 * util.assert(util.isFunction(f),
 * () => 'The f passed in valueAndGrad(f)
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must be a function');\n return (x: I, dy?: O) => {\n util.assert(\n x instanceof Tensor,\n () => 'The x\n passed in valueAndGrad(f)(x) must be a tensor');\n util.assert(\n dy == null || dy instanceof Tensor,\n ()\n => 'The dy passed in valueAndGrad(f)(x, dy) must be a tensor');\n const { grads, value } = ENGINE.gradients(() =>\n f(x), [x], dy);\n checkGrads(grads);\n return { grad: grads[0] as I, value};\n };}\n\n/**\n * Like `tf.grads`, but\n * returns also the value of `f()`. Useful when `f()`\n * returns a metric you want to show.\n *\n * The result is a rich\n * object with the following properties:\n * - grads: The gradients of `f()` w.r.t each input (result of `tf.grads`).\n * -\n * value: The value returned\n * by `f(x)`.\n */\njs\n * // f(a, b) = a * b\n * const f = (a, b) => a.mul(b);\n * // df/da = b, df/db = a\n * const g =\n * tf.valueAndGrads(f);\n * const a = tf.tensor1d([2, 3]);\n * const b = tf.tensor1d([-2, -3]);\n * const { value, grads }\n * = g([a, b]);\n * const [da, db] = grads;\n * console.log('value');\n * value.print();\n * console.log('da');\n * da.print();\n * console.log('db');\n * db.print();\n *```\n *\n * @doc {heading: 'Training', subheading: 'Gradients'}\n *\n * \nfunction valueAndGrads<O extends Tensor>(f: (...args: Tensor[]) => O): (\n args: Tensor[], dy?: O) => {\n grads: Tensor[];\n value: O;\n} {\n util.assert(\n util.isFunction(f),\n () => 'The f passed in valueAndGrads(f)\n must be a function');\n return (args: Tensor[], dy?: O) => {\n util.assert(\n Array.isArray(args) &&\n args.every(arg => arg instanceof Tensor),\n () => 'The args passed in valueAndGrads(f)(args) must be array of '\n +\n 'tensors');\n util.assert(\n dy == null || dy instanceof Tensor,\n () => 'The dy passed in valueAndGrads(f)(args, dy) must be a\n tensor');\n const res = ENGINE.gradients(() => f(...args), args, dy);\n if (dy != null) {\n util.assertShapesMatch(\n res.value.shape, dy.shape,\n 'The shape of dy passed in\n valueAndGrads(f)([x1,...], dy) must '\n +\n 'match the shape returned by f([x1,...])');\n }\n checkGrads(res.grads);\n return res;\n };\n}\n\n/**\n * Computes and returns the gradient of f(x) with respect to\n * the list of\n * trainable variables provided by `varList`. If no list is provided, it\n * defaults to all trainable\n * variables.\n */\njs\n * const a = tf.variable(tf.tensor1d([3, 4]));\n * const b = tf.variable(tf.tensor1d([5, 6]));\n * const x = tf.tensor1d([1, 2]);\n * // f(a, b) = a * x ^ 2 + b * x\n * const f = () =>\n * a.mul(x.square()).add(b.mul(x)).sum();\n * // df/da = x ^ 2, df/db = x\n * const { value, grads } =\n * tf.variableGrads(f);\n *\n * Object.keys(grads).forEach(varName => grads[varName].print());\n *```\n *\n * @param f The function to\n * execute. f() should return a scalar.\n * @param varList The list of variables to compute the gradients with respect\n * to. Defaults to all trainable variables.\n * @returns An object with the following keys and values:\n * - `value`: The value of the function `f`.\n * - `grads`: A map from the names of the variables to the gradients.\n * If the\n * `varList` argument is provided explicitly and contains a subset of\n * non-trainable variables, this map in the\n * return value will contain keys\n * that map the names of the non-trainable variables to `null`.\n *\n * @doc\n * {heading: 'Training', subheading: 'Gradients'}\n *\n * \nfunction variableGrads(f: () => Scalar, varList?: Variable[]):\n { value: Scalar, grads: NamedTensorMap } {\n util.assert(\n util.isFunction(f),\n () => 'The f passed in\n variableGrads(f) must be a function');\n util.assert(\n varList == null ||\n Array.isArray(varList) && varList.every(v => v instanceof Variable),\n () =>\n 'The varList passed in variableGrads(f, varList) must be an array '\n +\n 'of variables');\n const\n specifiedVarList = varList != null;\n if (!specifiedVarList) {\n // Get all of the trainable variables.\n varList =\n [];\n for (const varName in ENGINE.registeredVariables) {\n varList.push(ENGINE.registeredVariables[varName]);\n }\n }\n const specifiedNonTrainable: Variable[] =\n specifiedVarList ? varList.filter(variable => !variable.trainable) : null;\n // Prune non-trainable variables.\n const\n originalVarCount = varList.length;\n varList = varList.filter(variable => variable.trainable);\n util.assert(\n varList.length > 0,\n () => `variableGrads() expects at least one of the input variables to ` +\n `be trainable,\n but none of the ${originalVarCount} variables is ` +\n `trainable.`);\n const\n allowNoGradients = true;\n const { value, grads } = ENGINE.gradients(f, varList, null, allowNoGradients);\n util.assert(\n grads.some(g => g != null),\n () => 'Cannot find a connection between any variable and the result\n of ' +\n 'the loss function y=f(x). Please make sure the operations that ' +\n 'use variables are inside the\n function f passed to minimize().');\n util.assert(\n value.rank === 0,\n () => `The f passed in variableGrads(f)

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must return a scalar, but it `+` returned a rank- $\{value.rank\}$ tensor`);
const namedGrads:
NamedTensorMap = {};
varList.forEach((v, i) => {
 if (grads[i] != null) {
 namedGrads[v.name] =
grads[i];
 }
 if (specifiedNonTrainable != null) {
 // If varList is explicitly provided and contains non-
trainable values,
 // add them to the returned gradients with `null` values.
 specifiedNonTrainable.forEach(v
=> namedGrads[v.name] = null);
 }
 return {value, grads:
namedGrads};
});
// Overrides the gradient computation of a function `f`.
// Takes a function
`f(...inputs, save) => {value: Tensor, gradFunc: (dy, saved) => Tensor[]}`
and returns another function
`g(...inputs)` which takes the same inputs as `f`. When called, `g` returns `f().value`. In backward mode, custom
gradients with respect to each input of `f` are computed using `f().gradFunc`. The `save` function passed
to `f` should be used for saving tensors needed in the gradient. And the `saved` passed to the `gradFunc` is a
`NamedTensorMap`, which contains those saved tensor.
js
const customOp = tf.customGrad((x, save)
=> {
 // Save x to make sure it's available later for the gradient.
 save([x]);
 // Override gradient of our
custom x ^ 2 op to be dy * abs(x);
 return {
 value: x.square(),
 // Note `saved.x` which points to the
`x` we saved earlier.
 gradFunc: (dy, saved) => [dy.mul(saved[0].abs())]
 };
});
const x = tf.tensor1d([-1, -2, 3]);
const dx = tf.grad(x => customOp(x));
console.log(`f(x):`);
customOp(x).print();
console.log(`f'(x):`);
dx(x).print();
`
@param f
The function to evaluate in forward mode, which should return
`{value: Tensor, gradFunc: (dy, saved) =>
Tensor[]}`, where `gradFunc` returns the custom gradients of `f` with respect to its inputs.
@doc
{heading: 'Training', subheading: 'Gradients'}
function customGrad<T extends Tensor>(f:
CustomGradientFunc<T>):
(...args: Tensor[]) => T {
 return ENGINE.customGrad(f);
}
function
checkGrads(grads: Tensor[]) {
 const numNullGradients = grads.filter(g => g == null).length;
 if
(numNullGradients > 0) {
 throw new Error(
`Cannot compute gradient of y=f(x) with respect to x. Make
sure that the f you passed encloses all operations that lead from x to y.`);
 }
}
export {
 customGrad,
 variableGrads,
 valueAndGrad,
 valueAndGrads,
 grad,
 grads,
};
"/**
 * @license
 * Copyright 2018
Google LLC. All Rights Reserved.
 * Licensed under the Apache License, Version 2.0 (the "License");
 * you
may not use this file except in compliance with the License.
 * You may obtain a copy of the License at
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software
 * distributed under the License is distributed on an "AS IS" BASIS,
 * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.
 * See the License for the specific language
governing permissions and
 * limitations under the License.
 */
=====
*/
import {ENGINE} from '../engine';
import {Neg, NegInputs} from '../kernel_names';
import {Tensor} from
'../tensor';
import {NamedTensorMap} from '../tensor_types';
import {convertToTensor}
from '../tensor_util_env';
import {TensorLike} from '../types';
import {op} from '../operation';
//
Computes `1 * x` element-wise.
js
const x = tf.tensor2d([1, 2, -2, 0], [2, 2]);
x.neg().print(); //
or tf.neg(x)
`
@param x The input tensor.
@doc {heading: 'Operations', subheading: 'Basic
math'}
function neg_<T extends Tensor>(x: T|TensorLike): T {
 const $x = convertToTensor(x, 'x',
'neg');
 const inputs: NegInputs = {x: $x};
 return ENGINE.runKernel(Neg, inputs as {
} as
NamedTensorMap);
}
export const neg = op({neg_});
"/**
 * @license
 * Copyright 2018 Google LLC. All
Rights Reserved.
 * Licensed under the Apache License, Version 2.0 (the "License");
 * you may not use this
file except in compliance with the License.
 * You may obtain a copy of the License at
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 * Unless required by applicable law or agreed to in writing,
software
 * distributed
under the License is distributed on an "AS IS" BASIS,
 * WITHOUT WARRANTIES OR CONDITIONS OF
ANY KIND, either express or implied.
 * See the License for the specific language governing permissions and
 * limitations under the License.
 */
=====
*/
import {ENGINE} from '../engine';
import {Softplus, SoftplusInputs} from '../kernel_names';
import

```



```
{Tensor} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from
'./tensor_util_env';\nimport {TensorLike} from './types';\n\nimport {op} from './operation';\n\n/**\n * Computes
softplus of the input `tf.Tensor` element-wise: `log(exp(x) + 1)`\n * \n * ``js\n * const x = tf.tensor1d([0, 1, -1,
.7]);\n * \n * x.softplus().print(); // or tf.softplus(x)\n * ``\n * @param x The input tensor.\n * \n * @doc {heading:
'Operations', subheading: 'Basic math'}\n * \nfunction softplus_<T extends Tensor>(x: T|TensorLike): T {\n const
$x = convertToTensor(x, 'x', 'softplus');\n \n const inputs: SoftplusInputs = {x: $x};\n return
ENGINE.runKernel(Softplus, inputs as {} as NamedTensorMap);\n}\n\nexport const softplus =
op({softplus_});\n\n",/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under
the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
```

```
=====\n
*\n\nimport {customGrad} from './gradients';\nimport {Tensor} from './tensor';\nimport
{convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\n\nimport {mul} from
'./mul';\nimport {neg} from './neg';\nimport {op} from './operation';\nimport {sigmoid} from './sigmoid';\nimport
{softplus} from './softplus';\n\n/**\n * Computes log sigmoid of the input `tf.Tensor` element-wise:\n *
`logSigmoid(x)`. For numerical stability, we use `-tf.softplus(-x)`.\n * \n * ``js\n * const x = tf.tensor1d([0, 1, -1,
.7]);\n * \n * x.logSigmoid().print(); // or tf.logSigmoid(x)\n * ``\n * @param x The input tensor.\n * \n * @doc
{heading: 'Operations', subheading: 'Basic math'}\n * \nfunction logSigmoid_<T extends Tensor>(x: T|TensorLike):
T {\n const $x = convertToTensor(x, 'x', 'logSigmoid');\n \n // Use a custom gradient to maintain previous
implementation.\n // There is no LogSigmoid kernel in TF so we can't use engine.runKernel\n // directly\n const
customOp = customGrad((x: Tensor) => {\n // TODO(yassogba) we can remove the chained
softplus call here only\n // after backends have modularized softplus at which point we can call\n // engine
runKernel(..., Softplus, ...) directly.\n const value = neg(softplus(neg(x)));\n \n const gradFunc = (dy: T) => {\n
const derX = mul(dy, sigmoid(neg(x)));\n return derX;\n });\n return {value, gradFunc};\n});\n\nreturn
customOp($x) as T;\n}\n\nexport const logSigmoid = op({logSigmoid_});\n\n",/**\n * @license\n * Copyright 2020
Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you
may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
```

```
=====\n
*\n\nimport {ENGINE} from './engine';\nimport {Max, MaxAttrs, MaxInputs} from './kernel_names';\nimport
{NamedAttrMap} from './kernel_registry';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from
'./tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from
'./types';\n\nimport {op} from './operation';\n\n/**\n * Computes the maximum of elements across dimensions of a
`tf.Tensor`.\n * \n * Reduces the input along the dimensions given in `axes`. Unless `keepDims`\n * is true, the rank
of the `tf.Tensor` is reduced by 1 for each entry in\n * `axes`. If `keepDims` is true, the reduced dimensions are
retained with\n * length 1. If `axes` has no entries, all dimensions are reduced, and an\n * `tf.Tensor` with a single
element is returned.\n * \n * ``js\n * const x = tf.tensor1d([1, 2, 3]);\n * \n * x.max().print(); // or tf.max(x)\n * ``\n * \n * ``js\n * const x = tf.tensor2d([1, 2, 3, 4], [2, 2]);\n * \n * const
axis = 1;\n * x.max(axis).print(); // or tf.max(x, axis)\n * ``\n * \n * @param x The input tensor.\n * \n * @param axis
The dimension(s) to reduce. By default it reduces\n * all dimensions.\n * \n * @param keepDims If true, retains
reduced dimensions with size 1.\n * \n * @doc {heading: 'Operations', subheading: 'Reduction'}\n * \nfunction
```

```

max_<T extends Tensor>(\n x: Tensor|TensorLike, axis: number|number[] = null, keepDims = false): T {\n const
$x = convertToTensor(x, 'x', 'max');\n const inputs: MaxInputs = {x: $x};\n const attrs: MaxAttrs =
{reductionIndices: axis, keepDims};\n return ENGINE.runKernel(\n Max, inputs as {} as NamedTensorMap,
attrs as {} as NamedAttrMap);\n}\n\nexport const max = op({max_});\n", "/*\n * @license\n * Copyright 2020
Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n
* you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n
*\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in
writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT
WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific
language governing permissions and\n * limitations under the License.\n *

```

```

=====
\n
*\nimport {ENGINE} from '../engine';\nimport {Sub, SubInputs} from '../kernel_names';\nimport {Tensor} from
'../tensor';\nimport {NamedTensorMap} from '../tensor_types';\nimport {makeTypesMatch} from
'../tensor_util';\nimport {convertToTensor} from '../tensor_util_env';\nimport {TensorLike} from '../types';\n\nimport
{op} from '../operation';\n\n/*\n * Subtracts two `tf.Tensor`s element-wise, A - B. Supports broadcasting.\n
*\n * ```js\n * const a = tf.tensor1d([10, 20, 30, 40]);\n * const b = tf.tensor1d([1, 2, 3, 4]);\n * a.sub(b).print();
// or tf.sub(a, b)\n * ```\n * // Broadcast subtract a with b.\n * const a = tf.tensor1d([10, 20, 30, 40]);\n *
const b = tf.scalar(5);\n * a.sub(b).print(); // or tf.sub(a, b)\n * ```\n * @param a The first `tf.Tensor` to subtract
from.\n * @param b The second `tf.Tensor` to be subtracted. Must have the same dtype as\n * `a`.\n * @doc
{heading: 'Operations', subheading: 'Arithmetic'}\n */\nfunction sub_<T extends Tensor>(a: Tensor|TensorLike, b:
Tensor|TensorLike): T {\n let $a = convertToTensor(a, 'a', 'sub');\n let $b = convertToTensor(b, 'b', 'sub');\n [$a,
$b] = makeTypesMatch($a, $b);\n const inputs: SubInputs = {a: $a, b: $b};\n return ENGINE.runKernel(Sub,
inputs as {} as NamedTensorMap);\n}\n\nexport const sub = op({sub_});\n", "/*\n * @license\n * Copyright 2018
Google LLC. All Rights Reserved.\n * Licensed under
the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *

```

```

=====
\n
*\nimport {ENGINE} from '../engine';\nimport {Sum, SumAttrs, SumInputs} from '../kernel_names';\nimport
{NamedAttrMap} from '../kernel_registry';\nimport {Tensor} from '../tensor';\nimport {NamedTensorMap} from
'../tensor_types';\nimport {convertToTensor} from '../tensor_util_env';\nimport {TensorLike} from
'../types';\n\nimport {cast} from './cast';\nimport {op} from
'../operation';\n\n/*\n * Computes the sum of elements across dimensions of a `tf.Tensor`.\n * Reduces the input
along the dimensions given in `axes`. Unless `keepDims`\n * is true, the rank of the `tf.Tensor` is reduced by 1 for
each entry in\n * `axes`. If `keepDims` is true, the reduced dimensions are retained with\n * length 1. If axes has no
entries, all dimensions are reduced, and a\n * `tf.Tensor` with a single element is returned.\n * ```js\n * const x =
tf.tensor1d([1, 2, 3]);\n * x.sum().print(); // or tf.sum(x)\n * ```\n * const x = tf.tensor2d([1, 2, 3, 4],
[2, 2]);\n * const axis = 1;\n * x.sum(axis).print(); // or tf.sum(x, axis)\n * ```\n * @param x The input tensor
to compute the sum over. If the dtype is `bool`\n * it will be converted to `int32` and the output dtype will be
`int32`.\n * @param axis The dimension(s) to reduce. By default it reduces\n * all dimensions.\n * @param
keepDims If true, retains reduced dimensions
with size 1.\n * @doc {heading: 'Operations', subheading: 'Reduction'}\n */\nfunction sum_<T extends
Tensor>(\n x: Tensor|TensorLike, axis: number|number[] = null, keepDims = false): T {\n let $x =
convertToTensor(x, 'x', 'sum');\n if ($x.dtype === 'bool') {\n $x = cast($x, 'int32');\n }\n const inputs:
SumInputs = {x: $x};\n const attrs: SumAttrs = {axis, keepDims};\n return ENGINE.runKernel(\n Sum,

```

inputs as { } as NamedTensorMap, attrs as { } as NamedAttrMap);\n\n\nexport const sum = op({sum\_});\n", "/\*\n \* @license\n \* Copyright 2020 Google Inc. All Rights Reserved.\n \* Licensed under the Apache License, Version 2.0\n (the \"License\");\n \* you may not use this file except in compliance with the License.\n \* You may obtain a copy of\n the License at\n \* http://www.apache.org/licenses/LICENSE-2.0\n \* Unless required by applicable law or\n agreed to in writing, software\n \* distributed under the License is distributed on an \"AS IS\" BASIS,\n \* WITHOUT WARRANTIES

OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language\n governing permissions and\n \* limitations under the License.\n \*

```
=====\n\n*\\n\\nimport {customGrad} from '../gradients';\\n\\nimport {Tensor} from '../tensor';\\nimport {GradSaveFunc} from\n '../tensor_types';\\nimport {convertToTensor} from '../tensor_util_env';\\nimport {TensorLike} from\n '../types';\\nimport {cast} from './cast';\\nimport {exp} from './exp';\\nimport {log} from './log';\\nimport {max} from\n './max';\\nimport {mul} from './mul';\\nimport {op} from './operation';\\nimport {sub} from './sub';\\nimport {sum}\n from './sum';\\n\\n/*\n * Computes the log softmax.\n *\\n * ``js\n * const a = tf.tensor1d([1, 2, 3]);\\n *\\n *\n a.logSoftmax().print(); // or tf.logSoftmax(a)\n *\\n * ``\n *\\n * const a = tf.tensor2d([2, 4, 6, 1, 2, 3], [2, 3]);\\n\n *\\n * a.logSoftmax().print(); // or tf.logSoftmax(a)\n *\\n * ``\n *\\n *\n @param logits The logits array.\n * @param axis The dimension softmax would be performed on. Defaults to -1\n * which indicates the last dimension.\n *\\n * @doc {heading: 'Operations', subheading: 'Normalization'}\n\n*\\nfunction logSoftmax_<T extends Tensor>(logits: T|TensorLike, axis = -1): T {\n const $logits =\n convertToTensor(logits, 'logits', 'logSoftmax');\n\n if (axis === -1) {\n axis = $logits.rank - 1;\n }\n if (axis !==\n $logits.rank - 1) {\n throw Error(`Log Softmax along a non-last dimension is not yet supported. '\n `Logits was rank ${$logits.rank} and axis was ${axis}`);\n }\n\n // const forward: ForwardFunc<Tensor> =\n (backend, save) => {\n // const keepDims = true;\n // const xMax = max(logits, axis, true);\n // const shifted =\n sub(logits, xMax);\n // const value =\n // sub(cast(shifted, 'float32'), log(sum(exp(shifted), axis,\n // keepDims)));\\n // save([value]);\\n // return value;\n }\n\n // Use a\n custom gradient for numerical stability.\n const customOp = customGrad((logits: Tensor, save: GradSaveFunc) =>\n {\n const keepDims = true;\n const xMax = max(logits, axis, true);\n const shifted = sub(logits, xMax);\n const value =\n sub(cast(shifted, 'float32'), log(sum(exp(shifted), axis, keepDims)));\\n save([value]);\\n\n const gradFunc = (dy: Tensor, saved: Tensor[]) => {\n const [value] = saved;\n const keepDims = true;\n const softmax = exp(value);\n return sub(dy, mul(sum(dy, axis, keepDims), softmax));\n };\n return {value,\n gradFunc};\n });\n\n return customOp($logits) as T;\n\n // TODO Use Engine.runKernel when\n CPU/WebGL/WASM backends implement this.\n // const inputs: LogSoftmaxInputs = {logits: $logits};\n // const\n attrs: LogSoftmaxAttrs = {axis};\n // return ENGINE.runKernel(\n // LogSoftmax, inputs as { } as\n NamedTensorMap,\n // attrs as { } as NamedAttrMap);\n\n\\n\\nexport const logSoftmax =\n op({logSoftmax_});\n", "/*\n * @license\n * Copyright 2017 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version\n 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a\n copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable\n law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n\n*\\n\\nimport * as util from '../util';\n\n/*\n * Returns true if the axis specifies the inner most dimensions of the\n array.\n */\n\\nexport function axesAreInnerMostDims(axes: number[], rank: number): boolean {\n for (let i = 0; i <\n axes.length; ++i) {\n if\n (axes[axes.length - i - 1] !== rank - 1 - i) {\n return false;\n }\n }\n return true;\n}\n\n\\nexport function\n combineLocations(\n outputLoc: number[], reduceLoc: number[], axes: number[]): number[] {\n const rank =\n outputLoc.length + reduceLoc.length;\n const loc = [];\n let outIdx = 0;\n let reduceIdx = 0;\n for (let dim = 0;
```

```
dim < rank; dim++) {\n if (axes.indexOf(dim) === -1) {\n loc.push(outputLoc[outIdx++]);\n } else {\n\nloc.push(reduceLoc[reduceIdx++]);\n }\n}\n return loc;\n}\n\nexport function computeOutAndReduceShapes(\n aShape: number[], axes: number[]): [number[], number[]] {\n const outShape = [];\n const rank = aShape.length;\n for (let dim = 0; dim < rank; dim++) {\n if (axes.indexOf(dim) === -1) {\n outShape.push(aShape[dim]);\n }\n }\n const reduceShape = axes.map(dim => aShape[dim]);\n return [outShape, reduceShape];\n}\n\nexport function expandShapeToKeepDim(\n shape: number[], axes: number[]): number[]\n{\n const reduceSubShape = axes.map(x => 1);\n return combineLocations(shape, reduceSubShape,\n axes);\n}\n\nexport function assertAxesAreInnerMostDims(\n msg: string, axes: number[], rank: number): void\n{\n util.assert(\n axesAreInnerMostDims(axes, rank),\n () => `${msg} supports only inner-most axes for now.`)\n}\n\n/**\n * Returns the axes permutation to be used with `tf.transpose`, if such\n * permutation is necessary. Otherwise it returns null. This method is used by\n * operations that operate only on inner-most axes.\n */\nexport function getAxesPermutation(axes: number[], rank: number):\n number[]\n{\n null {\n if (axesAreInnerMostDims(axes, rank)) {\n return null;\n }\n const result: number[] = [];\n for (let i = 0; i < rank; ++i) {\n if (axes.indexOf(i) === -1) {\n result.push(i);\n }\n }\n axes.forEach(axis => result.push(axis));\n return result;\n }\n}\n\n/**\n * Returns the axes permutation that undoes the original permutation.\n */\nexport function getUndoAxesPermutation(axes: number[]): number[]\n{\n return axes.map((axis, i) => [i, axis])\n .sort((a, b) => a[1] - b[1])\n .map(x => x[0]);\n}\n\nexport function getInnerMostAxes(numAxes: number, rank: number): number[]\n{\n const res: number[] = [];\n for (let i = rank - numAxes; i < rank; ++i) {\n res.push(i);\n }\n return res;\n}\n"}\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,\n * software distributed under the License is distributed on an "AS IS"\n * BASIS, WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express\n * or implied. See the License for the specific language governing\n * permissions and limitations under the License.\n */\n\n=====\n\nimport {Tensor} from '../tensor';\nimport {convertToTensor} from '../tensor_util_env';\nimport {TensorLike} from '../types';\nimport {parseAxisParam} from '../util';\nimport {add} from './add';\nimport {expandShapeToKeepDim} from './axis_util';\nimport {exp} from './exp';\nimport {log} from './log';\nimport {max} from './max';\nimport {op} from './operation';\nimport {reshape} from './reshape';\nimport {sub} from './sub';\nimport {sum} from './sum';\n\n/**\n * Computes the log(sum(exp(elements across the reduction dimensions))).\n * Reduces the input along the dimensions given in `axis`. Unless `keepDims`\n * is true, the rank of the array is reduced by 1 for each entry in `axis`.\n * If `keepDims` is true, the reduced dimensions are retained with length 1.\n * If `axis` has no entries, all dimensions are reduced, and an array with a\n * single element is returned.\n */\nconst x = tf.tensor1d([1, 2, 3]);\nconst y = x.logSumExp().print(); // or\nx.logSumExp(x).print();\nconst z = tf.tensor2d([1, 2, 3, 4], [2, 2]);\nz.logSumExp(1).print(); // or\nz.logSumExp(z, 1).print();\n// or\nz.logSumExp(z, [1, 2]).print();\n// or\nz.logSumExp(z, [1, 2], {keepDims: true}).print();\n\n@doc {'Operations', subheading: 'Reduction'}\nfunction logSumExp<T extends Tensor>(x: T|TensorLike, axis: number|number[] =\n null, keepDims = false): T {\n const $x = convertToTensor(x, 'x', 'logSumExp');\n const axes = parseAxisParam(axis, $x.shape);\n const xMax = max($x, axes, true /* keepDims */);\n const a = sub($x, xMax);\n const b = exp(a);\n const c = sum(b, axes);\n const d = log(c);\n const res = add(reshape(xMax, d.shape), d);\n if (keepDims) {\n const newShape = expandShapeToKeepDim(res.shape, axes);\n return reshape(res, newShape) as T;\n }\n return res as T;\n}\n\nexport const logSumExp = op({logSumExp});\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version
```

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```
=====
*/nimport {ENGINE} from '../engine';nimport {LogicalAnd, LogicalAndInputs}
from '../kernel_names';nimport {Tensor} from '../tensor';nimport {NamedTensorMap} from
'../tensor_types';nimport {convertToTensor} from '../tensor_util_env';nimport {TensorLike} from
'../types';nimport {assertAndGetBroadcastShape} from '../broadcast_util';nimport {op} from '../operation';n/n**n
* Returns the truth value of `a AND b` element-wise. Supports broadcasting.n *`jsn * const a =
tf.tensor1d([false, false, true, true], 'bool');n * const b = tf.tensor1d([false, true, false, true], 'bool');n *
a.logicalAnd(b).print();n *`n * @param a The first input tensor. Must be of dtype bool.n * @param b The
second input tensor. Must be of dtype bool.n * @doc {heading: 'Operations', subheading: 'Logical'}n
*/nfunction logicalAnd_<T extends Tensor>(n a: Tensor|TensorLike, b: Tensor|TensorLike): T {n const $a =
convertToTensor(a, 'a', 'logicalAnd', 'bool');n const $b = convertToTensor(b, 'b', 'logicalAnd', 'bool');n
assertAndGetBroadcastShape($a.shape,
$b.shape);n const inputs: LogicalAndInputs = {a: $a, b: $b};n return ENGINE.runKernel(LogicalAnd, inputs
as { } as NamedTensorMap);n}nexport const logicalAnd = op({logicalAnd_});n", "*/n * @licensen *
Copyright 2020 Google LLC. All Rights Reserved.n * Licensed under the Apache License, Version 2.0 (the
"License");n * you may not use this file except in compliance with the License.n * You may obtain a copy of the
License atn *`n * http://www.apache.org/licenses/LICENSE-2.0n * Unless required by applicable law or
agreed to in writing, softwaren * distributed under the License is distributed on an "AS IS" BASIS,n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.n * See the License for
the specific language governing permissions andn * limitations under the License.n *
```

```
=====
*/nimport {ENGINE} from '../engine';nimport {LogicalNot, LogicalNotInputs}
from '../kernel_names';nimport {Tensor} from '../tensor';nimport {NamedTensorMap} from
'../tensor_types';nimport {convertToTensor} from '../tensor_util_env';nimport {TensorLike} from '../types';nimport
{op} from '../operation';n/n**n
* Returns the truth value of `NOT x` element-wise.n *`jsn * const a =
tf.tensor1d([false, true], 'bool');n * a.logicalNot().print();n *`n * @param x The input tensor. Must be of
dtype 'bool'.n * @doc {heading: 'Operations', subheading: 'Logical'}n */nfunction logicalNot_<T extends
Tensor>(x: T|TensorLike): T {n const $x = convertToTensor(x, 'x', 'logicalNot', 'bool');n const inputs:
LogicalNotInputs = {x: $x};n return ENGINE.runKernel(LogicalNot, inputs as { } as
NamedTensorMap);n}nexport const logicalNot = op({logicalNot_});n", "*/n * @licensen * Copyright 2020
Google LLC. All Rights Reserved.n * Licensed under the Apache License, Version 2.0 (the "License");n * you
may not use this file except
in compliance with the License.n * You may obtain a copy of the License atn *`n *
http://www.apache.org/licenses/LICENSE-2.0n * Unless required by applicable law or agreed to in writing,
softwaren * distributed under the License is distributed on an "AS IS" BASIS,n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.n * See the License for the specific language
governing permissions andn * limitations under the License.n *
```

```
=====
*/nimport {ENGINE} from '../engine';nimport {LogicalOr, LogicalOrInputs} from '../kernel_names';nimport
{Tensor} from '../tensor';nimport {NamedTensorMap} from '../tensor_types';nimport {convertToTensor} from
'../tensor_util_env';nimport {TensorLike} from '../types';nimport {assertAndGetBroadcastShape} from
'../broadcast_util';nimport {op} from '../operation';n/n**n
* Returns the truth value of `a OR b` element-wise.
Supports broadcasting.n
```

```

*\n * ``js\n * const a = tf.tensor1d([false, false, true, true], 'bool');\n * const b = tf.tensor1d([false, true, false, true],
'bool');\n * a.logicalOr(b).print();\n * ``\n * @param a The first input tensor. Must be of dtype bool.\n *
@param b The second input tensor. Must be of dtype bool.\n * \n * @doc {heading: 'Operations', subheading:
'Logical'}\n * \nfunction logicalOr_<T extends Tensor>(\n a: Tensor|TensorLike, b: Tensor|TensorLike): T {\n
const $a = convertToTensor(a, 'a', 'logicalOr', 'bool');\n const $b = convertToTensor(b, 'b', 'logicalOr', 'bool');\n
assertAndGetBroadcastShape($a.shape, $b.shape);\n\n const inputs: LogicalOrInputs = {a: $a, b: $b};\n return
ENGINE.runKernel(LogicalOr, inputs as { } as NamedTensorMap);\n }\n\nexport const logicalOr =
op({logicalOr_});\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under
the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with
the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n
*\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is
distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n *

```

```

=====
\n
*\n\nimport {Tensor} from './tensor';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike}
from './types';\n\nimport {assertAndGetBroadcastShape} from './broadcast_util';\nimport {logicalAnd} from
'./logical_and';\nimport {logicalNot} from './logical_not';\nimport {logicalOr} from './logical_or';\nimport {op} from
'./operation';\n\n/**\n * Returns the truth value of `a XOR b` element-wise. Supports broadcasting.\n * \n * ``js\n *
const a = tf.tensor1d([false,
false, true, true], 'bool');\n * const b = tf.tensor1d([false, true, false, true], 'bool');\n * a.logicalXor(b).print();\n *
``\n * \n * @param a The first input tensor. Must be of dtype bool.\n * @param b The second input tensor. Must be
of dtype bool.\n * \n * @doc {heading: 'Operations', subheading: 'Logical'}\n * \nfunction logicalXor_<T extends
Tensor>(\n a: Tensor|TensorLike, b: Tensor|TensorLike): T {\n const $a = convertToTensor(a, 'a', 'logicalXor',
'bool');\n const $b = convertToTensor(b, 'b', 'logicalXor', 'bool');\n assertAndGetBroadcastShape($a.shape,
$b.shape);\n\n // x ^ y = (x | y) & ~(x & y)\n return logicalAnd(logicalOr(a, b), logicalNot(logicalAnd(a,
b))); \n }\n\nexport const logicalXor = op({logicalXor_});\n"/**\n * @license\n * Copyright 2020 Google LLC. All
Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the
License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *

```

```

=====
\n
*\n\nimport {ENGINE} from './engine';\nimport {MaxPool, MaxPoolAttrs, MaxPoolInputs} from
'./kernel_names';\nimport {NamedAttrMap} from './kernel_registry';\nimport {Tensor3D, Tensor4D} from
'./tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from
'./tensor_util_env';\nimport {TensorLike} from './types';\nimport * as util from './util';\nimport * as conv_util
from './conv_util';\nimport {op} from './operation';\nimport {reshape} from './reshape';\n\n/**\n * Computes the
2D max pooling of an image.\n * \n * @param x The input tensor, of rank 4 or rank 3 of shape\n * `[batch, height,
width, inChannels]`. If rank 3, batch of 1 is assumed.\n * @param filterSize The filter size: `[filterHeight,
filterWidth]`. If\n * `filterSize` is a single number, then `filterHeight == filterWidth`.\n * @param strides The
strides of the pooling: `[strideHeight, strideWidth]`. If\n * `strides` is a single number, then `strideHeight ==
strideWidth`.\n * @param dilations The dilation rates: `[dilationHeight, dilationWidth]` \n * in which we sample
input values across the height and width dimensions\n * in dilated pooling. Defaults to `[1, 1]`. If `dilations` is a
single\n * number, then `dilationHeight == dilationWidth`. If it is greater than\n * 1, then all values of `strides`
must be 1.\n * @param pad The type of padding algorithm.\n * - `same` and stride 1: output will be of same size
as input,\n * regardless of filter size.\n * - `valid`

```

```

output will be smaller than input if filter is larger\n * than 1x1.\n * - For more info, see this guide:\n *
[https://www.tensorflow.org/api_guides/python/nn#Convolution](\n *
https://www.tensorflow.org/api_guides/python/nn#Convolution)\n * @param dimRoundingMode A string from:
'ceil', 'round', 'floor'. If none is\n * provided, it will default to truncate.\n * \nfunction maxPool_<T extends
Tensor3D|Tensor4D>(\n * x: T|TensorLike, filterSize: [number, number]|number,\n * strides: [number,
number]|number, pad: 'valid'|'same'|number,\n * dimRoundingMode?: 'floor'|'round'|'ceil'): T {\n * const $x =
convertToTensor(x, 'x', 'maxPool');\n * const dilations = 1;\n * let x4D = $x as Tensor4D;\n * let reshapedTo4D =
false;\n * if ($x.rank === 3) {\n * reshapedTo4D = true;\n * x4D = reshape($x, [1, $x.shape[0], $x.shape[1],
$x.shape[2]]);\n * }\n * util.assert(\n * x4D.rank === 4,\n * () => `Error in maxPool: input must be rank 4 but got
rank ${x4D.rank}`);\n *
util.assert(\n * conv_util.eitherStridesOrDilationsAreOne(strides, dilations),\n * () => `Error in maxPool: Either
strides or dilations must be 1.`);\n * `Got strides ${strides} and dilations '${dilations}'`);\n * if
(dimRoundingMode != null) {\n * util.assert(\n * util.isInt(pad as number),\n * () => `Error in maxPool: pad
must be an integer when using,`\n * `dimRoundingMode ${dimRoundingMode} but got pad ${pad}`);\n *
}\n * const inputs: MaxPoolInputs = {x: x4D};\n * const attrs: MaxPoolAttrs = {filterSize, strides, pad,
dimRoundingMode};\n * // tslint:disable-next-line: no-unnecessary-type-assertion\n * const res =
ENGINE.runKernel(\n * MaxPool, inputs as { } as NamedTensorMap,\n * attrs as { } as
NamedAttrMap) as T;\n * if (reshapedTo4D) {\n * return reshape(res, [res.shape[1], res.shape[2], res.shape[3]]) as
T;\n * }\n * return res;\n * }\n * \nexport const maxPool = op({maxPool_});\n * ",`/>\n * @license\n * Copyright
2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n *
you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
===== \n
*\n * \nimport {ENGINE} from '../engine';\n * \nimport {MaxPool3D, MaxPool3DAttrs, MaxPool3DInputs} from
'../kernel_names';\n * \nimport {NamedAttrMap} from '../kernel_registry';\n * \nimport {Tensor4D, Tensor5D} from
'../tensor';\n * \nimport {NamedTensorMap} from '../tensor_types';\n * \nimport {convertToTensor} from
'../tensor_util_env';\n * \nimport
{TensorLike} from '../types';\n * \nimport * as util from '../util';\n * \nimport {op} from './operation';\n * \nimport {reshape}
from './reshape';\n * \n`/>\n * Computes the 3D max pooling.\n * \n * ``js\n * const x = tf.tensor5d([1, 2, 3, 4, 5, 6, 7,
8], [1, 2, 2, 2, 1]);\n * const result = tf.maxPool3d(x, 2, 1, 'valid');\n * result.print();\n * ```\n * \n * @param x The
input tensor, of rank 5 or rank 4 of shape\n * [batch, depth, height, width, inChannels].\n * \n * @param filterSize
The filter size:\n * [filterDepth, filterHeight, filterWidth].\n * \n * If `filterSize` is a single number,\n * then
`filterDepth == filterHeight == filterWidth`.\n * \n * @param strides The strides of the pooling:\n * [strideDepth,
strideHeight, strideWidth].\n * \n * If `strides` is a single number,\n * then `strideDepth == strideHeight ==
strideWidth`.\n * \n * @param pad The type of padding algorithm.\n * - `same` and stride 1: output will be of same
size as input,\n * regardless of
filter size.\n * - `valid`: output will be smaller than input if filter is larger\n * than 1*1x1.\n * - For more
info, see this guide:\n * [https://www.tensorflow.org/api_guides/python/nn#Convolution](\n *
https://www.tensorflow.org/api_guides/python/nn#Convolution)\n * \n * @param dimRoundingMode A string from:
'ceil', 'round', 'floor'. If none is\n * provided, it will default to truncate.\n * \n * @param dataFormat An optional string
from: "NDHWC", "NCDHW". Defaults to\n * "NDHWC". Specify the data format of the input and output
data. With the\n * default format "NDHWC", the data is stored in the order of: [batch,\n * depth, height,
width, channels]. Only "NDHWC" is currently supported.\n * \n * @doc {heading: 'Operations', subheading:
'Convolution'}\n * \nfunction maxPool3d_<T extends Tensor4D|Tensor5D>(\n * x: T|TensorLike, filterSize:
[number, number, number]|number = [1, 1, 1],\n * strides: [number, number, number]|number, pad:

```

```
'valid'|'same'|number,\n
 dimRoundingMode?: 'floor'|'round'|'ceil',\n dataFormat: 'NDHWC'|"NCDHW" = 'NDHWC'): T {\n const $x =
convertToTensor(x, 'x', 'maxPool3d');\n\n let x5D = $x as Tensor5D;\n let reshapedTo5D = false;\n if ($x.rank
=== 4) {\n reshapedTo5D = true;\n x5D = reshape($x, [1, $x.shape[0], $x.shape[1], $x.shape[2],
$x.shape[3]]);\n }\n\n util.assert(\n x5D.rank === 5,\n () => `Error in maxPool3d: x must be rank 5 but got
rank ${x5D.rank}.`);\n util.assert(\n dataFormat === 'NDHWC',\n () => `Error in maxPool3d: Only NDHWC
is currently supported, ` +\n `but got dataFormat of ${dataFormat}`);\n if (dimRoundingMode != null) {\n
util.assert(\n util.isInt(pad as number),\n () => `Error in maxPool3d: pad must be an integer when using, `
+\n `dimRoundingMode ${dimRoundingMode} but got pad ${pad}.`);\n }\n\n const inputs:
MaxPool3DInputs = {x: x5D};\n\n const attrs:\n MaxPool3DAttrs = {filterSize, strides, pad,
dimRoundingMode, dataFormat};\n\n // tslint:disable-next-line: no-unnecessary-type-assertion\n const res =
ENGINE.runKernel(\n MaxPool3D, inputs as {} as NamedTensorMap,\n attrs as {} as
NamedAttrMap) as T;\n\n if (reshapedTo5D) {\n return reshape(\n res, [res.shape[1], res.shape[2],
res.shape[3], res.shape[4]]) as\n T;\n }\n\n return res;\n}\n\nexport const maxPool3d =
op({maxPool3d_});\n", "/*\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under
the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * \n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the
License for the specific language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {ENGINE} from '../engine';\nimport {MaxPoolWithArgmax, MaxPoolWithArgmaxAttrs,
MaxPoolWithArgmaxInputs} from '../kernel_names';\nimport {NamedAttrMap} from '../kernel_registry';\nimport
{Tensor, Tensor4D} from '../tensor';\nimport {NamedTensorMap} from '../tensor_types';\nimport
{convertToTensor} from '../tensor_util_env';\nimport {TensorLike} from '../types';\nimport {op} from
'/operation';\n\n/**\n * Computes the 2D max pooling of an image with Argmax index.\n * The indices in argmax
are flattened, so that a maximum value at position `[b, n * y, x, c]` becomes flattened index: `(y * width + x) *
channels + c` if\n * include_batch_in_index is False; `((b * height + y) * width + x) * channels\n * + c` if
include_batch_in_index is True.\n * \n * The indices returned are always in `[0, height) x [0,
width)` before\n * flattening.\n * \n * @param x The input tensor, of rank 4 or rank 3 of shape\n * `[batch, height,
width, inChannels]`. If rank 3, batch of 1 is assumed.\n * \n * @param filterSize The filter size: `[filterHeight,
filterWidth]`. If\n * `filterSize` is a single number, then `filterHeight == filterWidth`.\n * \n * @param strides The
strides of the pooling: `[strideHeight, strideWidth]`. If\n * `strides` is a single number, then `strideHeight ==
strideWidth`.\n * \n * @param dataFormat An optional string from: "NDHWC", "NCDHW". Defaults to\n *
"NDHWC". Specify the data format of the input and output data. With the\n * default format "NDHWC", the
data is stored in the order of: [batch,\n * depth, height, width, channels]. Only "NDHWC" is currently
supported.\n * \n * @param pad The type of padding algorithm.\n * - `same` and stride 1: output will be of same size
as input,\n * regardless of filter size.\n * - `valid`: output will be smaller than
input if filter is larger\n * than 1x1.\n * - For more info, see this guide:\n *
[https://www.tensorflow.org/api_guides/python/nn#Convolution](\n *
https://www.tensorflow.org/api_guides/python/nn#Convolution)\n * \n * @param includeBatchIndex Defaults to False.
Whether to include batch\n * dimension in flattened index of argmax.\n * \n * @doc {heading: 'Operations',
subheading: 'Convolution'}\n */\nfunction maxPoolWithArgmax_<T extends Tensor4D>(\n x: T|TensorLike,\n filterSize: [number, number]|number,\n strides: [number, number]|number, pad: 'valid'|'same'|number,\n includeBatchInIndex = false): NamedTensorMap {\n const $x = convertToTensor(x, 'x',
'maxPoolWithArgmax');\n\n const inputs: MaxPoolWithArgmaxInputs = {x: $x};\n const attrs:\n MaxPoolWithArgmaxAttrs = {filterSize, strides, pad, includeBatchInIndex};\n\n // tslint:disable-next-line: no-
```



```
unnecessary-type-assertion\nconst result = ENGINE.runKernel(\n MaxPoolWithArgmax,\ninputs as { } as NamedTensorMap,\n attrs as { } as NamedAttrMap) as Tensor[];\n\nreturn {result:\nresult[0], indexes: result[1]};\n}\n\nexport const maxPoolWithArgmax = op({maxPoolWithArgmax_});\n","/**\n *\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version\n * 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a\n * copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable\n * law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n * the specific language governing permissions and\n * limitations under the License.\n *\n *=====\n *\n */\nimport {ENGINE} from '../engine';\nimport {Maximum, MaximumInputs}\nfrom './kernel_names';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from\n'./tensor_types';\nimport {makeTypesMatch} from './tensor_util';\nimport {convertToTensor} from\n'./tensor_util_env';\nimport {TensorLike} from './types';\nimport {assertAndGetBroadcastShape} from\n'./broadcast_util';\nimport {cast} from './cast';\nimport {op} from './operation';\n\n/**\n * Returns the max of a and b\n * ($a > b ? a : b$) element-wise.\n * Supports broadcasting.\n * We also expose `tf.maximumStrict` which has the\n * same signature as this op and\n * asserts that `a` and `b` are the same shape (does not broadcast).\n * \n * js\n * const a = tf.tensor1d([1, 4, 3, 16]);\n * const b = tf.tensor1d([1, 2, 9, 4]);\n * a.maximum(b).print(); // or\n * tf.maximum(a, b)\n * \n * js\n * // Broadcast maximum a with b.\n * const a = tf.tensor1d([2, 4, 6, 8]);\n * const b = tf.scalar(5);\n * a.maximum(b).print(); // or tf.maximum(a, b)\n * \n * @param a The first\n * tensor.\n * @param b The second tensor. Must have the same type as `a`. \n * @doc {heading: 'Operations',\n * subheading: 'Arithmetic'}\n */\nfunction maximum_<T extends Tensor>(a: Tensor|TensorLike, b:\nTensor|TensorLike): T {\n let $a = convertToTensor(a, 'a', 'maximum');\n let $b = convertToTensor(b, 'b',\n'maximum');\n [$a, $b] = makeTypesMatch($a, $b);\n if ($a.dtype === 'bool') {$a = cast($a, 'int32');\n $b = cast($b, 'int32');\n }\n assertAndGetBroadcastShape($a.shape, $b.shape);\n const inputs: MaximumInputs =\n{a: $a, b: $b};\n return ENGINE.runKernel(Maximum, inputs as { } as NamedTensorMap);\n}\n\nexport const\nmaximum = op({maximum_});\n","/**\n *\n * @license\n * Copyright 2020 Google Inc. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in\n * compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless\n * required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an\n * \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *\n *=====\n *\n */\nimport {ENGINE} from '../engine';\nimport {Mean, MeanAttrs, MeanInputs} from './kernel_names';\nimport\n{NamedAttrMap} from './kernel_registry';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from\n'./tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from\n'./types';\nimport {op} from './operation';\n\n/**\n * Computes the mean of elements across dimensions of a\n * `tf.Tensor`.\n * Reduces `x` along the dimensions given in `axis`. Unless `keepDims` is true, the rank of the\n * `tf.Tensor` is reduced by 1 for each entry in `axis`. \n *\n * If `keepDims` is true, the reduced dimensions are retained with length 1. \n * If `axis` has no entries, all\n * dimensions are reduced, and a `tf.Tensor` with\n * a single element is returned.\n * \n * js\n * const x =\ntf.tensor1d([1, 2, 3]);\n * x.mean().print(); // or tf.mean(a)\n * \n * js\n * const x = tf.tensor2d([1, 2, 3,\n * 4], [2, 2]);\n * const axis = 1;\n * x.mean(axis).print(); // or tf.mean(x, axis)\n * \n * @param x The input\n * tensor.\n * @param axis The dimension(s) to reduce. By default it reduces\n * all dimensions.\n * @param\n * keepDims If true, retains reduced dimensions with size 1. \n * @doc {heading: 'Operations', subheading:\n'Reduction'}\n */\nfunction mean_<T extends Tensor>(x: Tensor|TensorLike, axis: number|number[] = null,\nkeepDims: boolean): T {\n const $x = convertToTensor(x, 'x', 'mean');\n const inputs: MeanInputs = {x: $x};\n
```

```
const attrs: MeanAttrs = {axis, keepDims};\n\n return ENGINE.runKernel(\n Mean, inputs\n as { } as NamedTensorMap, attrs as { } as NamedAttrMap);\n}\n\nexport const mean = op({mean_});\n", "/*\n *\n * Copyright 2020 Google Inc. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0\n * (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of\n * the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or\n * agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n * the specific language governing permissions and\n * limitations under the License.\n */
```

```

*\\n\\nimport {ENGINE} from './engine';\\nimport {Minimum, MinimumInputs} from './kernel_names';\\nimport
{Tensor} from './tensor';\\nimport {NamedTensorMap} from './tensor_types';\\nimport {makeTypesMatch} from
'./tensor_util';\\nimport {convertToTensor} from './tensor_util_env';\\nimport {TensorLike} from './types';\\n\\nimport
{assertAndGetBroadcastShape} from './broadcast_util';\\nimport {cast} from './cast';\\nimport {op} from
'./operation';\\n\\n**\\n * Returns the min of a and b ($a < b ? a : b$) element-wise.\\n * Supports broadcasting.\\n * \\n *
We also expose `minimumStrict` which has the same signature as this op and\\n * asserts that `a` and `b` are the
same shape (does not broadcast).\\n * \\n * ```js\\n * const
a = tf.tensor1d([1, 4, 3, 16]);\\n * const b = tf.tensor1d([1, 2, 9, 4]);\\n * \\n * a.minimum(b).print(); // or
tf.minimum(a, b)\\n * ```\\n * \\n * ```js\\n * // Broadcast minimum a with b.\\n * const a = tf.tensor1d([2, 4, 6, 8]);\\n *
const b = tf.scalar(5);\\n * \\n * a.minimum(b).print(); // or tf.minimum(a, b)\\n * ```\\n * \\n * @param a The first
tensor.\\n * @param b The second tensor. Must have the same type as `a`.\\n * \\n * @doc {heading: 'Operations',
subheading: 'Arithmetic'}\\n * \\nfunction minimum_<T extends Tensor>(\\n a: Tensor|TensorLike, b:
Tensor|TensorLike): T {\\n let $a = convertToTensor(a, 'a', 'minimum');\\n let $b = convertToTensor(b, 'b',
'minimum');\\n [$a, $b] = makeTypesMatch($a, $b);\\n \\n if ($a.dtype === 'bool') {\\n $a = cast($a, 'int32');\\n $b =
cast($b, 'int32');\\n }\\n \\n assertAndGetBroadcastShape($a.shape, $b.shape);\\n \\n const inputs: MinimumInputs = {a:

```

```

$a, b: $b};\n\n return ENGINE.runKernel(Minimum, inputs as { } as NamedTensorMap);\n}\n\nexport const
minimum = op({minimum_});\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n *
Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in
compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {ENGINE} from '../engine';\nimport {MirrorPad, MirrorPadAttrs, MirrorPadInputs} from
'../kernel_names';\nimport {NamedAttrMap} from '../kernel_registry';\nimport {Tensor} from '../tensor';\nimport
{NamedTensorMap} from '../tensor_types';\nimport
{convertToTensor} from '../tensor_util_env';\nimport {TensorLike} from '../types';\nimport * as util from
'../util';\n\nimport {op} from '../operation';\n\n/**\n * Pads a `tf.Tensor` using mirror padding.\n * This operation
implements the `REFLECT` and `SYMMETRIC` modes of pad.\n * const x = tf.range(0, 9).reshape([1,
1, 3, 3]);\n * x.mirrorPad([[0, 0], [0, 0], [2, 2], [2, 2]], 'reflect').print();\n * @param x The tensor to pad.\n *
@param paddings An array of length `R` (the rank of the tensor), where\n * each element is a length-2 tuple of ints
`[padBefore, padAfter]`,\n * specifying how much to pad along each dimension of the tensor.\n * In `reflect`
mode, the padded regions do not include the borders,\n * while in `symmetric` mode the padded regions do
include the borders.\n * For example, if the input is `[1, 2, 3]` and paddings is `[0, 2]`,\n * then the output is
`[1, 2, 3, 2, 1]` in `reflect` mode, and\n * `[1, 2, 3, 3, 2]` in `symmetric`
mode.\n * If `mode` is `reflect` then both `paddings[D, 0]` and `paddings[D, 1]`\n * must be no greater than
`x.shape[D] - 1`. If mode is `symmetric`\n * then both `paddings[D, 0]` and `paddings[D, 1]` must be no greater
than\n * `x.shape[D]`\n * @param mode String to specify padding mode. Can be `reflect` | `symmetric`\n */\n\n@doc {heading: 'Tensors', subheading: 'Transformations'}\nfunction mirrorPad_<T extends Tensor>(\n x:
T|TensorLike, paddings: Array<[number, number]>,\n mode: 'reflect'|'symmetric'): T {\n util.assert(\n mode
=== 'reflect' || mode === 'symmetric',\n () => `Invalid mode. Mode must be either reflect or symmetric.` +\n
`Got ${mode}.`);\n\n const $x = convertToTensor(x, 'x', 'mirrorPad');\n if ($x.rank === 0) {\n throw new Error(\n
'mirrorPad(scalar) is not defined.' +\n 'Pass non-scalar to mirrorPad');\n }\n util.assert(\n
paddings.length === $x.rank,\n () => `Padding doesn't match input. Must
be ${$x.rank}.` +\n `Got ${paddings.length}.`);\n const shapeOffset = mode === 'reflect' ? 1 : 0;\n for (let i
= 0; i < $x.rank; i++) {\n util.assert(\n paddings[i].length === 2,\n () => `Invalid number of paddings.
Must be length of 2 each.`);\n util.assert(\n paddings[i][0] >= 0 && paddings[i][0] <= $x.shape[i] -
shapeOffset &&\n paddings[i][1] >= 0 && paddings[i][1] <= $x.shape[i] - shapeOffset,\n () => `Padding
in dimension ${i} cannot be greater than or equal ` +\n `to ${$x.shape[i] - shapeOffset} or less than 0 for
input of ` +\n `shape ${$x.shape}`);\n }\n\n const attrs: MirrorPadAttrs = {paddings, mode};\n const inputs:
MirrorPadInputs = {x: $x};\n return ENGINE.runKernel(\n MirrorPad, inputs as { } as NamedTensorMap, attrs
as { } as NamedAttrMap);\n}\n\nexport const mirrorPad = op({mirrorPad_});\n", "/*\n * @license\n * Copyright
2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache
License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You
may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required
by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\"
BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the
License for the specific language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {ENGINE} from '../engine';\nimport {Mod, ModInputs} from '../kernel_names';\nimport {Tensor}
from '../tensor';\nimport {NamedTensorMap} from '../tensor_types';\nimport {makeTypesMatch} from
'../tensor_util';\nimport {convertToTensor} from '../tensor_util_env';\nimport {TensorLike} from '../types';\n\nimport

```

```

{op} from './operation';\n\n**\n * Returns the mod of
a and b element-wise.\n * `floor(x / y) * y + mod(x, y) = x`\n * Supports broadcasting.\n *\n * We also expose
`tf.modStrict` which has the same signature as this op and\n * asserts that `a` and `b` are the same shape (does not
broadcast).\n *\n * ```js\n * const a = tf.tensor1d([1, 4, 3, 16]);\n * const b = tf.tensor1d([1, 2, 9, 4]);\n *\n * a.mod(b).print(); // or tf.mod(a, b)\n *\n * ```\n *\n * // Broadcast a mod b.\n * const a = tf.tensor1d([2, 4, 6, 8]);\n * const b = tf.scalar(5);\n *\n * a.mod(b).print(); // or tf.mod(a, b)\n *\n * @param a The first tensor.\n * @param b The second tensor. Must have the same type as `a`.\n * @doc {heading: 'Operations', subheading:
'Arithmetic'}\n *\nfunction mod_<T extends Tensor>(a: Tensor|TensorLike, b: Tensor|TensorLike): T {\n let $a =
convertToTensor(a, 'a', 'mod');\n let $b = convertToTensor(b, 'b', 'mod');\n [$a, $b] = makeTypesMatch($a, $b);\n\n const inputs: ModInputs = {a: $a, b: $b};\n\n return ENGINE.runKernel(Mod,
inputs as {} as NamedTensorMap);\n}\n\nexport const mod = op({mod_});\n", "/*\n * @license\n * Copyright
2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n *
you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
\n\nimport {ENGINE} from '../engine';\nimport {Tensor} from './tensor';\nimport {convertToTensor} from
'./tensor_util_env';\nimport {TensorLike} from './types';\nimport {op} from './operation';\n\n**\n * Computes square of `x` element-wise: `x ^ 2`\n *\n * ```js\n * const x = tf.tensor1d([1, 2, Math.sqrt(2), -1]);\n *\n * x.square().print(); // or tf.square(x)\n *\n * ```\n *\n * @param x The input Tensor.\n * @doc {heading: 'Operations',
subheading: 'Basic math'}\n *\nfunction square_<T extends Tensor>(x: T|TensorLike): T {\n const $x =
convertToTensor(x, 'x', 'square');\n const attrs = {};\n return ENGINE.runKernel('Square', {x: $x,
attrs});\n}\n\nexport const square = op({square_});\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF
ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n *
limitations under the License.\n *
=====
\n\nimport {Tensor} from './tensor';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike}
from './types';\nimport {parseAxisParam} from './util';\nimport {expandShapeToKeepDim} from
'./axis_util';\nimport {cast} from './cast';\nimport {mean} from './mean';\nimport {op} from './operation';\nimport
{reshape} from './reshape';\nimport {square} from './square';\nimport {sub} from './sub';\n\n**\n * Calculates the
mean and variance of `x`. The mean and variance are\n * calculated by aggregating the contents of `x` across `axes`.
If `x` is\n * 1-D and `axes = [0]` this is just the mean and variance of a vector.\n *\n * @param x The input tensor.\n * @param axis The dimension(s) along with to compute mean and\n * variance. By default
it reduces all dimensions.\n * @param keepDims If true, the moments have the same dimensionality as the\n *
input.\n * @return An object with two keys: `mean` and `variance`.\n *\n * @doc {heading: 'Operations',
subheading: 'Normalization'}\n *\nfunction moments_(\n x: Tensor|TensorLike, axis: number|number[] = null,\n keepDims = false): {mean: Tensor, variance: Tensor} {\n x = convertToTensor(x, 'x', 'moments');\n const axes =
parseAxisParam(axis, x.shape);\n const xMean = mean(x, axes, keepDims);\n let keepDimsShape =
xMean.shape;\n if (!keepDims) {\n keepDimsShape = expandShapeToKeepDim(xMean.shape, axes);\n }\n\n const devSquared =\n square(sub(cast(x, 'float32'), reshape(xMean, keepDimsShape)));\n const variance =
mean(devSquared, axes, keepDims);\n return {mean: xMean, variance};\n}\n\nexport const moments =

```

op({moments\_});\n","/\*\*\n \* @license\n \* Copyright 2020 Google LLC. All Rights Reserved.\n \* Licensed under the Apache License, Version 2.0 (the \"License\");\n

\* you may not use this file except in compliance with the License.\n \* You may obtain a copy of the License at\n \*\n \* http://www.apache.org/licenses/LICENSE-2.0\n \*\n \* Unless required by applicable law or agreed to in writing, software\n \* distributed under the License is distributed on an \"AS IS\" BASIS,\n \* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*

=====\n\n\*/\nimport {Tensor2D} from '../tensor';\nimport {convertToTensor, convertToTensorArray} from\n '../tensor\_util\_env';\nimport {TensorLike} from '../types';\nimport {op} from './operation';\n\n/\*\*\n \* @docalias\n (data: Tensor2D, c: Tensor2D, h: Tensor2D): [Tensor2D, Tensor2D]\n \*/\nexport type LSTMCellFunc = {\n (data: Tensor2D, c: Tensor2D, h: Tensor2D): [Tensor2D, Tensor2D];\n};\n\n/\*\*\n \* Computes the next\n states and outputs of a stack of LSTMCells.\n \*\n \* Each cell output is used as input to the next cell.\n \*\n \* Returns\n `[cellState, cellOutput]`.\n \*\n \* Derived from tf.contrib.rnn.MultiRNNCell.\n \*\n \* @param lstmCells Array of\n LSTMCell functions.\n \* @param data The input to the cell.\n \* @param c Array of previous cell states.\n \* @param h Array of previous cell outputs.\n \*\n \* @doc {heading: 'Operations', subheading: 'RNN'}\n \*/\nfunction\n multiRNNCell\_(\n lstmCells: LSTMCellFunc[], data: Tensor2D|TensorLike,\n c:\n Array<Tensor2D|TensorLike>,\n h: Array<Tensor2D|TensorLike>): [Tensor2D[], Tensor2D[]] {\n const \$data =\n convertToTensor(data, 'data', 'multiRNNCell');\n const \$c = convertToTensorArray(c, 'c', 'multiRNNCell');\n const\n \$h = convertToTensorArray(h, 'h', 'multiRNNCell');\n \n let input = \$data;\n const newStates = [];\n for (let i = 0; i\n < lstmCells.length; i++) {\n const output = lstmCells[i](input, \$c[i], \$h[i]);\n newStates.push(output[0]);\n newStates.push(output[1]);\n }\n

input = output[1];\n }\n const newC: Tensor2D[] = [];\n const newH: Tensor2D[] = [];\n for (let i = 0; i <\n newStates.length; i += 2) {\n newC.push(newStates[i]);\n newH.push(newStates[i + 1]);\n }\n return [newC,\n newH];\n}\n\nexport const multiRNNCell = op({multiRNNCell\_});\n\n","/\*\*\n \* @license\n \* Copyright 2020 Google LLC. All Rights Reserved.\n \* Licensed under the Apache License, Version 2.0 (the \"License\");\n \* you may not use this file except in compliance with the License.\n \* You may obtain a copy of the License at\n \*\n \* http://www.apache.org/licenses/LICENSE-2.0\n \*\n \* Unless required by applicable law or agreed to in writing, software\n \* distributed under the License is distributed on an \"AS IS\" BASIS,\n \* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*

=====\n\n\*/\nimport {ENGINE} from '../engine';\nimport {Multinomial, MultinomialAttrs, MultinomialInputs} from\n '../kernel\_names';\nimport {NamedAttrMap} from '../kernel\_registry';\nimport {Tensor1D, Tensor2D} from\n '../tensor';\nimport {NamedTensorMap} from '../tensor\_types';\nimport {convertToTensor} from\n '../tensor\_util\_env';\nimport {TensorLike} from '../types';\nimport {op} from './operation';\nimport {reshape} from\n './reshape';\n\n/\*\*\n \* Creates a `tf.Tensor` with values drawn from a multinomial distribution.\n \*\n \* ``js\n \* const\n probs = tf.tensor([.75, .25]);\n \* tf.multinomial(probs, 3).print();\n \* ``\n \*\n \* @param logits 1D array with\n unnormalized log-probabilities, or\n \* 2D array of shape `[batchSize, numOutcomes]`. See the `normalized`\n \* parameter.\n \* @param numSamples Number of samples to draw for each row slice.\n \* @param seed The seed\n number.\n \* @param normalized Whether the provided `logits` are normalized true\n \* probabilities\n (sum to 1). Defaults to false.\n \* @return 1D array of shape `[numSamples]`, or 2D array of shape\n \*\n `[batchSize, numSamples]`, depending on the rank of the input.\n \*\n \* @doc {heading: 'Tensors', subheading:\n 'Random'}\n \*/\nfunction multinomial\_(\n logits: Tensor1D|Tensor2D|TensorLike, numSamples: number, seed?:\n number,\n normalized = false): Tensor1D|Tensor2D {\n const \$logits = convertToTensor(logits, 'logits',\n 'multinomial');\n const numOutcomes = \$logits.size;\n const origRank = \$logits.rank;\n if (numOutcomes < 2) {\n throw new Error(\n `Error in multinomial: you need at least 2 outcomes, but got ` +\n `\${numOutcomes}`);\n }\n if (origRank > 2) {\n throw new Error(`Rank of probabilities must be 1 or 2, but is

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${origRank}`);\n } \n // TODO(linal28): Investigate correct seed behavior. The code seems not allow\n // setting
see to 0.\n seed = seed || Math.random();\n\n // The kernel only accepts (and returns) rank 2 tensors.\n const
logits2D: Tensor2D = \n origRank === 1 ? reshape($logits, [1, -1]) : $logits as Tensor2D;\n\n const inputs:
MultinomialInputs = {logits: logits2D};\n const attrs: MultinomialAttrs = {numSamples, seed, normalized};\n\n //
tslint:disable-next-line: no-unnecessary-type-assertion\n const res = ENGINE.runKernel(\n Multinomial,
inputs as { } as NamedTensorMap,\n attrs as { } as NamedAttrMap) as Tensor2D;\n\n // tslint:disable-
next-line: no-unnecessary-type-assertion\n return origRank === 1 ? reshape(res, [res.size]) as Tensor1D :
res;\n}\n\nexport const multinomial = op({multinomial_});\n", "/*\n * @license\n * Copyright 2020 Google LLC.
All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *

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===== \n
*/\nimport {ENGINE} from '../engine';\nimport {NotEqual, NotEqualInputs} from '../kernel_names';\nimport
{Tensor} from '../tensor';\nimport {NamedTensorMap} from '../tensor_types';\nimport {makeTypesMatch} from
'../tensor_util';\nimport {convertToTensor} from '../tensor_util_env';\nimport {TensorLike} from '../types';\nimport
{assertAndGetBroadcastShape} from '../broadcast_util';\nimport {op} from '../operation';\n\n/**\n * Returns the truth
value of (a != b) element-wise. Supports broadcasting.\n * \n * ``js\n * const a = tf.tensor1d([1, 2, 3]);\n * const b =
tf.tensor1d([0, 2, 3]);\n * \n * a.notEqual(b).print();\n * ``\n * @param a
The first input tensor.\n * @param b The second input tensor. Must have the same dtype as `a`.\n * \n * @doc
{heading: 'Operations', subheading: 'Logical'}\n */\nfunction notEqual<T extends Tensor>(\n a:
Tensor|TensorLike, b: Tensor|TensorLike): T {\n let $a = convertToTensor(a, 'a', 'notEqual');\n let $b =
convertToTensor(b, 'b', 'notEqual');\n [$a, $b] = makeTypesMatch($a, $b);\n\n
assertAndGetBroadcastShape($a.shape, $b.shape);\n\n const inputs: NotEqualInputs = {a: $a, b: $b};\n\n return
ENGINE.runKernel(NotEqual, inputs as { } as NamedTensorMap);\n}\n\nexport const notEqual =
op({notEqual_});\n", "/*\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under
the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n *
Unless required by applicable law or agreed to in writing, software\n *
distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR
CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing
permissions and\n * limitations under the License.\n *

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===== \n
*/\nimport {ENGINE} from '../engine';\nimport {Tensor} from '../tensor';\nimport {DataType, Rank, ShapeMap}
from '../types';\nimport {makeZerosTypedArray, sizeFromShape} from '../util';\n\nimport {complex} from
'../complex';\n\n/**\n * Creates a `tf.Tensor` with all elements set to 0.\n * \n * ``js\n * tf.zeros([2, 2]).print();\n *
``\n * \n * @param shape An array of integers defining the output tensor shape.\n * @param dtype The type of an
element in the resulting tensor. Can\n * be 'float32', 'int32' or 'bool'. Defaults to 'float'. \n * \n * @doc {heading:
'Tensors', subheading: 'Creation'}\n */\nexport function zeros<R extends Rank>(\n shape: ShapeMap[R],
dtype: DataType = 'float32'): Tensor<R> {\n if (dtype === 'complex64') {\n const real = zeros(shape, 'float32');\n
const imag = zeros(shape, 'float32');\n return complex(real, imag);\n }\n\n const values =
makeZerosTypedArray(sizeFromShape(shape), dtype);\n return ENGINE.makeTensor(values, shape, dtype) as
Tensor<R>;\n}\n", "/*\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed

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on an \"AS IS\" BASIS,\n \* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*

```
=====
*\n\nimport {ENGINE} from './engine';\nimport {Tensor} from './tensor';\nimport {DataType, Rank, ShapeMap}\nfrom './types';\nimport {makeOnesTypedArray, sizeFromShape} from './util';\n\nimport {complex} from\n'./complex';\nimport {zeros} from './zeros';\n\n/**\n * Creates a `tf.Tensor` with all elements set to 1.\n *\n * ``js\n * tf.ones([2, 2]).print();\n * ``\n *\n * @param shape An array of integers defining the output tensor shape.\n *\n * @param dtype The type of an element in the resulting tensor. Defaults to\n * 'float'.\n *\n * @doc {heading:\n'Tensors', subheading: 'Creation'}\n */\n\nexport function ones<R extends Rank>(\n shape: ShapeMap[R], dtype:\n DataType = 'float32'): Tensor<R> {\n if (dtype === 'complex64') {\n const real = ones(shape, 'float32');\n const imag = zeros(shape, 'float32');\n return complex(real, imag);\n }\n const values =\n makeOnesTypedArray(sizeFromShape(shape), dtype);\n return\n ENGINE.makeTensor(values, shape, dtype) as Tensor<R>;\n}\n\n"/**\n * @license\n * Copyright 2018 Google\n LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not\n use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,\n software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\n OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n governing permissions and\n * limitations under the License.\n */\n
```

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=====
*\n\nimport {ENGINE} from './engine';\nimport {OnesLike, OnesLikeInputs} from './kernel_names';\nimport\n{Tensor} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from\n'./tensor_util_env';\nimport {TensorLike} from './types';\n\nimport {op} from './operation';\n\n/**\n * Creates a\n * `tf.Tensor` with all elements set to 1 with the same shape as the\n * given tensor.\n *\n * ``js\n * const x =\n tf.tensor([1, 2]);\n * tf.onesLike(x).print();\n * ``\n *\n * @param x A tensor.\n *\n * @doc {heading: 'Tensors',\n subheading: 'Creation'}\n */\n\nfunction onesLike_<T extends Tensor>(x: T|TensorLike): T {\n const $x =\n convertToTensor(x, 'x', 'onesLike');\n const inputs: OnesLikeInputs = {x: $x};\n return\n ENGINE.runKernel(OnesLike, inputs as { } as NamedTensorMap);\n}\n\nexport const onesLike =\n op({onesLike_});\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under\n the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the\n License.\n * You may obtain a copy of the License at\n *\n http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed\n to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT\n WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific\n language governing permissions and\n * limitations under the License.\n */\n
```

```
=====
*\n\nimport {Tensor1D, Tensor2D} from './tensor';\nimport {convertToTensor} from './tensor_util_env';\nimport\n{TensorLike} from './types';\nimport * as util from './util';\n\nimport {matMul} from './mat_mul';\nimport {op}\nfrom './operation';\nimport {reshape} from './reshape';\n\n/**\n * Computes the outer product of two vectors, `v1`\n * and `v2`.\n *\n * ``js\n * const a = tf.tensor1d([1, 2, 3]);\n * const b = tf.tensor1d([3, 4, 5]);\n *\n * tf.outerProduct(a, b).print();\n * ``\n *\n * @param v1 The first vector in the outer product operation.\n *\n * @param v2 The second vector in the outer product operation.\n *\n * @doc {heading:\n'Operations', subheading: 'Matrices'}\n */\n\nfunction outerProduct_(\n v1: Tensor1D|TensorLike, v2:\n Tensor1D|TensorLike): Tensor2D {\n const $v1 = convertToTensor(v1, 'v1', 'outerProduct');\n const $v2 =\n convertToTensor(v2, 'v2', 'outerProduct');\n util.assert(\n $v1.rank === 1 && $v2.rank === 1,\n () =>\n `Error in outerProduct: inputs must be rank 1, but got ranks ` +\n `${$v1.rank} and `${$v2.rank}`.`);\n const\n v12D = reshape($v1, [-1, 1]);\n const v22D = reshape($v2, [1, -1]);\n return matMul(v12D, v22D);\n}\n\nexport\n
```

```

const outerProduct = op({outerProduct_});\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under
the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY
KIND, either express or implied.\n * See the License for the specific language governing permissions and\n *
limitations under the License.\n *
=====\\n
*\n\nimport {ENGINE} from '../engine';\nimport {PadV2, PadV2Attrs, PadV2Inputs} from
'../kernel_names';\nimport {NamedAttrMap} from '../kernel_registry';\nimport {Tensor} from '../tensor';\nimport
{NamedTensorMap} from '../tensor_types';\nimport {convertToTensor} from '../tensor_util_env';\nimport
{TensorLike} from '../types';\n\nimport {op} from './operation';\n\n/**\n * Pads a `tf.Tensor` with a given value and
padding.\n *\n * This operation implements `CONSTANT` mode. For `REFLECT` and `SYMMETRIC`,\n * refer
to `tf.mirrorPad`\n *\n * Also available are stricter rank-specific methods with the same signature\n * as this method
that assert that `padding` is of given
length.\n * - `tf.pad1d`\n * - `tf.pad2d`\n * - `tf.pad3d`\n * - `tf.pad4d`\n *\n * ``js\n * const x = tf.tensor1d([1,
2, 3, 4]);\n * x.pad([[1, 2]]).print();\n * ``\n *\n * @param x The tensor to pad.\n * @param padding An array of
length `R` (the rank of the tensor), where\n * each element is a length-2 tuple of ints `[padBefore, padAfter]`,\n *
specifying how much to pad along each dimension of the tensor.\n * @param constantValue The pad value to use.
Defaults to 0.\n *\n * @doc {heading: 'Tensors', subheading: 'Transformations'}\n *\n\nfunction pad_<T extends
Tensor>(\n x: T|TensorLike, padding: Array<[number, number]>, constantValue = 0): T {\n const $x =
convertToTensor(x, 'x', 'pad');\n if ($x.rank === 0) {\n throw new Error('pad(scalar) is not defined. Pass non-
scalar to pad');\n }\n\n const attrs: PadV2Attrs = {padding, constantValue};\n const inputs: PadV2Inputs = {x:
$x};\n return ENGINE.runKernel(\n PadV2, inputs as unknown as NamedTensorMap,\n attrs as unknown as NamedAttrMap);\n }\n\n\nexport const pad = op({pad_});\n", "/*\n * @license\n * Copyright
2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n *
you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\\n
*\n\nimport {Tensor1D} from '../tensor';\nimport {TensorLike} from '../types';\nimport {assert} from '../util';\nimport
{op} from './operation';\nimport {pad} from './pad';\n\n/**\n * Pads a `tf.Tensor1D`
with a given value and padding. See `pad` for details.\n *\n\nfunction pad1d_(\n x: Tensor1D|TensorLike,
padding: [number, number],\n constantValue = 0): Tensor1D {\n assert(\n padding.length === 2,\n () =>
'Invalid number of padding. Must be length of 2.);\n return pad(x, [padding], constantValue);\n }\n\n\nexport const
pad1d = op({pad1d_});\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed
under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n *
distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n
* =====\\n
*\n\nimport {Tensor2D} from '../tensor';\nimport {TensorLike} from '../types';\nimport {assert} from '../util';\nimport
{op} from './operation';\nimport {pad} from './pad';\n\n/**\n * Pads a `tf.Tensor2D` with a given value and

```



```

paddings. See `pad` for details.\n *\nfunction pad2d_(\n x: Tensor2D|TensorLike, paddings: [[number, number],\n [number, number]],\n constantValue = 0): Tensor2D {\n assert(\n paddings.length === 2 &&\n paddings[0].length === 2 &&\n paddings[1].length === 2,\n () => 'Invalid number of paddings. Must be\nlength of 2 each.');\n return pad(x, paddings, constantValue);\n}\n\nexport const pad2d = op({pad2d_});\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version\n2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a\n copy of the License\nat\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in\n writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT\n WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific\n language governing permissions and\n * limitations under the License.\n *\n=====\n\n *\nimport {Tensor3D} from '../tensor';\nimport {TensorLike} from '../types';\nimport {assert} from '../util';\nimport\n{op} from '../operation';\nimport {pad} from './pad';\n\n/**\n * Pads a `tf.Tensor3D` with a given value and\n paddings. See `pad` for details.\n *\nfunction pad3d_(\n x: Tensor3D|TensorLike,\n paddings: [[number,\n number], [number, number], [number, number]],\n constantValue = 0): Tensor3D {\n assert(\n paddings.length\n === 3 && paddings[0].length === 2 &&\n paddings[1].length === 2 &&\n paddings[2].length === 2,\n () => 'Invalid number of paddings. Must be length of 2 each.');\n return pad(x,\n paddings, constantValue);\n}\n\nexport const pad3d = op({pad3d_});\n"/**\n * @license\n * Copyright 2020\n Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you\n may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,\n software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES\n OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific\n language governing permissions and\n * limitations under the License.\n *\n=====\n\n *\nimport {Tensor4D} from '../tensor';\nimport {TensorLike} from '../types';\nimport {assert}\nfrom '../util';\nimport {op} from '../operation';\nimport {pad} from './pad';\n\n/**\n * Pads a `tf.Tensor4D` with a\n given value and paddings. See `pad` for details.\n *\nfunction pad4d_(\n x: Tensor4D|TensorLike,\n paddings:\n [\n [number, number], [number, number], [number, number], [number, number]\n],\n constantValue\n = 0): Tensor4D {\n assert(\n paddings.length === 4 && paddings[0].length === 2 &&\n paddings[1].length === 2 && paddings[2].length === 2 &&\n paddings[3].length === 2,\n () => 'Invalid\n number of paddings. Must be length of 2 each.');\n return pad(x, paddings, constantValue);\n}\n\nexport const\n pad4d = op({pad4d_});\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed\n under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the\n License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is\n distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either\n express or implied.\n * See the License for the specific\n language governing permissions and\n * limitations under\n the License.\n *\n=====\n\n *\nimport {ENGINE} from '../engine';\nimport {SpaceToBatchND, SpaceToBatchNDAttrs,\n SpaceToBatchNDInputs} from '../kernel_names';\nimport {NamedAttrMap} from '../kernel_registry';\nimport\n{Tensor} from '../tensor';\nimport {NamedTensorMap} from '../tensor_types';\nimport {convertToTensor} from\n '../tensor_util_env';\nimport {TensorLike} from '../types';\nimport * as util from '../util';\nimport {op} from\n '../operation';\n\n/**\n * This operation divides "spatial" dimensions `[1, ..., M]` of the input into\n * a grid of\n blocks of shape `blockShape`, and interleaves

```

these blocks with the "batch" dimension (0) such that in the output, the spatial dimensions [1, ..., M] correspond to the position within the grid, and the batch dimension combines both the position within a spatial block and the original batch position. Prior to division into blocks, the spatial dimensions of the input are optionally zero padded according to `paddings`. See below for a precise description.

```

const x = tf.tensor4d([1, 2, 3, 4], [1, 2, 2, 1]);
const blockSize = [2, 2];
const paddings = [[0, 0], [0, 0]];
x.spaceToBatchND(blockShape, paddings).print();

```

N-D with `x.shape` = [batch] + spatialShape + remainingShape, where spatialShape has M dimensions. @param blockShape A 1-D array. Must have shape [M], all values must be >= 1. @param paddings A 2-D array. Must have shape [M, 2], all values must be >= 0. `paddings[i] = [padStart, padEnd]` specifies

the amount to zero-pad from input dimension i + 1, which corresponds to spatial dimension i. It is required that (inputShape[i + 1] + padStart + padEnd) % blockShape[i] === 0. This operation is equivalent to the following steps:

1. Zero-pad the start and end of dimensions [1, ..., M] of the input according to `paddings` to produce `padded` of shape paddedShape.
2. Reshape `padded` to `reshapedPadded` of shape: [batch] + [paddedShape[1] / blockShape[0], blockShape[0], ..., paddedShape[M] / blockShape[M-1], blockShape[M-1]] + remainingShape.
3. Permute dimensions of `reshapedPadded` to produce `permutedReshapedPadded` of shape: blockShape + [batch] + [paddedShape[1] / blockShape[0], ..., paddedShape[M] / blockShape[M-1]] + remainingShape.
4. Reshape `permutedReshapedPadded` to flatten `blockShape` into the batch dimension, producing an output tensor of shape: [batch \* prod(blockShape)] + [paddedShape[1] / blockShape[0], ..., paddedShape[M] / blockShape[M-1]] + remainingShape.

```

@doc {heading: 'Tensors',
subheading: 'Transformations'}
function spaceToBatchND<T extends Tensor>(x: T|TensorLike,
blockShape: number[], paddings: number[][]): T {
 const $x = convertToTensor(x, 'x', 'spaceToBatchND');
 util.assert($x.rank >= 1 + blockShape.length, () => `input rank ${$x.rank} should be > than [blockShape]
[${blockShape.length}]`);
 util.assert(paddings.length === blockShape.length, () =>
`paddings.shape[0] ${paddings.length} must be equal to [blockShape] ${blockShape.length}`);
 util.assert($x.shape.reduce((a, b, i) => {if (i > 0 && i <= blockShape.length) {
return a && ((b + paddings[i - 1][0] + paddings[i - 1][1]) % blockShape[i - 1] === 0);
}}, true), () => `input spatial dimensions ${$x.shape.slice(1)} with paddings ${paddings.toString()} must be divisible by blockShapes ${blockShape.toString()}`);
 const inputs: SpaceToBatchNDInputs = {x: $x};
 const attrs: SpaceToBatchNDAttrs = {blockShape, paddings};
 return ENGINE.runKernel(spaceToBatchND, inputs as {} as NamedTensorMap, attrs as {} as NamedAttrMap);
}
export const spaceToBatchND = op({spaceToBatchND});

```

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ANY KIND, either express or implied. See the License for the specific language governing permissions and limitations under the License.

```

=====
import {Tensor3D, Tensor4D} from '../tensor';
import {convertToTensor} from '../tensor_util_env';
import {TensorLike} from '../types';
import * as util from '../util';
import {avgPool} from './avg_pool';
import {batchToSpaceND} from './batch_to_space_nd';
import * as conv_util from './conv_util';
import {maxPool} from './max_pool';
import {op} from './operation';
import {reshape} from './reshape';
import {spaceToBatchND} from './space_to_batch_nd';

```

Performs an N-D pooling operation. @param input The input tensor, of rank 4 or rank 3 of shape [batch, height, width, inChannels]. If rank 3, batch of 1 is assumed. @param windowShape The filter size: [filterHeight, filterWidth]. If filterSize is a single number,

then `filterHeight == filterWidth`.\n * @param poolingType` The type of pooling, either 'max' or 'avg'.  
`pad` The type of padding algorithm:  
 - `'same'` and `stride 1`: output will be of same size as input,  
 regardless of filter size.  
 - `'valid'`: output will be smaller than input if filter is larger  
 than `1x1`.  
 For more info, see this guide:  
[https://www.tensorflow.org/api\\_guides/python/nn#Convolution](https://www.tensorflow.org/api_guides/python/nn#Convolution)  
`@param dilations` The dilation rates:  
`[dilationHeight, dilationWidth]` in which we sample input values across the height and width dimensions  
 in dilated pooling. Defaults to `[1, 1]`. If `dilationRate` is a single  
 number, then `dilationHeight == dilationWidth``. If it is greater than  
 1, then all values of `'strides'` must be 1.  
`@param strides` The strides of the pooling: `[strideHeight, strideWidth]`. If  
`'strides'` is a single number, then `strideHeight == strideWidth``.  
`@doc {heading: 'Operations', subheading: 'Convolution'}`  
`function pool_<T extends Tensor3D|Tensor4D>(\n input: T|TensorLike, windowShape: [number, number],\n poolingType: 'avg'|'max', pad: 'valid'|'same'|number,\n dilations?: [number, number]|number, strides?: [number, number]|number) {\n if (dilations == null) {\n dilations = [1, 1];\n }\n if (strides == null) {\n strides = 1;\n }\n if (pad === 0) {\n pad = 'valid';\n }\n\n const $x = convertToTensor(input, 'x', 'maxPool');\n let x4D = $x as Tensor4D;\n let reshapedTo4D = false;\n\n if ($x.rank === 3) {\n reshapedTo4D = true;\n x4D = reshape($x, [1, $x.shape[0], $x.shape[1], $x.shape[2]]);\n }\n\n util.assert(\n conv_util.eitherStridesOrDilationsAreOne(strides, dilations),\n () => 'Error in pool: Either strides or dilations must be 1.' +\n `Got strides ${strides} and dilations ${dilations}`);\n\n const convInfo = conv_util.computePool2DInfo(\n x4D.shape, windowShape, strides, dilations, pad);\n const dilation: [number, number] = [\n convInfo.dilationHeight, convInfo.dilationWidth];\n\n // The following implementation does batchToSpace(pool(spaceToBatch(x)))\n // whenever dilation > 1 since the TF kernels do not support dilation > 1.\n // tslint:disable-next-line:max-line-length\n\n https://github.com/tensorflow/tensorflow/blob/50f6bb67dc98c9b74630b6047aae7a4f8a40fd02/tensorflow/python/ops/nn\_ops.py#L1037\n\n let basePadding: number[][];\n if (pad === 'same') {\n basePadding = withSpaceToBatchBasePaddings(\n [convInfo.filterHeight, convInfo.filterWidth], dilation);\n } else {\n basePadding = [[0, 0], [0, 0]];\n }\n\n const isDilationOne = dilation[0] === 1 && dilation[1] === 1;\n const [adjustedPadding, adjustedCrops] = requiredSpaceToBatchPaddings(\n [convInfo.inHeight, convInfo.inWidth], dilation, basePadding);\n const convertedPad = isDilationOne ? pad : 'valid';\n const convertedX =\n isDilationOne ? x4D : spaceToBatchND(x4D, dilation, adjustedPadding);\n\n const forwardOp = poolingType === 'avg' ?\n () => avgPool(convertedX, windowShape, strides, convertedPad) : \n () => maxPool(convertedX, windowShape, strides, convertedPad);\n const y = forwardOp();\n\n const res = isDilationOne ? y : batchToSpaceND(y, dilation, adjustedCrops);\n\n if (reshapedTo4D) {\n return reshape(res, [res.shape[1], res.shape[2], res.shape[3]]) as T;\n }\n\n return res as T;\n}\n\n// Helper function to compute crops and paddings for pool with dilation > 1.\n// tslint:disable-next-line:max-line-length\n\n https://github.com/tensorflow/tensorflow/blob/50f6bb67dc98c9b74630b6047aae7a4f8a40fd02/tensorflow/python/ops/array\_ops.py#L2184\n\n function requiredSpaceToBatchPaddings(\n inputShape: [number, number], blockShape: [number, number],\n basePadding: number[][]) {\n const padStart = basePadding.map(b => b[0]);\n const origPadEnd = basePadding.map(b => b[1]);\n const fullInputShape = inputShape.concat(padStart, origPadEnd);\n const padEndExtra = blockShape.map((b, i) => (b - fullInputShape[i] % b) % b);\n const padEnd = origPadEnd.map((s, i) => s + padEndExtra[i]);\n const paddings = blockShape.map((_, i) => [padStart[i], padEnd[i]]);\n const crops = blockShape.map((_, i) => [0, padEndExtra[i]]);\n return [paddings, crops];\n}\n\n// Helper function to compute base paddings for pool with dilation > 1.\n// tslint:disable-next-line:max-line-length\n\n https://github.com/tensorflow/tensorflow/blob/50f6bb67dc98c9b74630b6047aae7a4f8a40fd02/tensorflow/python/ops/nn\_ops.py#L524\n\n function withSpaceToBatchBasePaddings(\n filterShape: [number, number], dilation: [number, number]) {\n // Spatial dimensions of the filters and the upsampled filters in which we\n // introduce (rate - 1) zeros between consecutive filter values.\n const dilatedFilterShape = filterShape.map((s, i) => {\n return s +`

```
(s - 1)
* (dilation[i] - 1);\n });\n const padExtraShape = dilatedFilterShape.map(s => s - 1);\n // When padding is odd,
we pad more at end, following the same\n // convention as conv2d.\n const padExtraStart = padExtraShape.map(s
=> Math.floor(s / 2));\n const padExtraEnd = padExtraShape.map((s, i) => s - padExtraStart[i]);\n return
padExtraShape.map((_, i) => {\n return [padExtraStart[i], padExtraEnd[i]];\n });\n }\n }\n\nexport const pool =
op({pool_});\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See
the License for the specific language governing permissions and\n * limitations under the License.\n *
=====
*\nimport {ENGINE} from '../engine';\nimport {Pow, PowInputs} from '../kernel_names';\nimport {Tensor} from
../tensor';\nimport {NamedTensorMap} from '../tensor_types';\nimport {makeTypesMatch} from
../tensor_util';\nimport {convertToTensor} from '../tensor_util_env';\nimport {TensorLike} from '../types';\nimport
{op} from '../operation';\n\n/**\n * Computes the power of one `tf.Tensor` to another. Supports broadcasting.\n *
Given a `tf.Tensor` x and a `tf.Tensor` y, this operation computes x^y for\n * corresponding elements in x and y.
The result's dtype will be the upcasted\n * type of the `base` and `exp` dtypes.\n *\n * `js`\n * const a =
tf.tensor([[2, 3], [4, 5]])\n * const b = tf.tensor([[1, 2], [3, 0]]).toInt();\n *\n * a.pow(b).print(); // or tf.pow(a, b)\n *
`js`\n * const
a = tf.tensor([[1, 2], [3, 4]])\n * const b = tf.tensor(2).toInt();\n *\n * a.pow(b).print(); // or tf.pow(a, b)\n *
We also expose `powStrict` which has the same signature as this op and\n * asserts that `base` and `exp` are the
same shape (does not broadcast).\n *\n * @param base The base `tf.Tensor` to pow element-wise.\n * @param exp
The exponent `tf.Tensor` to pow element-wise.\n *\n * @doc {heading: 'Operations', subheading: 'Arithmetic'}\n
*\nfunction pow_<T extends Tensor>(\n base: Tensor|TensorLike, exp: Tensor|TensorLike): T {\n let $base =
convertToTensor(base, 'base', 'pow');\n let $exp = convertToTensor(exp, 'exp', 'pow');\n [$base, $exp] =
makeTypesMatch($base, $exp);\n\n const inputs: PowInputs = {a: $base, b: $exp};\n\n return
ENGINE.runKernel(Pow, inputs as {} as NamedTensorMap);\n }\n\nexport const pow = op({pow_});\n", "/*\n *
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2.0 (the \"License\");\n
* you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n
*\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in
writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT
WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific
language governing permissions and\n * limitations under the License.\n *
=====
*\nimport {ENGINE} from '../engine';\nimport {Prelu, PreluInputs} from '../kernel_names';\nimport {Tensor}
from '../tensor';\nimport {NamedTensorMap} from '../tensor_types';\nimport {convertToTensor} from
../tensor_util_env';\nimport {TensorLike} from '../types';\nimport {op} from '../operation';\n\n/**\n * Computes
leaky rectified linear element-wise with parametric alphas.\n *\n * $x < 0 ? \alpha * x :$ \n *
 $f(x) = x$ \n *\n * `js`\n * const x = tf.tensor1d([-1, 2, -3, 4]);\n *\n * const alpha = tf.scalar(0.1);\n *\n *
x.prelu(alpha).print(); // or tf.prelu(x, alpha)\n *\n * @param x The input tensor.\n * @param alpha Scaling
factor for negative values.\n *\n * @doc {heading: 'Operations', subheading: 'Basic math'}\n
*\nfunction prelu_<T extends Tensor>(x: T|TensorLike, alpha: T|TensorLike): T {\n const $x = convertToTensor(x, 'x', 'prelu');\n const
$alpha = convertToTensor(alpha, 'alpha', 'prelu');\n\n const inputs: PreluInputs = {x: $x, alpha: $alpha};\n return
ENGINE.runKernel(Prelu, inputs as {} as NamedTensorMap);\n }\n\nexport const prelu = op({prelu_});\n", "/*\n *
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```

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```
=====
* \n\nimport {ENGINE} from '../engine';\nimport {Prod, ProdAttrs, ProdInputs} from '../kernel_names';\nimport {NamedAttrMap} from '../kernel_registry';\nimport {Tensor} from '../tensor';\nimport {NamedTensorMap} from '../tensor_types';\nimport {convertToTensor} from '../tensor_util_env';\nimport {TensorLike} from '../types';\n\nimport {cast} from './cast';\nimport {op} from './operation';\n\n/**\n * Computes the product of elements across dimensions of a `tf.Tensor`.\n *\n * Reduces the input along the dimensions given in `axes`. Unless `keepDims` is true, the rank of the `tf.Tensor` is reduced by 1 for each entry in `axes`. If `keepDims` is true, the reduced dimensions are retained with length 1. If `axes` has no entries, all dimensions are reduced, and a `tf.Tensor` with a single element is returned.\n *\n * ```js\n * const x = tf.tensor1d([1, 2, 3]);\n * x.prod().print(); // or tf.prod(x)\n *\n * const x = tf.tensor2d([1, 2, 3, 4], [2, 2]);\n * const axis = 1;\n * x.prod(axis).print(); // or tf.prod(x, axis)\n *\n * @param x The input tensor to compute the product over. If the dtype is `bool` it will be converted to `int32` and the output dtype will be `int32`.\n * @param axis The dimension(s) to reduce. By default it reduces all dimensions.\n * @param keepDims If true, retains reduced dimensions with size 1.\n * @doc {heading: 'Operations', subheading: 'Reduction'}\n */\nfunction prod<T extends Tensor>(\n x: Tensor|TensorLike, axis: number|number[] = null, keepDims = false): T {\n let $x = convertToTensor(x, 'x', 'prod');\n\n if ($x.dtype === 'bool') {\n // bool is not an allowed type for the underlying kernel.\n $x = cast($x, 'int32');\n }\n\n const inputs: ProdInputs = {x: $x};\n const attrs: ProdAttrs = {axis, keepDims};\n\n return ENGINE.runKernel(\n Prod, inputs as { } as NamedTensorMap, attrs as { } as NamedAttrMap);\n}\n\nexport const prod = op({prod_});\n\n/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n=====
```

```
* \n\nimport {ENGINE} from '../engine';\nimport {Tensor} from '../tensor';\nimport {DataType, Rank, ShapeMap} from '../types';\nimport {sizeFromShape} from '../util';\n\nimport {op} from './operation';\n\n/**\n * Creates a `tf.Tensor` with values sampled from a random number generator\n * function defined by the user.\n *\n * @param shape An array of integers defining the output tensor shape.\n * @param randFunction A random number generator function which is called\n * for each element in the output tensor.\n * @param dtype The data type of the output tensor. Defaults to 'float32'.\n */\nfunction rand<R extends Rank>(\n shape: ShapeMap[R], randFunction: () => number,\n dtype?: DataType): Tensor<R> {\n const size = sizeFromShape(shape);\n let values = null;\n if (dtype == null || dtype === 'float32') {\n values = new Float32Array(size);\n } else if (dtype === 'int32') {\n values = new Int32Array(size);\n } else if (dtype === 'bool') {\n values = new Uint8Array(size);\n } else {\n throw new Error(`Unknown data type ${dtype}`);\n }\n for (let i = 0; i < size; i++) {\n values[i] = randFunction();\n }\n return ENGINE.makeTensor(values, shape, dtype) as Tensor<R>;\n}\n\nexport const rand = op({rand_});\n\n/**\n * A port of an algorithm by Johannes Baagøe <baagoe@baagoe.com>, 2010\n * http://baagoe.com/en/RandomMusings/javascript/\n * https://github.com/nquinlan/better-random-numbers-for-javascript-mirror\n * Original work is under MIT license -\n * Copyright (C) 2010 by Johannes Baagøe <baagoe@baagoe.org>\n * Permission is hereby granted, free of charge, to any person obtaining a copy\n * of this
```

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```
(function(global, module, define)
{
function Alea(seed) {
 var me = this, mash = Mash();
 me.next = function() {
 var t = 2091639 * me.s0 + me.c * 2.3283064365386963e-10; // 2^32
 me.s0 = me.s1; me.s1 = me.s2;
 return me.s2 = t - (me.c = t | 0);
 };
 // Apply the seeding algorithm from Baagoe
 me.c = 1; me.s0 = mash(' ');
 me.s1 = mash(' '); me.s2 = mash(' ');
 me.s0 -= mash(seed); if (me.s0 < 0) { me.s0 += 1; }
 me.s1 -= mash(seed); if (me.s1 < 0) { me.s1 += 1; }
 me.s2 -= mash(seed); if (me.s2 < 0) { me.s2 += 1; }
 mash = null;
}

function copy(f, t) {
 t.c = f.c; t.s0 = f.s0; t.s1 = f.s1; t.s2 = f.s2;
 return t;
}

function impl(seed, opts) {
 var xg = new Alea(seed), state = opts && opts.state, prng = xg.next;
 prng.int32 = function() { return (xg.next() * 0x100000000) | 0; };
 prng.double = function() {
 return prng() + (prng() * 0x200000 | 0) * 1.1102230246251565e-16; // 2^-53
 };
 prng.quick = prng;
 if (state) {
 if (typeof(state) === 'object') copy(state, xg);
 prng.state = function() { return copy(xg, {}); };
 }
 return prng;
}

function Mash() {
 var n = 0xefc8249d;
 var mash = function(data) {
 data = data.toString();
 for (var i = 0; i < data.length; i++) {
 n += data.charCodeAt(i);
 var h = 0.02519603282416938 * n;
 n = h >>> 0; h -= n; h *= n; n = h >>> 0; h -= n; n += h * 0x100000000; // 2^32
 }
 return (n >>> 0) * 2.3283064365386963e-10; // 2^-32
 };
 return mash;
}

if (module && module.exports) {
 module.exports = impl;
} else if (define && define.amd) {
 define(function() { return impl; });
} else {
 this.alea = impl;
}

}(this, (typeof module === 'object' && module, // present in node.js
(typeof define) === 'function' && define, // present with an AMD
loader))));

// A Javascript implementation of the "xor128" prng algorithm by George Marsaglia. See
http://www.jstatsoft.org/v08/i14/paper

(function(global, module, define) {
function XorGen(seed) {
 var me = this, strseed = "";
 me.x = 0; me.y = 0; me.z = 0; me.w = 0;

 // Set up generator function
 me.next = function() {
 var t = me.x ^ (me.x << 11);
 me.x = me.y; me.y = me.z; me.z = me.w;
 return me.w ^= (me.w >>> 19) ^ t ^ (t >>> 8);
 };

 if (seed === (seed | 0)) {
 // Integer seed
 me.x = seed;
 } else {
 // String seed
 strseed += seed;
 }

 // Mix in string seed, then discard an initial batch of 64 values
 for (var k = 0; k < strseed.length + 64; k++) {
 me.x ^= strseed.charCodeAt(k) | 0;
 me.next();
 }
}

function copy(f, t) {
 t.x = f.x; t.y = f.y; t.z = f.z; t.w = f.w;
 return t;
}

function impl(seed, opts) {
 var xg = new XorGen(seed), state = opts && opts.state, prng = function() {
 return (xg.next() >>> 0) / 0x100000000;
 };
 prng.double = function() {
 do {
 var top = xg.next() >>> 11, bot = (xg.next() >>> 0) / 0x100000000, result = (top + bot) / (1 << 21);
 } while (result === 0);
 return result;
 };
 prng.int32 = xg.next;
 prng.quick = prng;
 if (state) {
 if (typeof(state) === 'object') copy(state, xg);
 prng.state = function() { return copy(xg, {}); };
 }
 return prng;
}

if (module && module.exports) {
 module.exports = impl;
} else if (define && define.amd) {
 define(function() { return impl; });
} else {
 this.xor128 = impl;
}

}(this, (typeof module === 'object' && module, // present in node.js
(typeof define) === 'function' && define, // present with an AMD
loader))));

// A Javascript implementation of the "xorwow" prng algorithm by George Marsaglia. See
http://www.jstatsoft.org/v08/i14/paper

(function(global, module, define) {
function XorGen(seed) {
 var me = this, strseed = "";
 me.x = 0; me.y = 0; me.z = 0; me.w = 0;

 // Set up generator function
 me.next = function() {
 var t = me.x ^ (me.x << 11);
 me.x = me.y; me.y = me.z; me.z = me.w;
 return me.w ^= (me.w >>> 19) ^ t ^ (t >>> 8);
 };

 if (seed === (seed | 0)) {
 // Integer seed
 me.x = seed;
 } else {
 // String seed
 strseed += seed;
 }

 // Mix in string seed, then discard an initial batch of 64 values
 for (var k = 0; k < strseed.length + 64; k++) {
 me.x ^= strseed.charCodeAt(k) | 0;
 me.next();
 }
}

function copy(f, t) {
 t.x = f.x; t.y = f.y; t.z = f.z; t.w = f.w;
 return t;
}

function impl(seed, opts) {
 var xg = new XorGen(seed), state = opts && opts.state, prng = function() {
 return (xg.next() >>> 0) / 0x100000000;
 };
 prng.double = function() {
 do {
 var top = xg.next() >>> 11, bot = (xg.next() >>> 0) / 0x100000000, result = (top + bot) / (1 << 21);
 } while (result === 0);
 return result;
 };
 prng.int32 = xg.next;
 prng.quick = prng;
 if (state) {
 if (typeof(state) === 'object') copy(state, xg);
 prng.state = function() { return copy(xg, {}); };
 }
 return prng;
}

if (module && module.exports) {
 module.exports = impl;
} else if (define && define.amd) {
 define(function() { return impl; });
} else {
 this.xorwow = impl;
}

}(this, (typeof module === 'object' && module, // present in node.js
(typeof define) === 'function' && define, // present with an AMD
loader))));
```

```

= this, strseed = "";
// Set up generator function.
me.next = function() {
 var t = (me.x ^ (me.x >>> 2));
 me.x = me.y; me.y = me.z; me.z = me.w; me.w = me.v;
 return (me.d = (me.d + 362437 | 0)) + (me.v =
 (me.v
 ^ (me.v << 4) ^ (t ^ (t << 1))) | 0);
 me.x = 0; me.y = 0; me.z = 0; me.w = 0; me.v = 0;
 if (seed === (seed | 0)) {
 // Integer seed.
 me.x = seed;
 } else {
 // String seed.
 strseed += seed;
 }
 // Mix in string seed, then discard an initial batch of 64 values.
 for (var k = 0; k < strseed.length + 64; k++) {
 me.x ^= strseed.charCodeAt(k | 0);
 if (k === strseed.length) {
 me.d = me.x << 10 ^ me.x >>> 4;
 }
 me.next();
 }
}
function copy(f, t) {
 t.x = f.x; t.y = f.y; t.z = f.z; t.w = f.w; t.v = f.v; t.d = f.d;
 return t;
}
function impl(seed, opts) {
 var xg = new XorGen(seed);
 state = opts && opts.state;
 prng = function() {
 return (xg.next() >>> 0) / 0x100000000;
 };
 prng.double = function() {
 do {
 var top = xg.next() >>> 11,
 bot = (xg.next() >>> 0) / 0x100000000,
 result = (top + bot) / (1 << 21);
 } while (result === 0);
 return result;
 };
 prng.int32 = xg.next;
 prng.quick = prng;
 if (state) {
 if (typeof(state) === 'object')
 copy(state, xg);
 prng.state = function() {
 return copy(xg, {});
 };
 }
 return prng;
}
if (module && module.exports) {
 module.exports = impl;
} else if (define && define.amd) {
 define(function() {
 return impl;
 });
} else {
 this.xorwow = impl;
}
})(this, (typeof module) === 'object' && module, // present in node.js
(typeof define) === 'function' && define // present with an AMD loader
);
// A Javascript implementaion of the "xorshift7" algorithm by
// François Panneton and Pierre L'ecuyer.
// "On the Xorshift Random Number Generators"
// http://saluc.engr.uconn.edu/refs/crypto/rng/panneton05onthexorshift.pdf
(function(global, module, define) {
 function XorGen(seed) {
 var me = this;
 // Set up generator function.
 me.next = function() {
 // Update xor generator.
 var X = me.x, i = me.i, t,
 v, w;
 t = X[i]; t ^= (t >>> 7); v = t ^ (t << 24); t = X[(i + 1) & 7]; v ^= t ^ (t >>> 10); t = X[(i + 3) & 7]; v ^= t ^ (t >>> 3); t = X[(i + 4) & 7]; v ^= t ^ (t << 7); t = X[(i + 7) & 7]; t = t ^ (t << 13); v ^= t ^ (t << 9); t = X[i] = v; me.i = (i + 1) & 7; return v;
 };
 function init(me, seed) {
 var j, w, X = [];
 if (seed === (seed | 0)) {
 // Seed state array using a 32-bit integer.
 w = X[0] = seed;
 } else {
 // Seed state using a string.
 seed = "" + seed;
 for (j = 0; j < seed.length; ++j) {
 X[j & 7] = (X[j & 7] << 15) ^ (seed.charCodeAt(j) + X[(j + 1) & 7] << 13);
 }
 // Enforce an array length of 8, not all zeroes.
 while (X.length < 8) X.push(0);
 for (j = 0; j < 8 && X[j] === 0; ++j);
 if (j === 8) w = X[7] = -1; else w = X[j];
 }
 me.x = X; me.i = 0;
 // Discard an initial 256 values.
 for (j = 256; j > 0; --j) {
 me.next();
 }
 }
 init(me, seed);
 }
 function copy(f, t) {
 t.x = f.x.slice(); t.i = f.i;
 return t;
 }
 function impl(seed, opts) {
 if (seed == null) seed = +(new Date);
 var xg = new XorGen(seed);
 state = opts && opts.state;
 prng = function() {
 return (xg.next() >>> 0) / 0x100000000;
 };
 prng.double = function() {
 do {
 var top = xg.next() >>> 11,
 bot = (xg.next() >>> 0) / 0x100000000,
 result = (top + bot) / (1 << 21);
 } while (result === 0);
 return result;
 };
 prng.int32 = xg.next;
 prng.quick = prng;
 if (state) {
 if (state.x) copy(state, xg);
 prng.state = function() {
 return copy(xg, {});
 };
 }
 return prng;
 }
 if (module && module.exports) {
 module.exports = impl;
 } else if (define && define.amd) {
 define(function() {
 return impl;
 });
 } else {
 this.xorshift7 = impl;
 }
})(this, (typeof module) === 'object' && module, // present in node.js
(typeof define) === 'function' && define // present with an AMD loader
);
// A Javascript implementaion of Richard Brent's Xorgens xor4096 algorithm.
// This fast non-cryptographic random number generator is designed for use in Monte-Carlo algorithms. It combines a long-period xorshift generator with a Weyl generator, and it passes all common batteries of stasticial tests for randomness while consuming only a few nanoseconds for each prng generated. For background on the generator, see Brent's paper: "Some long-period random number generators using shifts and xors."
// http://arxiv.org/pdf/1004.3115v1.pdf
// Usage:
var xor4096 = require('xor4096');
// random = xor4096(1); // Seed with int32 or string.
assert.equal(random(), 0.1520436450538547); // (0, 1) range, 53 bits.
assert.equal(random.int32(), 1806534897); // signed int32, 32 bits.
// For nonzero numeric keys, this impelementation provides a

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sequence\n// identical to that by Brent's xorgens 3 implementaion in C. This\n// implementation also provides for
initializing the generator with\n// string seeds, or for saving and restoring the state of the generator.\n/>\n// On
Chrome, this prng benchmarks about 2.1 times slower than\n// Javascript's built-in
Math.random().\n\n(function(global, module, define) {\n\nfunction XorGen(seed) {\n var me = this;\n\n // Set up
generator function.\n me.next = function() {\n var w = me.w,\n X = me.X, i = me.i, t, v;\n // Update Weyl
generator.\n me.w = w = (w + 0x61c88647) | 0;\n // Update xor generator.\n v = X[(i + 34) & 127];\n t = X[i
= ((i + 1) & 127)];\n v ^= v << 13;\n t ^= t << 17;\n v ^= v >>> 15;\n t ^= t >>> 12;\n // Update Xor
generator array state.\n v = X[i] = v ^ t;\n me.i = i;\n // Result is the combination.\n return (v + (w ^ (w >>>
16))) | 0;\n };\n\n function init(me, seed) {\n var t, v, i, j, w, X = [], limit = 128;\n
 if (seed === (seed | 0)) {\n // Numeric seeds initialize v, which is used to generates X.\n v = seed;\n seed
= null;\n } else {\n // String seeds are mixed into v and X one character at a time.\n seed = seed + '\0';\n
v = 0;\n limit = Math.max(limit, seed.length);\n }\n // Initialize circular array and weyl value.\n for (i = 0, j
= -32; j < limit; ++j) {\n // Put the unicode characters into the array, and shuffle them.\n if (seed) v ^=
seed.charCodeAtAt((j + 32) % seed.length);\n // After 32 shuffles, take v as the starting w value.\n if (j === 0) w
= v;\n v ^= v << 10;\n v ^= v >>> 15;\n v ^= v << 4;\n v ^= v >>> 13;\n if (j >= 0) {\n w = (w +
0x61c88647) | 0; // Weyl.\n t = (X[j & 127] ^ (v + w)); // Combine xor and weyl to init array.\n i = (0
== t) ? i + 1 : 0; // Count zeroes.\n }\n }\n // We have detected all zeroes; make the key nonzero.\n
 if (i >= 128) {\n X[(seed && seed.length || 0) & 127] = -1;\n }\n // Run the generator 512 times to further
mix the state before using it.\n // Factoring this as a function slows the main generator, so it is just\n // unrolled
here. The weyl generator is not advanced while warming up.\n i = 127;\n for (j = 4 * 128; j > 0; --j) {\n v =
X[(i + 34) & 127];\n t = X[i = ((i + 1) & 127)];\n v ^= v << 13;\n t ^= t << 17;\n v ^= v >>> 15;\n t
^= t >>> 12;\n X[i] = v ^ t;\n }\n // Storing state as object members is faster than using closure variables.\n
me.w = w;\n me.X = X;\n me.i = i;\n }\n\n init(me, seed);\n}\n\nfunction copy(f, t) {\n t.i = f.i;\n t.w = f.w;\n
t.X = f.X.slice();\n return t;\n};\n\nfunction impl(seed, opts) {\n if (seed == null) seed = +(new Date);\n var xg =
new XorGen(seed),\n state = opts && opts.state,\n prng = function() { return (xg.next() >>> 0) /
0x100000000; };\n\n prng.double
= function() {\n do {\n var top = xg.next() >>> 11,\n bot = (xg.next() >>> 0) / 0x100000000,\n
result = (top + bot) / (1 << 21);\n } while (result === 0);\n return result;\n };\n\n prng.int32 = xg.next;\n
prng.quick = prng;\n if (state) {\n if (state.X) copy(state, xg);\n prng.state = function() { return copy(xg, {}); }\n
 }\n return prng;\n}\n\nif (module && module.exports) {\n module.exports = impl;\n} else if (define &&
define.amd) {\n define(function() { return impl; });\n} else {\n this.xor4096 = impl;\n}\n\n})\n\n// window object or global\n
(typeof module) == 'object' && module, // present in node.js\n (typeof
define) == 'function' && define // present with an AMD loader\n\n", "A Javascript implementaion of the
'Tyche-i' prng algorithm by\n// Samuel Neves and Filipe Araujo.\n// See https://eden.dei.uc.pt/~sneves/pubs/2011-snfa2.pdf\n\n(function(global, module, define) {\n\nfunction
XorGen(seed) {\n var me = this, strseed = ";\n\n // Set up generator function.\n me.next = function() {\n var b =
me.b, c = me.c, d = me.d, a = me.a;\n b = (b << 25) ^ (b >>> 7) ^ c;\n c = (c - d) | 0;\n d = (d << 24) ^ (d >>>
8) ^ a;\n a = (a - b) | 0;\n me.b = b = (b << 20) ^ (b >>> 12) ^ c;\n me.c = c = (c - d) | 0;\n me.d = (d << 16) ^
(c >>> 16) ^ a;\n return me.a = (a - b) | 0;\n };\n\n /* The following is non-inverted tyche, which has better
internal\n * bit diffusion, but which is about 25% slower than tyche-i in JS.\n me.next = function() {\n var a =
me.a, b = me.b, c = me.c, d = me.d;\n a = (me.a + me.b | 0) >>> 0;\n d = me.d ^ a; d = d << 16 ^ d >>> 16;\n c
= me.c + d | 0;\n b = me.b ^ c; b = b << 12 ^ d >>> 20;\n me.a = a = a + b | 0;\n d = d ^ a; me.d = d = d << 8 ^
d >>> 24;\n me.c = c = c + d | 0;\n b = b ^ c;\n return me.b = (b << 7 ^ b >>> 25);\n }\n\n *\n\n me.a = 0;\n me.b = 0;\n me.c = 2654435769
| 0;\n me.d = 1367130551;\n\n if (seed === Math.floor(seed)) {\n // Integer seed.\n me.a = (seed /
0x100000000) | 0;\n me.b = seed | 0;\n } else {\n // String seed.\n strseed += seed;\n }\n\n // Mix in string
seed, then discard an initial batch of 64 values.\n for (var k = 0; k < strseed.length + 20; k++) {\n me.b ^=
strseed.charCodeAtAt(k) | 0;\n me.next();\n }\n}\n\nfunction copy(f, t) {\n t.a = f.a;\n t.b = f.b;\n t.c = f.c;\n t.d =

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f.d;\n return t;\n};\n\nfunction impl(seed, opts) {\n var xg = new XorGen(seed);\n state = opts && opts.state;\n prng = function() { return (xg.next() >>> 0) / 0x100000000; };\n prng.double = function() {\n do {\n var top\n = xg.next() >>> 11;\n bot = (xg.next() >>> 0) / 0x100000000;\n result = (top + bot) / (1 << 21);\n } while (result === 0);\n return result;\n };\n prng.int32 = xg.next;\n prng.quick = prng;\n if (state) {\n if (typeof(state) === 'object') copy(state, xg);\n prng.state = function() { return copy(xg, {}); }\n }\n return prng;\n}\n\nif (module && module.exports) {\n module.exports = impl;\n} else if (define && define.amd) {\n define(function() { return impl; });\n} else {\n this.tychei = impl;\n}\n\n})(\n this,\n (typeof module) === 'object' && module, // present in node.js\n (typeof define) === 'function' && define // present with an AMD loader\n);\n\n"/*\nCopyright 2014 David Bau.\n\nPermission is hereby granted, free of charge, to any person obtaining\na copy of this software and associated documentation files (the\n"Software"), to deal in the Software without restriction, including\nwithout limitation the rights to use, copy, modify, merge, publish,\ndistribute, sublicense, and/or sell copies of the Software, and to\npermit persons to whom the Software is furnished to do so, subject to\nthe following conditions:\n\nThe above copyright notice and this permission notice shall be\nincluded in all copies or substantial portions of the Software.\n\nTHE SOFTWARE IS PROVIDED "AS IS", WITHOUT WARRANTY OF ANY KIND,\nEXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE WARRANTIES\nOF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE AND NONINFRINGEMENT.\n\nIN NO EVENT SHALL THE AUTHORS OR COPYRIGHT HOLDERS BE LIABLE FOR ANY\nCLAIM, DAMAGES OR OTHER LIABILITY, WHETHER IN AN ACTION OF CONTRACT,\nTORT OR OTHERWISE, ARISING FROM, OUT OF OR IN CONNECTION WITH THE\nSOFTWARE OR THE USE OR OTHER DEALINGS IN THE SOFTWARE.\n\n*/\n\n(function (pool, math) {\n // The following constants are related to IEEE 754 limits.\n var global = this;\n width = 256, // each RC4 output is 0 <= x < 256\n chunks = 6, // at least six RC4 outputs for each double\n digits = 52, // there are 52 significant digits in a double\n rngname = 'random', // rngname: name for Math.random and Math.seedrandom\n startdenom = math.pow(width, chunks),\n significance = math.pow(2, digits),\n overflow = significance * 2,\n mask = width - 1,\n nodecrypto; // node.js crypto module, initialized at the bottom.\n\n // seedrandom()\n // This is the seedrandom function described above.\n function seedrandom(seed, options, callback) {\n var key = [];\n options = (options == true) ? { entropy: true } : (options || {});\n // Flatten the seed string or build one from local entropy if needed.\n var shortseed = mixkey(flatten(\n options.entropy ? [seed, toString(pool)] : (seed == null) ? autoseed() : seed, 3), key);\n // Use the seed to initialize an ARC4 generator.\n var arc4 = new ARC4(key);\n // This function returns a random double in [0, 1) that contains\n // randomness in every bit of the mantissa of the IEEE 754 value.\n var prng = function() {\n var n = arc4.g(chunks),\n // Start with a numerator n < 2 ^ 48\n d = startdenom, // and denominator d = 2 ^ 48.\n x = 0;\n // and no 'extra last byte'.\n while (n < significance) {\n // Fill up all significant digits by\n n = (n + x) * width;\n // shifting numerator and\n d *= width; // denominator and generating a\n x = arc4.g(1);\n // new least-significant-byte.\n }\n while (n >= overflow) {\n // To avoid rounding up, before adding\n n /= 2; // last byte, shift everything\n d /= 2; // right using integer\n math.until(n >>>= 1; // we have exactly the desired bits.\n }\n return (n + x) / d;\n }\n // Form the number within [0, 1).\n prng.int32 = function() { return arc4.g(4) | 0; }\n prng.quick = function() {\n return arc4.g(4) / 0x100000000;\n }\n prng.double = prng;\n // Mix the randomness into accumulated entropy.\n mixkey(tostring(arc4.S), pool);\n // Calling convention: what to return as a function of prng, seed, is_math.\n return (options.pass || callback ||\n function(prng, seed, is_math_call, state) {\n if (state) {\n // Load the arc4 state from the given state if it has an S array.\n if (state.S) {\n copy(state, arc4);\n // Only provide the .state method if requested via options.\n prng.state = function() { return copy(arc4, {}); }\n }\n // If called as a method of Math (Math.seedrandom()), mutate\n // Math.random because that is how seedrandom.js has worked since v1.0.\n if (is_math_call) {\n math[rngname] = prng;\n return seed;\n }\n // Otherwise, it is a newer calling convention, so return the\n //

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prng directly.\n else return prng;\n })(\n prng,\n shortseed,\n 'global' in options ? options.global : (this ==
math),\n options.state);\n}\n\nmath['seed' + rngname] = seedrandom;\n\n// ARC4\n\n// An ARC4
implementation. The constructor takes a key in the
form of\n// an array of at most (width) integers that should be 0 <= x < (width).\n\n// The g(count) method returns
a pseudorandom integer that concatenates\n// the next (count) outputs from ARC4. Its return value is a number x\n//
that is in the range 0 <= x < (width ^ count).\n\n\nfunction ARC4(key) {\n var t, keylen = key.length,\n me =
this, i = 0, j = me.i = me.j = 0, s = me.S = [];\n\n // The empty key [] is treated as [0].\n if (!keylen) { key =
[keylen++]; }\n\n // Set up S using the standard key scheduling algorithm.\n while (i < width) {\n s[i] = i++;\n }\n for (i = 0; i < width; i++) {\n s[i] = s[j = mask & (j + key[i % keylen] + (t = s[i]))];\n s[j] = t;\n }\n\n // The
'g' method returns the next (count) outputs as one number.\n (me.g = function(count) {\n // Using instance
members instead of closure state nearly doubles speed.\n var t, r = 0,\n i = me.i, j = me.j, s = me.S;\n while
(count--) {\n t = s[i = mask & (i + 1)];\n r = r * width + s[mask & ((s[i] = s[j = mask & (j + t)]) + (s[j] = t))];\n }\n me.i = i; me.j = j;\n return r;\n })\n // For robust unpredictability, the function call below automatically\n // discards an initial batch of values. This is
called RC4-drop[256].\n // See http://google.com/search?q=rsa+fluhrer+response&btnI\n })(width);\n\n\n//\n\n// Copies internal state of ARC4 to or from a plain object.\n\n\nfunction copy(f, t) {\n t.i = f.i;\n t.j = f.j;\n t.S = f.S.slice();\n return t;\n};\n\n\n// flatten()\n\n// Converts an object tree to nested arrays of strings.\n\n\nfunction
flatten(obj, depth) {\n var result = [], typ = (typeof obj), prop;\n if (depth && typ == 'object') {\n for (prop in obj) {\n try { result.push(flatten(obj[prop], depth - 1)); } catch (e) {} }\n }\n return (result.length ? result : typ ==
'string' ? obj : obj + '\\0');\n}\n\n\n// mixkey()\n\n// Mixes a string seed into a key that is an array of integers, and\n//
returns a shortened string seed that is equivalent to the result key.\n\n\nfunction mixkey(seed, key) {\n var
stringseed = seed + '', smear, j = 0;\n while (j < stringseed.length) {\n key[mask & j] =\n mask & ((smear ^=
key[mask & j] * 19) + stringseed.charCodeAt(j++));\n }\n return toString(key);\n}\n\n\n// autoseed()\n\n// Returns
an object for autoseeding, using window.crypto and Node crypto\n// module if available.\n\n\nfunction autoseed()\n{\n try {\n var out;\n if (nodecrypto && (out = nodecrypto.randomBytes)) {\n // The use of 'out' to remember
randomBytes makes tight minified code.\n out = out(width);\n } else {\n out = new Uint8Array(width);\n (global.crypto || global.msCrypto).getRandomValues(out);\n }\n return toString(out);\n } catch (e) {\n var
browser = global.navigator,\n plugins = browser && browser.plugins;\n return [+new Date, global, plugins,
global.screen, toString(pool)];\n }\n}\n\n\n// toString()\n\n//
Converts an array of charcodes to a string\n\n\nfunction toString(a) {\n return String.fromCharCode.apply(0,
a);\n}\n\n\n// When seedrandom.js is loaded, we immediately mix a few bits\n// from the built-in RNG into the
entropy pool. Because we do\n// not want to interfere with deterministic PRNG state later,\n// seedrandom will not
call math.random on its own again after\n// initialization.\n\n\nmixkey(math.random(), pool);\n\n\n// Nodejs and
AMD support: export the implementation as a module using\n// either convention.\n\n\nif ((typeof module) ==
'object' && module.exports) {\n module.exports = seedrandom;\n // When in node.js, try using crypto package for
autoseeding.\n try {\n nodecrypto = require('crypto');\n } catch (ex) {} }\n else if ((typeof define) == 'function'
&& define.amd) {\n define(function() { return seedrandom; });\n }\n\n // End anonymous scope, and pass initial
values.\n})(\n [],\n // pool: entropy pool starts empty\n Math\n // math: package containing
random, pow, and seedrandom\n);\n\n",\n // A library of seedable RNGs implemented in Javascript.\n\n\n// Usage:\n\n\n// var seedrandom = require('seedrandom');\n// var random = seedrandom(1); // or any seed.\n// var x =
random();\n // 0 <= x < 1. Every bit is random.\n// var x = random.quick(); // 0 <= x < 1. 32 bits of
randomness.\n\n// alea, a 53-bit multiply-with-carry generator by Johannes Baag e.\n// Period: ~2^116\n// Reported
to pass all BigCrush tests.\nvar alea = require('./lib/alea');\n\n// xor128, a pure xor-shift generator by George
Marsaglia.\n// Period: 2^128-1.\n// Reported to fail: MatrixRank and LinearComp.\nvar xor128 =
require('./lib/xor128');\n\n// xorwow, George Marsaglia's 160-bit xor-shift combined plus weyl.\n// Period: 2^192-
2^32\n// Reported to fail: CollisionOver, SimpPoker, and LinearComp.\nvar xorwow = require('./lib/xorwow');\n\n\n//
xorshift7, by Fran ois Panneton and Pierre L'ecuyer, takes\n// a different approach: it adds robustness by allowing
more

```

shifts than Marsaglia's original three. It is a 7-shift generator with 256 bits, that passes BigCrush with no systematic failures. Period  $2^{256}-1$ . No systematic BigCrush failures reported. `require('./lib/xorshift7');` xor4096, by Richard Brent, is a 4096-bit xor-shift with a very long period that also adds a Weyl generator. It also passes BigCrush with no systematic failures. Its long period may be useful if you have many generators and need to avoid collisions. Period:  $2^{4128}-2^{32}$ . No systematic BigCrush failures reported. `require('./lib/xor4096');` Tyche-i, by Samuel Neves and Filipe Araujo, is a bit-shifting random number generator derived from ChaCha, a modern stream cipher.

<https://eden.dei.uc.pt/~sneves/pubs/2011-snfa2.pdf> Period:  $\sim 2^{127}$ . No systematic BigCrush failures reported. `require('./lib/tychei');` The original ARC4-based prng included in this library. Period:  $\sim 2^{1600}$  `require('./seedrandom');` `nsr.alea = alea;` `nsr.xor128 = xor128;` `nsr.xorwow = xorwow;` `nsr.xorshift7 = xorshift7;` `nsr.xor4096 = xor4096;` `nsr.tychei = tychei;` `module.exports = sr;`

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```

=====
*/
import * as seedrandom from 'seedrandom';
import {expectNumbersClose,
testEpsilon} from '../test_util';
import {TypedArray} from '../types';
export interface RandomBase {
nextValue(): number;
}
export interface RandomGamma {
nextValue(): number;
}
export interface
RandNormalDataTypes {
float32: Float32Array;
int32: Int32Array;
}
export interface
RandGammaDataTypes {
float32: Float32Array;
int32: Int32Array;
}
//
https://en.wikipedia.org/wiki/Marsaglia_polar_method
export class MPRandGauss implements RandomBase {
private mean: number;
private stdDev: number;
private nextVal: number;
private dtype?: keyof
RandNormalDataTypes;
private truncated?: boolean;
private upper?: number;
private lower?: number;
private random: seedrandom.prng;
constructor(
mean: number, stdDeviation: number, dtype?: keyof
RandNormalDataTypes,
truncated?: boolean, seed?: number) {
this.mean = mean;
this.stdDev =
stdDeviation;
this.dtype = dtype;
this.nextVal = NaN;
this.truncated
= truncated;
if (this.truncated) {
this.upper = this.mean + this.stdDev * 2;
this.lower = this.mean -
this.stdDev * 2;
}
const seedValue = seed ? seed : Math.random();
this.random =
seedrandom.alea(seedValue.toString());
}
/** Returns next sample from a Gaussian distribution. */
public
nextValue(): number {
if (!isNaN(this.nextVal)) {
const value = this.nextVal;
this.nextVal = NaN;
return value;
}
let resultX: number, resultY: number;
let isValid = false;
while (!isValid) {
let
v1: number, v2: number, s: number;
do {
v1 = 2 * this.random() - 1;
v2 = 2 * this.random() - 1;
s = v1 * v1 + v2 * v2;
} while (s >= 1 || s === 0);
const mul = Math.sqrt(-2.0 * Math.log(s) / s);
resultX = this.mean + this.stdDev * v1 * mul;
resultY = this.mean + this.stdDev * v2 * mul;
if
(!this.truncated || this.isValidTruncated(resultX))
{
isValid = true;
}
}
if (!this.truncated || this.isValidTruncated(resultY)) {
this.nextVal =
this.convertValue(resultY);
}
return this.convertValue(resultX);
}
/** Handles proper rounding for
non-floating-point numbers. */
private convertValue(value: number): number {
if (this.dtype == null ||
this.dtype === 'float32') {
return value;
}
return Math.round(value);
}
/** Returns true if less
than 2-standard-deviations from the mean. */
private isValidTruncated(value: number): boolean {
return value
<= this.upper && value >= this.lower;
}
}
// Marsaglia, George, and Wai Wan Tsang. 2000. "A Simple
Method for Generating
Gamma Variables."
export class RandGamma implements RandomGamma {
private
alpha: number;
private beta: number;
private d: number;
private c: number;
private dtype?: keyof
RandGammaDataTypes;
private randu: seedrandom.prng;
private randn:

```

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MPRandGauss;\n\n constructor(\n alpha: number, beta: number, dtype: keyof RandGammaDataTypes,\n seed?: number) {\n this.alpha = alpha;\n this.beta = 1 / beta; // convert rate to scale parameter\n this.dtype =\n dtype;\n const seedValue = seed ? seed : Math.random();\n this.randu =\n seedrandom.alea(seedValue.toString());\n this.randn = new MPRandGauss(0, 1, dtype, false, this.randu());\n\n if\n (alpha < 1) {\n this.d = alpha + (2 / 3);\n } else {\n this.d = alpha - (1 / 3);\n }\n this.c = 1 / Math.sqrt(9 *\n this.d);\n }\n\n /** Returns next sample from a gamma distribution. */\n public nextValue(): number {\n let x2:\n number, v0: number, v1: number, x: number, u: number, v: number;\n while (true) {\n do {\n x =\n this.randn.nextValue();\n v = 1 + (this.c * x);\n } while (v <= 0);\n v *= v * v;\n x2 = x * x;\n v0 =\n 1 - (0.331 * x2 * x2);\n v1 = (0.5 * x2) + (this.d * (1 - v + Math.log(v)));\n u = this.randu();\n if (u < v0 || Math.log(u) < v1) {\n break;\n }\n v = (1 / this.beta) * this.d *\n v;\n if (this.alpha < 1) {\n v *= Math.pow(this.randu(), 1 / this.alpha);\n }\n return this.convertValue(v);\n }\n }\n\n /** Handles proper rounding for non-floating-point numbers. */\n private convertValue(value: number):\n number {\n if (this.dtype === 'float32') {\n return value;\n }\n return Math.round(value);\n }\n}\n\nexport\n class UniformRandom implements RandomBase {\n private min: number;\n private range: number;\n private\n random: seedrandom.prng;\n private dtype?: keyof RandNormalDataTypes;\n\n constructor(\n min = 0, max =\n 1, dtype?: keyof RandNormalDataTypes,\n seed?: string|number) {\n this.min = min;\n this.range = max -\n min;\n this.dtype = dtype;\n if (seed == null) {\n seed = Math.random();\n }\n if (typeof seed ===\n 'number') {\n seed = seed.toString();\n }\n if (!this.canReturnFloat()\n && this.range <= 1) {\n throw new Error(`\n The difference between ${min} - ${max} <= 1 and dtype is\n not float`);\n }\n this.random = seedrandom.alea(seed);\n }\n\n /** Handles proper rounding for non floating\n point numbers. */\n private canReturnFloat = () =>\n (this.dtype == null || this.dtype === 'float32');\n\n private\n convertValue(value: number): number {\n if (this.canReturnFloat()) {\n return value;\n }\n return\n Math.round(value);\n }\n\n nextValue() {\n return this.convertValue(this.min + this.range * this.random());\n }\n }\n\n export function jarqueBeraNormalityTest(values: TypedArray|number[]) {\n //\n https://en.wikipedia.org/wiki/Jarque%E2%80%93Bera_test\n const n = values.length;\n const s =\n skewness(values);\n const k = kurtosis(values);\n const jb = n / 6 * (Math.pow(s, 2) + 0.25 * Math.pow(k - 3, 2));\n\n // JB test requires 2-degrees of freedom from Chi-Square @ 0.95:\n http://www.itl.nist.gov/div898/handbook/eda/section3/eda3674.htm\n\n const CHI_SQUARE_2DEG = 5.991;\n if (jb > CHI_SQUARE_2DEG) {\n throw new Error(`Invalid p-value\n for JB: ${jb}`);\n }\n }\n\n export function expectArrayInMeanStdRange(\n actual: TypedArray|number[],\n expectedMean: number, expectedStdDev: number,\n epsilon?: number) {\n if (epsilon == null) {\n epsilon =\n testEpsilon();\n }\n const actualMean = mean(actual);\n expectNumbersClose(actualMean, expectedMean,\n epsilon);\n expectNumbersClose(\n standardDeviation(actual, actualMean), expectedStdDev,\n epsilon);\n }\n\n function mean(values: TypedArray|number[]) {\n let sum = 0;\n for (let i = 0; i < values.length;\n i++) {\n sum += values[i];\n }\n return sum / values.length;\n }\n\n function standardDeviation(values:\n TypedArray|number[], mean: number) {\n let squareDiffSum = 0;\n for (let i = 0; i < values.length; i++) {\n const\n diff = values[i] - mean;\n squareDiffSum += diff * diff;\n }\n return Math.sqrt(squareDiffSum\n / values.length);\n }\n\n function kurtosis(values: TypedArray|number[]) {\n //\n https://en.wikipedia.org/wiki/Kurtosis\n const valuesMean = mean(values);\n const n = values.length;\n let sum2 =\n 0;\n let sum4 = 0;\n for (let i = 0; i < n; i++) {\n const v = values[i] - valuesMean;\n sum2 += Math.pow(v,\n 2);\n sum4 += Math.pow(v, 4);\n }\n return (1 / n) * sum4 / Math.pow((1 / n) * sum2, 2);\n }\n\n function\n skewness(values: TypedArray|number[]) {\n // https://en.wikipedia.org/wiki/Skewness\n const valuesMean =\n mean(values);\n const n = values.length;\n let sum2 = 0;\n let sum3 = 0;\n for (let i = 0; i < n; i++) {\n const v =\n values[i] - valuesMean;\n sum2 += Math.pow(v, 2);\n sum3 += Math.pow(v, 3);\n }\n return (1 / n) * sum3 /\n Math.pow((1 / (n - 1)) * sum2, 3 / 2);\n }\n }\n\n /**\n * @license\n * Copyright 2020 Google LLC. All Rights\n * Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file\n * except in compliance

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with the License.\n \* You may obtain a copy of the License at\n \* <http://www.apache.org/licenses/LICENSE-2.0>\n \* Unless required by applicable law or agreed to in writing, software\n \* distributed under the License is distributed on an \"AS IS\" BASIS,\n \* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*

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=====
*\n\nimport {Tensor} from './tensor';\nimport {Rank, ShapeMap} from './types';\nimport {buffer} from './buffer';\nimport {op} from './operation';\nimport {RandGamma} from './rand_util';\n\n/**\n * Creates a `tf.Tensor` with values sampled from a gamma distribution.\n */\nexport function randomGamma(shape: number[], alpha: number, beta: number, dtype: string, seed?: number): Tensor<R> {\n if (beta == null) {\n beta = 1;\n }\n if (dtype == null) {\n dtype = 'float32';\n }\n if (dtype !== 'float32' && dtype !== 'int32') {\n throw new Error(`Unsupported data type ${dtype}`);\n }\n const rgamma = new RandGamma(alpha, beta, dtype, seed);\n const res = buffer(shape, dtype);\n for (let i = 0; i < res.values.length; i++) {\n res.values[i] = rgamma.nextValue();\n }\n return res.toTensor();\n}\n\nexport const randomGamma = op({randomGamma});\n\n/**\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */
```

```
=====
*\n\nimport {Tensor} from './tensor';\nimport {DataType, Rank, ShapeMap} from './types';\nimport {buffer} from './buffer';\nimport {op} from './operation';\nimport {MPRandGauss} from './rand_util';\n\n/**\n * Creates a `tf.Tensor` with values sampled from a normal distribution.\n */\nexport function randomNormal(shape: number[], mean: number, stdDev: number, dtype: string, seed?: number): Tensor<R> {\n if (dtype != null && (dtype as DataType) === 'bool') {\n throw new Error(`Unsupported data type ${dtype}`);\n }\n const randGauss = new MPRandGauss(mean, stdDev, dtype, false /* truncated */, seed);\n const res = buffer(shape, dtype);\n for (let i = 0; i < res.values.length; i++) {\n res.values[i] = randGauss.nextValue();\n }\n return res.toTensor();\n}\n\nexport const randomNormal = op({randomNormal});\n\n/**\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */
```

```

*\\n\\nimport {Tensor} from './tensor';\\nimport {DataType, Rank, ShapeMap} from './types';\\n\\nimport {buffer}
from './buffer';\\nimport {op} from './operation';\\nimport {UniformRandom} from './rand_util';\\n\\n/**\\n * Creates a
`tf.Tensor` with values sampled from a uniform distribution.\\n *\\n * The generated values follow a uniform
distribution in
the range [minval,\\n * maxval). The lower bound minval is included in the range, while the upper\\n * bound maxval
is excluded.\\n *\\n * ```js\\n * tf.randomUniform([2, 2]).print();\\n * ```\\n * @param shape An array of integers
defining the output tensor shape.\\n * @param minval The lower bound on the range of random values to generate.\\n
* Defaults to 0.\\n * @param maxval The upper bound on the range of random values to generate.\\n * Defaults to
1.\\n * @param dtype The data type of the output tensor. Defaults to 'float32'.\\n *\\n * @doc {heading: 'Tensors',
subheading: 'Random'}\\n */\\nfunction randomUniform_<R extends Rank>(\\n shape: ShapeMap[R], minval = 0,
maxval = 1, dtype: DataType = 'float32',\\n seed?: number|string): Tensor<R> {\\n const res = buffer(shape,
dtype);\\n const random = new UniformRandom(minval, maxval, null, seed);\\n for (let i = 0; i < res.values.length;
i++) {\\n res.values[i] = random.nextValue();\\n }\\n return res.toTensor();\\n}\\n\\nexport const
randomUniform = op({randomUniform_});\\n", "/*\\n * @license\\n * Copyright 2018 Google LLC. All Rights
Reserved.\\n * Licensed under the Apache License, Version 2.0 (the "License");\\n * you may not use this file
except in compliance with the License.\\n * You may obtain a copy of the License at\\n *\\n *
http://www.apache.org/licenses/LICENSE-2.0\\n *\\n * Unless required by applicable law or agreed to in writing,
software\\n * distributed under the License is distributed on an "AS IS" BASIS,\\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\\n * See the License for the specific language
governing permissions and\\n * limitations under the License.\\n *

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=====\\n
*\\n\\nimport {ENGINE} from './engine';\\nimport {Range, RangeAttrs} from './kernel_names';\\nimport
{NamedAttrMap} from './kernel_registry';\\nimport {Tensor1D} from './tensor';\\n\\n/**\\n * Creates a new
`tf.Tensor1D` filled with the numbers
in the range provided.\\n *\\n * The tensor is a is half-open interval meaning it includes start, but\\n * excludes stop.
Decrementing ranges and negative step values are also\\n * supported.\\n *\\n * ```js\\n * tf.range(0, 9,
2).print();\\n * ```\\n * @param start An integer start value\\n * @param stop An integer stop value\\n * @param
step An integer increment (will default to 1 or -1)\\n * @param dtype The data type of the output tensor. Defaults to
'float32'.\\n *\\n * @doc {heading: 'Tensors', subheading: 'Creation'}\\n */\\nexport function range(\\n start: number,
stop: number, step = 1,\\n dtype: 'float32'|'int32' = 'float32'): Tensor1D {\\n if (step === 0) {\\n throw new
Error('Cannot have a step of zero');\\n }\\n\\n const attrs: RangeAttrs = {start, stop, step, dtype};\\n\\n return
ENGINE.runKernel(Range, { } /* inputs */, attrs as { } as NamedAttrMap);\\n}\\n", "/*\\n * @license\\n * Copyright
2020 Google LLC. All Rights Reserved.\\n * Licensed under the Apache License, Version
2.0 (the "License");\\n * you may not use this file except in compliance with the License.\\n * You may obtain a
copy of the License at\\n *\\n * http://www.apache.org/licenses/LICENSE-2.0\\n *\\n * Unless required by applicable
law or agreed to in writing, software\\n * distributed under the License is distributed on an "AS IS" BASIS,\\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\\n * See the License for
the specific language governing permissions and\\n * limitations under the License.\\n *

```

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=====\\n
*\\n\\nimport {ENGINE} from './engine';\\nimport {Real, RealInputs} from './kernel_names';\\nimport {Tensor}
from './tensor';\\nimport {NamedTensorMap} from './tensor_types';\\nimport {convertToTensor} from
'./tensor_util_env';\\nimport {TensorLike} from './types';\\nimport {op} from './operation';\\n\\n/**\\n * Returns the
real part of a complex (or real) tensor.\\n *\\n * Given a tensor input, this
operation returns a tensor of type float that is\\n * the real part of each element in input considered as a complex
number.\\n *\\n * If the input is real, it simply makes a clone.\\n *\\n * ```js\\n * const x = tf.complex([-2.25, 3.25],
[4.75, 5.75]);\\n * tf.real(x).print();\\n * ```\\n * @doc {heading: 'Tensors', subheading: 'Creation'}\\n */\\nfunction
real_<T extends Tensor>(input: T|TensorLike): T {\\n const $input = convertToTensor(input, 'input', 'real');\\n\\n
const inputs: RealInputs = {input: $input};\\n return ENGINE.runKernel(Real, inputs as { } as

```



```
T[TensorLike]: T {\n const $x = convertToTensor(x, 'x', 'relu6');\nn const inputs: Relu6Inputs = {x: $x};\nn return ENGINE.runKernel(Relu6, inputs as {} as NamedTensorMap);\nn\nnext export const relu6 = op({relu6_});\nn","/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n=====\n*/\n\nimport {ENGINE} from '../engine';\nimport {Reverse, ReverseAttrs, ReverseInputs} from './kernel_names';\nimport {NamedAttrMap} from './kernel_registry';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\n\nimport {op} from './operation';\n\n/**\n * Reverses a `tf.Tensor` along a specified axis.\n *\n * Also available are stricter rank-specific methods that assert that `x` is of the given rank:\n * - `tf.reverse1d`\n * - `tf.reverse2d`\n * - `tf.reverse3d`\n * - `tf.reverse4d`\n *\n * Except `tf.reverse1d` (which does not have axis param), all methods have same signature as this method.\n *\n ```js\n const x = tf.tensor1d([1, 2, 3, 4]);\n console.log(x.reverse().print());\n```\n *\n ```js\n const x = tf.tensor2d([1, 2, 3, 4], [2, 2]);\n const axis = 1;\n console.log(x.reverse(axis).print());\n```\n *\n @param x The input tensor to be reversed.\n @param axis The set of dimensions to reverse. Must be in the range [-rank(x), rank(x)). Defaults to all axes.\n @doc {heading: 'Tensors', subheading: 'Slicing and Joining'}\n */\nfunction reverse<T extends Tensor>(x: T | TensorLike, axis?: number | number[]): T {\n const $x = convertToTensor(x, 'x', 'reverse');\nn\n const inputs: ReverseInputs = {x: $x};\n const attrs: ReverseAttrs = {dims: axis};\nn\n return ENGINE.runKernel(\n Reverse, inputs as {} as NamedTensorMap, attrs as {} as NamedAttrMap);\nn\n next export const reverse = op({reverse_});\nn","/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n=====\n*/\n\nimport {Tensor1D} from './tensor';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\nimport * as util from './util';\nimport {op} from './operation';\nimport {reverse} from './reverse';\n\n/**\n * Reverses a `tf.Tensor1D`. \n *\n @param x The input tensor.\n */\nfunction reverse1d(x: Tensor1D | TensorLike): Tensor1D {\n const $x = convertToTensor(x, 'x', 'reverse');\nn\n util.assert($x.rank === 1,\n () => `Error in reverse1D: x must be rank 1 but got rank ${$x.rank}`);\nn\n return reverse($x, 0);\nn\n next export const reverse1d = op({reverse1d_});\nn","/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n=====\n*/\n\nimport {Tensor2D} from './tensor';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\nimport * as util from './util';\nimport {op} from
```



```

./operation';\nimport {reverse} from './reverse';\n\n/**\n * Reverses a `tf.Tensor2D` along a specified axis.\n *\n * @param x The input tensor.\n * @param axis The set of dimensions to reverse. Must be in the\n * range [-rank(x), rank(x)). Defaults to all axes.\n */\nfunction reverse2d(x: Tensor2D|TensorLike, axis?: number|number[]):\n Tensor2D {\n const $x = convertToTensor(x, 'x', 'reverse');\n util.assert(\n $x.rank === 2,\n () => `Error in\nreverse2D: x must be rank 2 but got rank ${$x.rank}.`);\n return reverse($x, axis);\n}\n\nexport const reverse2d =\nop({reverse2d_});\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under\nthe Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the\nLicense.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed\nunder the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF\nANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */

```

```

=====
\n
*\n\nimport {Tensor3D} from './tensor';\nimport {convertToTensor} from './tensor_util_env';\nimport\n{TensorLike} from './types';\nimport * as util from './util';\nimport {op} from './operation';\nimport {reverse} from\n './reverse';\n\n/**\n * Reverses a `tf.Tensor3D` along a specified axis.\n *\n * @param x The input tensor.\n * @param axis The set of dimensions to reverse. Must be in the\n * range [-rank(x), rank(x)). Defaults to all axes.\n */\nfunction reverse3d(x: Tensor3D|TensorLike, axis?: number|number[]): Tensor3D {\n const $x =\nconvertToTensor(x, 'x', 'reverse');\n util.assert(\n $x.rank === 3,\n () => `Error in reverse3D: x must be rank\n3 but got rank ${$x.rank}.`);\n return reverse($x, axis);\n}\n\nexport const reverse3d = op({reverse3d_});\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version\n2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a\ncopy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable\nlaw or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\nthe specific language governing permissions and\n * limitations under the License.\n */

```

```

=====
\n
*\n\nimport {Tensor4D} from './tensor';\nimport {convertToTensor} from './tensor_util_env';\nimport\n{TensorLike} from './types';\nimport * as util from './util';\nimport\n{op} from './operation';\nimport {reverse} from './reverse';\n\n/**\n * Reverses a `tf.Tensor4D` along a specified\naxis.\n *\n * @param x The input tensor.\n * @param axis The set of dimensions to reverse. Must be in the\n * range [-rank(x), rank(x)). Defaults to all axes.\n */\nfunction reverse4d(x: Tensor4D|TensorLike, axis?:\nnumber|number[]): Tensor4D {\n const $x = convertToTensor(x, 'x', 'reverse');\n util.assert(\n $x.rank === 4,\n () => `Error in reverse4D: x must be rank 4 but got rank ${$x.rank}.`);\n return reverse($x, axis);\n}\n\nexport\nconst reverse4d = op({reverse4d_});\n"/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in\ncompliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,\nsoftware\n *\n * distributed under the License is distributed on an "AS IS" BASIS,\n *\n * WITHOUT WARRANTIES OR\nCONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing\npermissions and\n * limitations under the License.\n */

```

```

=====
\n
*\n\nimport {ENGINE} from './engine';\nimport {Round, RoundInputs} from './kernel_names';\nimport {Tensor}\nfrom './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport {convertToTensor} from\n './tensor_util_env';\nimport {TensorLike} from './types';\n\nimport {op} from './operation';\n\n/**\n * Computes\nround of input `tf.Tensor` element-wise: `round(x)`.\n * It implements banker's rounding.\n *\n * ``js\n * const x =\ntf.tensor1d([.6, 1.1, -3.3]);\n * x.round().print(); // or tf.round(x)\n *\n * ``\n *\n * @param x The input tensor.\n */

```

```

@doc {heading: 'Operations', subheading: 'Basic math'}\n *\nfunction round_<T extends Tensor>(x:
T|TensorLike): T {\n const $x = convertToTensor(x, 'x', 'round');\n const inputs: RoundInputs = {x: $x};\n\n return ENGINE.runKernel(Round, inputs as { } as NamedTensorMap);\n}\n\nexport const round =
op({round_});\n", "/*\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
=====
\n
*\n\nimport {ENGINE} from '../engine';\nimport {Rsqr, RsqrInputs}
from './kernel_names';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from
'./tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from
'./types';\n\nimport {op} from './operation';\n\n/**\n * Computes reciprocal of square root of the input `tf.Tensor`
element-wise:\n * `y = 1 / sqrt(x)`\n *\n * ``js\n * const x = tf.tensor1d([1, 2, 4, -1]);\n *\n * x.rsqr().print(); // or
tf.rsqr(x)\n *\n * ``\n * @param x The input tensor.\n *\n * @doc {heading: 'Operations', subheading: 'Basic math'}\n
*\nfunction rsqr_<T extends Tensor>(x: T|TensorLike): T {\n const $x = convertToTensor(x, 'x', 'rsqr');\n\n const
inputs: RsqrInputs = {x: $x};\n\n return ENGINE.runKernel(Rsqr, inputs as { } as NamedTensorMap);\n}\n\nexport
const rsqr = op({rsqr_});\n", "/*\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed
under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance
with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-
2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is
distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n *
=====
\n
*\n\nimport {Scalar} from './tensor';\nimport {DataType} from './types';\nimport {isTypedArray} from
'./util';\nimport {makeTensor} from './tensor_ops_util';\n\n/**\n * Creates rank-0 `tf.Tensor` (scalar) with the
provided value and dtype.\n *\n * The same functionality can be achieved with `tf.tensor`, but in general\n * we
recommend using `tf.scalar` as it makes the code more readable.\n *\n * ``js\n * tf.scalar(3.14).print();\n *\n * ``\n *\n * @param value
The value of the scalar.\n * @param dtype The data type.\n *\n * @doc {heading: 'Tensors', subheading:
'Creation'}\n *\nexport function scalar(\n value: number|boolean|string|Uint8Array, dtype?: DataType): Scalar {\n
if (((isTypedArray(value) && dtype !== 'string') || Array.isArray(value)) &&\n dtype !== 'complex64') {\n
throw new Error(\n 'Error creating a new Scalar: value must be a primitive ' +\n
'(' +\n
'(number|boolean|string)') +\n
')');\n }\n if (dtype === 'string' && isTypedArray(value) &&\n !(value instanceof
Uint8Array)) {\n throw new Error(\n 'When making a scalar from encoded string, ' +\n
'the value must be\n `Uint8Array`.');\n }\n const shape: number[] = [];\n const inferredShape: number[] = [];\n return
makeTensor(value, shape, inferredShape, dtype) as Scalar;\n}\n\n", "/*\n * @license\n * Copyright 2020 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not
use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
\n

```

```

* \n \n import {ENGINE} from './engine'; \n import {Selu, SeluInputs} from './kernel_names'; \n import {Tensor} from
'./tensor'; \n import {NamedTensorMap} from './tensor_types'; \n import {convertToTensor} from
'./tensor_util_env'; \n import {TensorLike} from './types'; \n import {op} from './operation'; \n \n /** \n * Computes
scaled exponential linear element-wise. \n * \n * `x < 0 ? scale * alpha * (exp(x) - 1) : x` \n * \n * ```js \n * const x =
tf.tensor1d([-1,
2, -3, 4]); \n * \n * x.selu().print(); // or tf.selu(x) \n * ``` \n * @param x The input tensor. \n * \n * @doc {heading:
'Operations', subheading: 'Basic math'} \n * \n function selu_<T extends Tensor>(x: T|TensorLike): T { \n const $x =
convertToTensor(x, 'x', 'selu'); \n \n const inputs: SeluInputs = {x: $x}; \n \n return ENGINE.runKernel(Selu, inputs
as { }) as NamedTensorMap; \n } \n \n export const selu = op({selu_}); \n ", "/* \n * @license \n * Copyright 2020
Google LLC. All Rights Reserved. \n * Licensed under the Apache License, Version 2.0 (the "License"); \n * you
may not use this file except in compliance with the License. \n * You may obtain a copy of the License at \n * \n *
http://www.apache.org/licenses/LICENSE-2.0 \n * \n * Unless required by applicable law or agreed to in writing,
software \n * distributed under the License is distributed on an "AS IS" BASIS, \n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied. \n * See the License for the specific language
governing permissions and \n * limitations under the License. \n *
===== \n
* \n \n import {Tensor3D, Tensor4D} from './tensor'; \n import {convertToTensor} from './tensor_util_env'; \n import
{TensorLike} from './types'; \n import * as util from './util'; \n \n import {conv2d} from './conv2d'; \n import
{depthwiseConv2d} from './depthwise_conv2d'; \n import {op} from './operation'; \n import {reshape} from
'./reshape'; \n \n /** \n * 2-D convolution with separable filters. \n * \n * Performs a depthwise convolution that acts
separately on channels followed \n * by a pointwise convolution that mixes channels. Note that this is \n *
separability between dimensions [1, 2] and 3, not spatial separability \n * between dimensions 1 and 2. \n * \n * See \n
* [https://www.tensorflow.org/api_docs/python/tf/nn/separable_conv2d] (\n *
https://www.tensorflow.org/api_docs/python/tf/nn/separable_conv2d) \n * for more details. \n * \n * @param x The
input
tensor, of rank 4 or rank 3, of shape \n * `[batch, height, width, inChannels]`. If rank 3, batch of 1 is \n *
assumed. \n * @param depthwiseFilter The depthwise filter tensor, rank 4, of shape \n * `[filterHeight, filterWidth,
inChannels, channelMultiplier]`. This is \n * the filter used in the first step. \n * @param pointwiseFilter The
pointwise filter tensor, rank 4, of shape \n * `[1, 1, inChannels * channelMultiplier, outChannels]`. This is \n *
the filter used in the second step. \n * @param strides The strides of the convolution: `[strideHeight, \n *
strideWidth]`. If strides is a single number, then `strideHeight == \n * strideWidth`. \n * @param pad The type of
padding algorithm. \n * - `same` and stride 1: output will be of same size as input, \n * regardless of filter size. \n
* - `valid`: output will be smaller than input if filter is larger \n * than 1x1. \n * - For more info, see this
guide: \n * [https://www.tensorflow.org/api_guides/python/nn#Convolution] (\n *
https://www.tensorflow.org/api_guides/python/nn#Convolution) \n * @param dilations The dilation rates:
`[dilationHeight, dilationWidth]` \n * in which we sample input values across the height and width dimensions \n *
in atrous convolution. Defaults to `[1, 1]`. If `rate` is a single \n * number, then `dilationHeight ==
dilationWidth`. If it is greater than \n * 1, then all values of `strides` must be 1. \n * @param dataType: An
optional string from: `"NHWC"`, `"NCHW"`. Defaults to \n * `"NHWC"`. Specify the data format of the input and
output data. With the \n * default format `"NHWC"`, the data is stored in the order of: [batch, \n * height, width,
channels]. Only `"NHWC"` is currently supported. \n * \n * @doc {heading: 'Operations', subheading:
'Convolution'} \n * \n function separableConv2d_<T extends Tensor3D|Tensor4D>(\n x: T|TensorLike,
depthwiseFilter: Tensor4D|TensorLike, \n pointwiseFilter: Tensor4D|TensorLike, strides: [number,
number]|number, \n pad: 'valid'|'same', dilation: [number, number]|number = [1, 1], \n dataType:
'NHWC'|'NCHW' = 'NHWC'): T { \n const $x = convertToTensor(x, 'x', 'separableConv2d'); \n const
$depthwiseFilter = \n convertToTensor(depthwiseFilter, 'depthwiseFilter', 'separableConv2d'); \n const
$pointwiseFilter = \n convertToTensor(pointwiseFilter, 'pointwiseFilter', 'separableConv2d'); \n \n let x4D = $x as
Tensor4D; \n let reshapedTo4D = false; \n if ($x.rank === 3) { \n reshapedTo4D = true; \n x4D = reshape($x, [1,

```

[illegible]

```

return [buffer.toTensor(), indices.toTensor()];\n}\nexport const setdiff1dAsync = setdiff1dAsync_;\n", "/*\n *
@license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version
2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n *\n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
=====
\n
*/\n\nimport {ENGINE} from '../engine';\nimport {Sign, SignInputs} from '../kernel_names';\nimport {Tensor}
from '../tensor';\nimport {NamedTensorMap} from '../tensor_types';\nimport {convertToTensor} from
 '../tensor_util_env';\nimport {TensorLike} from '../types';\n\nimport {op} from './operation';\n\n/**\n * Returns an
element-wise indication of the sign of a number.\n *\n * ```js\n * const x = tf.tensor1d([.6, 1.1, -3.3, NaN, 0]);\n *\n * x.sign().print(); // or tf.sign(x)\n * ```\n * @param x The input Tensor.\n *\n * @doc {heading: 'Operations',
subheading: 'Basic math'}\n */\nfunction
sign_<T extends Tensor>(x: T|TensorLike): T {\n const $x = convertToTensor(x, 'x', 'sign');\n const inputs:
SignInputs = {x: $x};\n return ENGINE.runKernel(Sign, inputs as { } as NamedTensorMap);\n}\n\nexport const sign
= op({sign_});\n", "/*\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n *\n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
=====
\n
*/\n\nimport {ENGINE} from '../engine';\nimport
{Sin, SinInputs} from '../kernel_names';\nimport {Tensor} from '../tensor';\nimport {NamedTensorMap} from
 '../tensor_types';\nimport {convertToTensor} from '../tensor_util_env';\nimport {TensorLike} from
 '../types';\n\nimport {op} from './operation';\n\n/**\n * Computes sin of the input Tensor element-wise: `sin(x)`\n *\n * ```js\n * const x = tf.tensor1d([0, Math.PI / 2, Math.PI * 3 / 4]);\n *\n * x.sin().print(); // or tf.sin(x)\n * ```\n *
@param x The input tensor.\n *\n * @doc {heading: 'Operations', subheading: 'Basic math'}\n */\nfunction sin_<T
extends Tensor>(x: T|TensorLike): T {\n const $x = convertToTensor(x, 'x', 'sin');\n const inputs: SinInputs = {x:
$x};\n return ENGINE.runKernel(Sin, inputs as { } as NamedTensorMap);\n}\n\nexport const sin =
op({sin_});\n", "/*\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n *\n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
=====
\n
*/\n\nimport {ENGINE} from '../engine';\nimport {Sinh, SinhInputs} from '../kernel_names';\nimport {Tensor}
from '../tensor';\nimport {NamedTensorMap} from '../tensor_types';\nimport {convertToTensor} from
 '../tensor_util_env';\nimport {TensorLike} from '../types';\n\nimport {op} from './operation';\n\n/**\n * Computes
hyperbolic sin of the input `tf.Tensor` element-wise: `sinh(x)`\n *\n * ```js\n * const x = tf.tensor1d([0, 1, -1, .7]);\n *\n * x.sinh().print(); // or tf.sinh(x)\n * ```\n *
@param x The input tensor.\n *\n * @doc {heading: 'Operations', subheading: 'Basic math'}\n */\nfunction
sinh_<T extends Tensor>(x: T|TensorLike): T {\n const $x = convertToTensor(x, 'x', 'sinh');\n const inputs:

```

```

SinhInputs = {x: $x};\n\n return ENGINE.runKernel(Sinh, inputs as { } as NamedTensorMap);\n}\n\nexport const
sinh = op({sinh_});\n", "/*\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under
the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n
* =====\n
*\n\nimport {Tensor1D} from '../tensor';\nimport {convertToTensor} from '../tensor_util_env';\nimport
{TensorLike} from '../types';\nimport * as util from '../util';\n\nimport {op} from './operation';\nimport {slice} from
'/slice';\n\n/**\n * Extracts a 1D slice from 1D array starting at coordinates `begin` and is\n * of length `size`. See
`slicing` for details.\n *\nfunction slice1d_(\n x: Tensor1D|TensorLike, begin: number, size: number): Tensor1D {\n
const $x = convertToTensor(x, 'x', 'slice1d');\n util.assert(\n $x.rank === 1,\n () =>\n `slice1d expects a
rank-1 tensor, but got a rank-${$x.rank} tensor`);\n return slice($x, [begin], [size]);\n}\n\nexport const slice1d =
op({slice1d_});\n", "/*\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance
with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-
2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is
distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n
* =====\n
*\n\nimport {Tensor2D} from '../tensor';\nimport {convertToTensor} from '../tensor_util_env';\nimport
{TensorLike} from '../types';\nimport * as util from '../util';\n\nimport {op} from './operation';\nimport {slice} from
'/slice';\n\n/**\n * Extracts a 2D slice from a 2D array starting at coordinates `begin` and\n * is of size `size`. See
`slicing` for details.\n *\nfunction slice2d_(\n x: Tensor2D|TensorLike, begin: [number, number],\n size: [number,
number]):\n Tensor2D {\n const $x = convertToTensor(x, 'x', 'slice2d');\n util.assert(\n $x.rank === 2,\n () =>\n `slice2d expects a rank-2 tensor, but got a rank-${$x.rank} tensor`);\n return slice($x, begin, size);\n}\n\nexport const slice2d = op({slice2d_});\n", "/*\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed
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on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n
* =====\n
*\n\nimport
{Tensor3D} from '../tensor';\nimport {convertToTensor} from '../tensor_util_env';\nimport {TensorLike} from
 '../types';\nimport * as util from '../util';\n\nimport {op} from './operation';\nimport {slice} from '/slice';\n\n/**\n
 * Extracts a 3D slice from a 3D array starting at coordinates `begin` and\n * is of size `size`. See `slicing` for
details.\n *\nfunction slice3d_(\n x: Tensor3D|TensorLike, begin: [number, number, number],\n size: [number,
number, number]): Tensor3D {\n const $x = convertToTensor(x, 'x', 'slice3d');\n util.assert(\n $x.rank === 3,\n ()
=>\n `slice3d expects a rank-3 tensor, but got a rank-${$x.rank} tensor`);\n return slice($x, begin,
size);\n}\n\nexport const slice3d = op({slice3d_});\n", "/*\n * @license\n * Copyright 2018 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of

```

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```
=====
* \n \n import {Tensor4D} from './tensor'; \n import {convertToTensor} from './tensor_util_env'; \n import
{TensorLike} from './types'; \n import * as util from './util'; \n \n import {op} from './operation'; \n import {slice} from
 './slice'; \n \n /** \n * Extracts a 4D slice from a 4D array starting at coordinates `begin` and \n * is of size `size`. See
`slice` for details. \n * \n function slice4d_(\n x: Tensor4D|TensorLike, begin: [number, number, number,
number], \n size: [number, number, number, number]): Tensor4D { \n
 const $x = convertToTensor(x, 'x', 'slice4d'); \n util.assert(\n $x.rank === 4, \n () => \n `slice4d expects a
rank-4 tensor, but got a rank-${$x.rank} tensor`); \n return slice($x, begin, size); \n } \n \n export const slice4d =
op({slice4d_}); \n \n , /** \n * @license \n * Copyright 2018 Google LLC. All Rights Reserved. \n * Licensed under the
Apache License, Version 2.0 (the "License"); \n * you may not use this file except in compliance with the
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on an "AS IS" BASIS, \n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied. \n * See the License for the specific language governing permissions and \n * limitations under the
License. \n *
=====
```

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=====
* \n \n import {ENGINE}
from './engine'; \n import {Softmax, SoftmaxAttrs, SoftmaxInputs} from './kernel_names'; \n import
{NamedAttrMap} from './kernel_registry'; \n import {Tensor} from './tensor'; \n import {NamedTensorMap} from
 './tensor_types'; \n import {convertToTensor} from './tensor_util_env'; \n import {TensorLike} from
 './types'; \n \n import {op} from './operation'; \n \n /** \n * Computes the softmax normalized vector given the logits. \n
* \n * ``js \n * const a = tf.tensor1d([1, 2, 3]); \n * \n * a.softmax().print(); // or tf.softmax(a) \n * `` \n * \n * ``js \n *
const a = tf.tensor2d([2, 4, 6, 1, 2, 3], [2, 3]); \n * \n * a.softmax().print(); // or tf.softmax(a) \n * `` \n * \n * @param
logits The logits array. \n * @param dim The dimension softmax would be performed on. Defaults to `-1` \n *
which indicates the last dimension. \n * \n * @doc {heading: 'Operations', subheading: 'Normalization'} \n
* \n function softmax_<T extends Tensor>(logits: T|TensorLike, dim = -1): T { \n const $logits =
convertToTensor(logits,
'logits', 'softmax', 'float32'); \n \n if (dim === -1) { \n dim = $logits.rank - 1; \n } \n if (dim !== $logits.rank - 1) { \n
throw Error(\n 'Softmax along a non-last dimension is not yet supported.' + \n `Logits was rank
${$logits.rank} and dim was ${dim}`); \n } \n \n const inputs: SoftmaxInputs = {logits: $logits}; \n const attrs:
SoftmaxAttrs = {dim}; \n \n return ENGINE.runKernel(\n Softmax, inputs as { } as NamedTensorMap, attrs as { }
as NamedAttrMap); \n } \n \n export const softmax = op({softmax_}); \n \n , /** \n * @license \n * Copyright 2020 Google
LLC. All Rights Reserved. \n * Licensed under the Apache License, Version 2.0 (the "License"); \n * you may not
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on an "AS IS" BASIS, \n * WITHOUT
WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied. \n * See the License for the specific
language governing permissions and \n * limitations under the License. \n *
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=====
* \n \n import {ENGINE} from './engine'; \n import {FFT, FFTInputs} from './kernel_names'; \n import {Tensor}
from './tensor'; \n import {NamedTensorMap} from './tensor_types'; \n import {assert} from './util'; \n import
{op} from './operation'; \n \n /** \n * Fast Fourier transform. \n * \n * Computes the 1-dimensional discrete Fourier
transform over the inner-most \n * dimension of input. \n * \n * ``js \n * const real = tf.tensor1d([1, 2, 3]); \n * const
imag = tf.tensor1d([1, 2, 3]); \n * const x = tf.complex(real, imag); \n * \n * x.fft().print(); // tf.spectral.fft(x).print(); \n
=====
```

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* ```\n * @param input The complex input to compute an fft over.\n *\n * @doc {heading: 'Operations', subheading:
'Spectral', namespace: 'spectral'}\n *\nfunction
fft_(input: Tensor): Tensor {\n assert(\n input.dtype === 'complex64',\n () => `The dtype for tf.spectral.fft()
must be complex64` +\n `but got ${input.dtype}.`);\n\n const inputs: FFTInputs = {input};\n\n return
ENGINE.runKernel(FFT, inputs as {} as NamedTensorMap);\n}\n\nexport const fft = op({fft_});\n", "/**\n *
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the specific language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {ENGINE} from '../engine';\nimport {IFFT, IFFTInputs} from '../kernel_names';\nimport
{Tensor} from '../tensor';\nimport {NamedTensorMap} from '../tensor_types';\nimport {assert} from
'../util';\nimport {op} from '../operation';\n\n/**\n * Inverse fast Fourier transform.\n *\n * Computes the inverse 1-
dimensional discrete Fourier transform over the\n * inner-most dimension of input.\n *\n * ```\n *\n const real =
tf.tensor1d([1, 2, 3]);\n *\n const imag = tf.tensor1d([1, 2, 3]);\n *\n const x = tf.complex(real, imag);\n *\n *
x.ifft().print(); // tf.spectral.ifft(x).print();\n *\n ```\n *\n @param input The complex input to compute an ifft over.\n *\n
* @doc {heading: 'Operations', subheading: 'Spectral', namespace: 'spectral'}\n *\nfunction ifft_(input: Tensor):
Tensor {\n assert(\n input.dtype === 'complex64',\n () => `The dtype for tf.spectral.ifft() must be complex64`
+\n `but got
${input.dtype}.`);\n\n const inputs: IFFTInputs = {input};\n\n return ENGINE.runKernel(IFFT, inputs as {} as
NamedTensorMap);\n}\n\nexport const ifft = op({ifft_});\n", "/**\n *
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http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {Tensor, Tensor2D} from '../tensor';\nimport {complex} from '../complex';\nimport {concat} from
'../concat';\nimport {imag} from '../imag';\nimport {mul} from '../mul';\nimport {op} from '../operation';\nimport
{real} from '../real';\nimport {reshape} from '../reshape';\nimport {reverse} from '../reverse';\nimport {scalar} from
'../scalar';\nimport {slice} from '../slice';\n\nimport {ifft} from './ifft';\n\n/**\n * Inversed real value input fast
Fourier transform.\n *\n * Computes the 1-dimensional inversed discrete Fourier transform over the\n * inner-most
dimension of the real input.\n *\n * ```\n *\n const real = tf.tensor1d([1, 2, 3]);\n *\n const imag = tf.tensor1d([0, 0,
0]);\n *\n const x = tf.complex(real, imag);\n *\n * x.irfft().print();\n *\n ```\n *\n @param input The real value input to
compute an irfft over.\n *\n * @doc {heading: 'Operations', subheading: 'Spectral', namespace: 'spectral'}\n *\n
*\nfunction irfft_(input: Tensor): Tensor {\n const innerDimensionSize = input.shape[input.shape.length - 1];\n
const batch = input.size / innerDimensionSize;\n let ret: Tensor;\n\n if (innerDimensionSize <= 2) {\n const complexInput = reshape(input, [batch, innerDimensionSize]);\n ret =
ifft(complexInput);\n } else {\n // The length of unique components of the DFT of a real-valued signal\n // is 2 *
(input_len - 1)\n const outputShape = [batch, 2 * (innerDimensionSize - 1)];\n const realInput =
reshape(real(input), [batch, innerDimensionSize]);\n const imagInput = reshape(imag(input), [batch,
innerDimensionSize]);\n\n const realConjugate =\n reverse(slice(realInput, [0, 1], [batch, innerDimensionSize
- 2]), 1);\n const imagConjugate: Tensor2D = mul(\n reverse(slice(imagInput, [0, 1], [batch,
innerDimensionSize - 2]), 1),\n scalar(-1));\n\n const r = concat([realInput, realConjugate], 1);\n const i =
concat([imagInput, imagConjugate], 1);\n const complexInput =\n reshape(complex(r, i), [outputShape[0],

```



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outputShape[1]);\n ret = ifft(complexInput);\n }\n ret = real(ret);\n // reshape the result
if the input is 3D tensor.\n if (input.rank === 3 && input.shape[0] !== 0) {\n const temp = ret;\n const batch =
input.shape[0];\n ret = reshape(ret, [batch, ret.shape[0] / batch, ret.shape[1]]);\n temp.dispose();\n }\n return
ret;\n}\n\nexport const irfft = op({irfft_});\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
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=====
\n
*/\nimport {ENGINE} from './engine';\nimport {SplitV, SplitVAttrs, SplitVInputs} from './kernel_names';\nimport
{NamedAttrMap} from './kernel_registry';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from
'./tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from
'./types';\n\nimport {op} from './operation';\n\n/**\n * Splits a `tf.Tensor` into sub tensors.\n *\n * If
`numOrSizeSplits` is a number, splits `x` along dimension `axis` into `numOrSizeSplits` smaller tensors.\n *\n
Requires that `numOrSizeSplits` evenly divides `x.shape[axis]`.\n *\n * If `numOrSizeSplits` is a number array,
splits `x` into\n *\n `numOrSizeSplits.length` pieces. The shape of the `i`-th piece has the\n *\n same size as `x` except
along dimension `axis` where the size is\n *\n `numOrSizeSplits[i]`.\n *\n * ```\n * const x = tf.tensor2d([1, 2, 3, 4,
5, 6, 7, 8], [2, 4]);\n * const [a, b] = tf.split(x, 2, 1);\n * a.print();\n * b.print();\n *\n * const [c, d, e] = tf.split(x, [1, 2, 1], 1);\n * c.print();\n * d.print();\n * e.print();\n * ```\n *\n * @param x The input
tensor to split.\n *\n * @param numOrSizeSplits Either an integer indicating the number of\n *\n splits along the axis or
an array of integers containing the sizes of\n *\n each output tensor along the axis. If a number then it must evenly
divide\n *\n `x.shape[axis]`; otherwise the sum of sizes must match `x.shape[axis]`.\n *\n * Can contain one -1 indicating
that dimension is to be inferred.\n *\n * @param axis The dimension along which to split. Defaults to 0 (the first\n *\n
dim).\n *\n * @doc {heading: 'Tensors', subheading: 'Slicing and Joining'}\n */\nfunction split<T extends
Tensor>(\n x: Tensor|TensorLike, numOrSizeSplits: number[]|number, axis = 0): T[] {\n const $x =
convertToTensor(x, 'x', 'split');\n\n const inputs: SplitVInputs = {x: $x};\n const attr: SplitVAttrs =
{numOrSizeSplits, axis};\n\n return ENGINE.runKernel(\n SplitV, inputs as {} as
NamedTensorMap,\n attr as {} as NamedAttrMap) as {} as T[];\n}\n\nexport const split =
op({split_});\n", "/*\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
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on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
=====
\n
*/\nimport {Tensor} from './../tensor';\nimport {assert} from './../util';\nimport {complex} from
'./../complex';\nimport {concat} from './concat';\nimport {imag}
from './imag';\nimport {op} from './operation';\nimport {real} from './real';\nimport {reshape} from
'./reshape';\nimport {slice} from './slice';\nimport {split} from './split';\nimport {zeros} from './zeros';\nimport
{zerosLike} from './zeros_like';\n\nimport {fft} from './fft';\n\n/**\n * Real value input fast Fourier transform.\n *\n
* Computes the 1-dimensional discrete Fourier transform over the\n *\n inner-most dimension of the real input.\n *\n
* ```\n * const real = tf.tensor1d([1, 2, 3]);\n * const realRfft = real.rfft().print();\n * ```\n *\n * @param input The real value input
to compute an rfft over.\n *\n * @doc {heading: 'Operations', subheading: 'Spectral', namespace: 'spectral'}\n */\nfunction rfft_(input: Tensor, fftLength?: number): Tensor {\n assert(\n input.dtype === 'float32',\n () =>
`The dtype for rfft() must be real value but got ${input.dtype}`);\n\n let innerDimensionSize =

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input.shape[input.shape.length - 1]);
const batch = input.size / innerDimensionSize;

let adjustedInput: Tensor;
if (fftLength != null && fftLength < innerDimensionSize) {
 // Need to crop
 const begin = input.shape.map(v => 0);
 const size = input.shape.map(v => v);
 size[input.shape.length - 1] =
 fftLength;
 adjustedInput = slice(input, begin, size);
 innerDimensionSize = fftLength;
} else if (fftLength
 != null && fftLength > innerDimensionSize) {
 // Need to pad with zeros
 const zerosShape =
 input.shape.map(v => v);
 zerosShape[input.shape.length - 1] =
 fftLength - innerDimensionSize;
 adjustedInput = concat([input, zeros(zerosShape)],
 input.shape.length - 1);
 innerDimensionSize = fftLength;
} else {
 adjustedInput = input;
}

// Complement the input with zero imaginary numbers.
const zerosInput = zerosLike(adjustedInput);
const complexInput =
 reshape(complex(adjustedInput, zerosInput), [batch,
 innerDimensionSize]);
const ret = fft(complexInput);
// Exclude complex conjugations.
These conjugations are put symmetrically.
const half = Math.floor(innerDimensionSize / 2) + 1;
const realValues = real(ret);
const imagValues = imag(ret);
const realComplexConjugate = split(
 realValues, [half, innerDimensionSize - half],
 realValues.shape.length - 1);
const imagComplexConjugate = split(
 imagValues, [half, innerDimensionSize - half],
 imagValues.shape.length - 1);
const outputShape =
 adjustedInput.shape.slice();
outputShape[adjustedInput.shape.length - 1] = half;
return reshape(
 complex(realComplexConjugate[0], imagComplexConjugate[0]),
 outputShape);
}

export const rfft =
 op({rfft_});
"/**
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 * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.
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 * limitations under the License.
 */
=====
*/
import {ENGINE} from '../engine';
import {Sqrt, SqrtInputs} from '../kernel_names';
import {Tensor} from
 '../tensor';
import {NamedTensorMap} from '../tensor_types';
import {convertToTensor} from
 '../tensor_util_env';
import {TensorLike} from '../types';
import {op} from '../operation';

/**
 * Computes
 * square root of the input `tf.Tensor` element-wise: `y = sqrt(x)`
 * const x = tf.tensor1d([1, 2, 4, -1]);
 * x.sqrt().print(); // or tf.sqrt(x)
 * @param x The input tensor.
 * @doc {heading: 'Operations',
 subheading: 'Basic math'}
 */
function
 sqrt<T extends Tensor>(x: T|TensorLike): T {
 const $x = convertToTensor(x, 'x', 'sqrt');
 const inputs:
 SqrtInputs = {x: $x};
 return ENGINE.runKernel(Sqrt, inputs as { } as NamedTensorMap);
}

export const sqrt
 = op({sqrt_});
"/**
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 * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
 * implied.
 * See the License for the specific language governing permissions and
 * limitations under the
 * License.
 */
=====
*/
import {ENGINE} from '../engine';
import
 {SquaredDifference, SquaredDifferenceInputs} from
 '../kernel_names';
import {Tensor} from
 '../tensor';
import {NamedTensorMap} from
 '../tensor_types';
import {makeTypesMatch} from
 '../tensor_util';
import
 {convertToTensor} from
 '../tensor_util_env';
import {TensorLike} from
 '../types';
import
 {assertAndGetBroadcastShape} from
 '../broadcast_util';
import {op} from
 '../operation';

/**
 * Returns (a - b) *
 * (a - b) element-wise.
 * Supports broadcasting.
 * const a = tf.tensor1d([1, 4, 3, 16]);
 * const b =
 tf.tensor1d([1, 2, 9, 4]);
 * a.squaredDifference(b).print(); // or
 tf.squaredDifference(a, b)
 * Broadcast squared difference a with b.
 * const a = tf.tensor1d([2, 4, 6, 8]);
 * const b = tf.scalar(5);
 */

```

```
a.squaredDifference(b).print(); // or tf.squaredDifference(a, b)\n * ``\n *\n * @param a The first tensor.\n *\n * @param b The second tensor. Must have the same type as `a`.\n *\n * @doc {heading:\n * 'Operations', subheading: 'Arithmetic'}\n */\nfunction squaredDifference_<T extends Tensor>(\n a:\n Tensor|TensorLike, b: Tensor|TensorLike): T {\n let $a = convertToTensor(a, 'a', 'squaredDifference');\n let $b =\n convertToTensor(b, 'b', 'squaredDifference');\n [$a, $b] = makeTypesMatch($a, $b);\n\n assertAndGetBroadcastShape($a.shape, $b.shape);\n\n const inputs: SquaredDifferenceInputs = {a: $a, b: $b};\n\n const attrs = {};\n\n return ENGINE.runKernel(\n SquaredDifference, inputs as unknown as NamedTensorMap,\n attrs);\n}\n\nexport const squaredDifference = op({squaredDifference_});\n", "/*\n *\n * @license\n * Copyright 2020\n * Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you\n * may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed\n * under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF\n * ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n\n=====\n\n*/\n\nimport {Tensor} from '../tensor';\nimport {convertToTensor} from '../tensor_util_env';\nimport {TensorLike}\nfrom '../types';\nimport {squeezeShape} from './util';\nimport {op} from './operation';\nimport {reshape} from\n'./reshape';\n\n/**\n * Removes dimensions of size 1 from the shape of a `tf.Tensor`. \n *\n *js\n * const x =\n * tf.tensor([1, 2, 3, 4], [1, 1, 4]);\n * x.squeeze().print();\n *\n * ``\n *\n * @param x The input tensor to be squeezed.\n *\n * @param axis An optional list of numbers. If specified, only\n * squeezes the dimensions listed. The dimension\n * index starts at 0. It\n * is an error to squeeze a dimension that is not 1.\n *\n * @doc {heading:\n * 'Tensors', subheading: 'Transformations'}\n */\nfunction squeeze_<T extends Tensor>(x: Tensor|TensorLike, axis?:\nnumber[]): T {\n const $x = convertToTensor(x, 'x', 'squeeze');\n return reshape($x, squeezeShape($x.shape,\naxis).newShape) as T;\n}\n\nexport const squeeze = op({squeeze_});\n", "/*\n *\n * @license\n * Copyright 2020\n * Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you\n * may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed\n * under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\n * OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n * governing permissions and\n * limitations under the License.\n */\n\n=====\n\n*/\n\nimport {ENGINE} from '../engine';\nimport {Pack, PackAttrs, PackInputs} from '../kernel_names';\nimport\n{NamedAttrMap} from '../kernel_registry';\nimport {Tensor} from '../tensor';\nimport {NamedTensorMap} from\n'../tensor_types';\nimport {convertToTensorArray} from '../tensor_util_env';\nimport {TensorLike} from\n'../types';\nimport * as util from './util';\nimport {op} from './operation';\n\n/**\n * Stacks a list of rank-`R`\n * `tf.Tensor`s into one rank-`(R+1)` `tf.Tensor`. \n *\n *js\n * const a = tf.tensor1d([1, 2]);\n * const b =\n * tf.tensor1d([3, 4]);\n * const c = tf.tensor1d([5, 6]);\n * tf.stack([a, b, c]).print();\n *\n * ``\n *\n * @param tensors A\n * list of tensor objects with the same shape and dtype.\n *\n * @param axis The axis to stack along. Defaults to 0 (the first\n * dim).\n *\n * @doc {heading: 'Tensors', subheading: 'Slicing and Joining'}\n */\nfunction stack_<T extends\nTensor>(\n tensors: Array<T|TensorLike>, axis = 0): Tensor {\n const $tensors =\n convertToTensorArray(tensors, 'tensors', 'stack', 'string_or_numeric');\n\n util.assert(\n $tensors.length >= 1,\n () => 'Pass at least one tensor to tf.stack');\n\n if ($tensors.length > 0) {\n util.assert(\n axis <=\n $tensors[0].rank, () => 'Axis must be <= rank of the tensor');\n }\n\n const inputs: PackInputs = $tensors;\n const\nattrs: PackAttrs = {axis};\n\n return ENGINE.runKernel(\n Pack, inputs as {} as NamedTensorMap, attrs as {}\n as NamedAttrMap);\n}\n\nexport const stack = op({stack_});\n", "/*\n *\n * @license\n * Copyright 2018 Google\n * LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not\n * use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
```



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```

*\n\nimport
{Tensor1D} from '../tensor';\nimport {inferShape} from '../tensor_util_env';\nimport {TensorLike1D} from
../types';\nimport {DataType} from '../types';\nimport {assertNonNull} from '../util';\nimport {makeTensor} from
../tensor_ops_util';\n\n/**\n * Creates rank-1 `tf.Tensor` with the provided values, shape and dtype.\n * The
same functionality can be achieved with `tf.tensor`, but in general\n * we recommend using `tf.tensor1d` as it makes
the code more readable.\n *\n * ```js\n * tf.tensor1d([1, 2, 3]).print();\n *\n * @param values The values of
the tensor. Can be array of numbers,\n * or a `TypedArray`.\n * @param dtype The data type.\n *\n * @doc
{heading: 'Tensors', subheading: 'Creation'}\n */\nexport function tensor1d(values: TensorLike1D, dtype?:
DataType): Tensor1D {\n assertNonNull(values);\n const inferredShape = inferShape(values, dtype);\n if
(inferredShape.length !== 1) {\n throw new Error('tensor1d() requires values to be a flat/TypedArray');\n
 }\n const shape: number[] = null;\n return makeTensor(values, shape, inferredShape, dtype) as
Tensor1D;}\n\n"/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
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Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
```



```

The shape of the tensor. Optional. If not provided,\n * it is inferred from `values`.\n * @param dtype The data
type.\n * @doc {heading: 'Tensors', subheading: 'Creation'}\n * ^\nexport function tensor5d(\n values:
TensorLike5D, shape?: [number, number, number, number, number],\n
 dtype?: DataType): Tensor5D {\n assertNonNull(values);\n if (shape != null && shape.length !== 5) {\n throw
new Error('tensor5d() requires shape to have five numbers');\n }\n const inferredShape = inferShape(values,
dtype);\n if (inferredShape.length !== 5 && inferredShape.length !== 1) {\n throw new Error(\n 'tensor5d()
requires values to be ' +\n 'number[][][] or flat/TypedArray');\n }\n if (inferredShape.length === 1 &&
shape == null) {\n throw new Error(\n 'tensor5d() requires shape to be provided when `values` ' +\n 'are a
flat array');\n }\n return makeTensor(values, shape, inferredShape, dtype) as Tensor5D;\n}\n", "/*\n * @license\n
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`AS IS` BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n
 * See the License for the specific language governing permissions and\n * limitations under the License.\n *
=====
\n
*\n\nimport {Tensor6D} from './tensor';\nimport {inferShape} from './tensor_util_env';\nimport {TensorLike6D}
from './types';\nimport {DataType} from './types';\nimport {assertNonNull} from './util';\nimport {makeTensor}
from './tensor_ops_util';\n\n/**\n * Creates rank-6 `tf.Tensor` with the provided values, shape and dtype.\n * The
same functionality can be achieved with `tf.tensor`, but in general\n * we recommend using `tf.tensor6d` as it makes
the code more readable.\n * \n * ``js\n * // Pass a nested array.\n *
tf.tensor6d([[[[[[1],[2]],[[3],[4]]],[[5],[6]],[[7],[8]]]]]).print();\n
 * \n * ``js\n * // Pass a flat array and specify a shape.\n * tf.tensor6d([1, 2, 3, 4, 5, 6, 7, 8], [1, 1, 2, 2,
2, 1]).print();\n * \n * @param values The values of the tensor. Can be nested array of numbers,\n * or a flat
array, or a `TypedArray`.\n * @param shape The shape of the tensor. Optional. If not provided,\n * it is inferred
from `values`.\n * @param dtype The data type.\n * @doc {heading: 'Tensors', subheading: 'Creation'}\n
 * ^\nexport function tensor6d(\n values: TensorLike6D, \n shape?: [number, number, number, number, number,
number],\n dtype?: DataType): Tensor6D {\n assertNonNull(values);\n if (shape != null && shape.length !== 6)
{\n throw new Error('tensor6d() requires shape to have six numbers');\n }\n const inferredShape =
inferShape(values, dtype);\n if (inferredShape.length !== 6 && inferredShape.length !== 1) {\n throw new
Error(\n 'tensor6d() requires values to be number[][][] or ' +\n 'flat/TypedArray');\n }\n if
(inferredShape.length === 1 && shape == null) {\n throw new Error(\n 'tensor6d() requires shape to
be provided when `values` ' +\n 'are a flat array');\n }\n shape = shape ||\n inferredShape as [number,
number, number, number, number, number];\n return makeTensor(values, shape, inferredShape, dtype) as
Tensor6D;\n}\n", "/*\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the `License`);\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless
 required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an `AS IS` BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
=====
\n
*\n\nimport {ENGINE} from './engine';\nimport {TopK, TopKAttrs, TopKInputs} from './kernel_names';\nimport
{NamedAttrMap} from './kernel_registry';\nimport {Tensor} from './tensor';\nimport {NamedTensorMap} from
'./tensor_types';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from
'./types';\n\nimport {op} from './operation';\n\n/**\n * Finds the values and indices of the `k` largest entries along
the last\n * dimension.\n * \n * If the input is a vector (rank=1), finds the k largest entries in the vector\n * and
outputs their values and indices as vectors. Thus values[j] is the j-th\n * largest entry in input, and its index is

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indices[j].\n * For higher rank inputs, computes the top k entries along the last dimension.\n *\n * If two elements
are equal, the lower-index element appears first.\n *\n * ``js\n * const a = tf.tensor2d([[1, 5], [4, 3]]);\n * const
{ values,
indices } = tf.topk(a);\n * values.print();\n * indices.print();\n * ``\n * @param x 1-D or higher `tf.Tensor` with last
dimension being at least `k`.\n * @param k Number of top elements to look for along the last dimension.\n *
@param sorted If true, the resulting `k` elements will be sorted by the\n * values in descending order.\n *\n *
@doc {heading: 'Operations', subheading: 'Evaluation'}\n */\nfunction topk_<T extends Tensor>(\n x:
T|TensorLike, k = 1, sorted = true): { values: T, indices: T } {\n const $x = convertToTensor(x, 'x', 'topk');\n if
($x.rank === 0) {\n throw new Error('topk() expects the input to be of rank 1 or higher');\n }\n const lastDim =
$x.shape[$x.shape.length - 1];\n if (k > lastDim) {\n throw new Error(\n `k` passed to topk() must be <= the
last dimension (${lastDim})` +\n `but got ${k}`);\n }\n const inputs: TopKInputs = { x: $x;\n const attrs:
TopKAttrs = { k, sorted };\n const [values, indices] = ENGINE.runKernel(\n
TopK, inputs as { } as NamedTensorMap, attrs as { } as NamedAttrMap);\n return { values, indices } as
{ values: T, indices: T };\n}\n\nexport const topk = op({topk_});\n", "/*\n * @license\n * Copyright 2020 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not
use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
\n
*/\n\nimport { Tensor } from '../tensor';\nimport { DataType, Rank, ShapeMap } from '../types';\nimport
{ buffer } from '../buffer';\nimport { op } from '../operation';\nimport { MPRandGauss } from '../rand_util';\n\n/*\n *
Creates a `tf.Tensor` with values sampled from a truncated normal\n * distribution.\n *\n * ``js\n *
tf.truncatedNormal([2, 2]).print();\n * ``\n *\n * The generated values follow a normal distribution with specified
mean and\n * standard deviation, except that values whose magnitude is more than 2\n * standard deviations from
the mean are dropped and re-picked.\n *\n * @param shape An array of integers defining the output tensor shape.\n
* @param mean The mean of the normal distribution.\n * @param stdDev The standard deviation of the normal
distribution.\n * @param dtype The data type of the output tensor.\n * @param seed The seed for the random
number generator.\n *\n * @doc {heading: 'Tensors', subheading: 'Creation'}\n */\nfunction truncatedNormal_<R
extends Rank>(\n shape: ShapeMap[R], mean = 0, stdDev = 1, dtype?: 'float32'|'int32',\n seed?: number):
Tensor<R>\n {\n if (dtype != null && (dtype as DataType) === 'bool') {\n throw new Error(`Unsupported data type $ { dtype
}`);\n }\n const randGauss =\n new MPRandGauss(mean, stdDev, dtype, true /* truncated */, seed);\n const res
= buffer(shape, dtype);\n for (let i = 0; i < res.values.length; i++) {\n res.values[i] = randGauss.nextValue();\n }\n
return res.toTensor();\n }\n\nexport const truncatedNormal = op({truncatedNormal_});\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
"License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
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agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the
specific language governing permissions and\n * limitations under the License.\n *
=====
\n
*/\n\nimport { ENGINE } from '../engine';\nimport { Unique, UniqueAttrs, UniqueInputs } from
'../kernel_names';\nimport { NamedAttrMap } from '../kernel_registry';\nimport { Tensor, Tensor1D } from
'../tensor';\nimport { NamedTensorMap } from '../tensor_types';\nimport { convertToTensor } from
'../tensor_util_env';\nimport { TensorLike } from '../types';\nimport { assert } from '../util';\n\nimport { op } from

```



```

'./operation';\n\n/**\n * Finds unique elements along an axis of a tensor.\n *\n * It returns a tensor `values`
containing all of the unique elements along the\n * `axis` of the given tensor `x` in the same order that they occur
along the\n * `axis` in `x`; `x` does not need to be sorted. It also returns a tensor\n * `indices` the same size as the
number of the elements in `x` along the `axis`\n * dimension. It contains the index in the
unique output `values`.\n *\n * ```js\n * // A 1-D tensor\n * const a = tf.tensor1d([1, 1, 2, 4, 4, 7, 8, 8]);\n * const
{ values, indices } = tf.unique(a);\n * values.print(); // [1, 2, 4, 7, 8,]\n * indices.print(); // [0, 0, 1, 2, 2, 3, 4, 4]\n
* ```\n *\n * ```js\n * // A 2-D tensor with axis=0\n * /\n * // 'a' is: [[1, 0, 0],\n * // [1, 0, 0],\n * // [2, 0,
0]]\n * const a = tf.tensor2d([[1, 0, 0], [1, 0, 0], [2, 0, 0]]);\n * const { values, indices } = tf.unique(a, 0)\n *
values.print(); // [[1, 0, 0],\n * // [2, 0, 0]]\n * indices.print(); // [0, 0, 1]\n * ```\n *\n * ```js\n * // A 2-
D tensor with axis=1\n * /\n * // 'a' is: [[1, 0, 0],\n * // [1, 0, 0],\n * // [2, 0, 0]]\n * const a =
tf.tensor2d([[1, 0, 0], [1, 0, 0], [2, 0, 0]]);\n * const { values, indices } = tf.unique(a, 1)\n * values.print(); // [[1, 0],\n
* // [1, 0],\n * // [2, 0]]\n * indices.print(); // [0, 1, 1]\n
* ```\n * @param x A tensor (int32, string, bool).\n * @param axis The axis of the tensor to find the unique
elements.\n * @returns [uniqueElements, indices] (see above for details)\n *\n * @doc {heading: 'Operations',
subheading: 'Evaluation'}\n */\nfunction unique_<T extends Tensor>(\n x: T|TensorLike, axis = 0): { values: T,
indices: Tensor1D } {\n const $x = convertToTensor(x, 'x', 'unique', 'string_or_numeric');\n assert($x.rank > 0, ()
=> "The input tensor must be at least 1D");\n const inputs: UniqueInputs = {x: $x};\n const attrs: UniqueAttrs =
{axis};\n const [values, indices] = ENGINE.runKernel(\n\n Unique, inputs as { } as
NamedTensorMap,\n\n attrs as { } as NamedAttrMap) as [T, Tensor1D];\n return { values,
indices};\n}\n\nexport const unique = op({unique_});\n", "/*\n * @license\n * Copyright 2020 Google LLC. All
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not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n */
=====
\n
*/\n\nimport {ENGINE} from './engine';\nimport {UnsortedSegmentSum, UnsortedSegmentSumAttrs,
UnsortedSegmentSumInputs} from './kernel_names';\nimport {NamedAttrMap} from './kernel_registry';\nimport
{Tensor, Tensor1D} from './tensor';\nimport {NamedTensorMap} from './tensor_types';\nimport
{convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\nimport {assert, isInt} from
'./util';\n\nimport
{op} from './operation';\n\n/**\n * Computes the sum along segments of a `tf.Tensor`.\n *\n * ```js\n * const x =
tf.tensor1d([1, 2, 3, 4]);\n * const segmentIds = tf.tensor1d([1, 2, 0, 1], 'int32');\n * const numSegments = 3;\n *\n * x.unsortedSegmentSum(segmentIds, numSegments).print()\n * //or tf.unsortedSegmentSum(x, segmentIds,
numSegments)\n * ```\n *\n * @param x The `tf.Tensor` that will be summed along its segments.\n * @param
segmentIds A `tf.Tensor1D` whose rank is equal to the rank of `x`'s\n * dimension along the `axis`. Maps each
element of `x` to a segment.\n * @param numSegments The number of distinct `segmentIds`.\n *\n * @doc
{heading: 'Operations', subheading: 'Segment'}\n */\nfunction unsortedSegmentSum_<T extends Tensor>(\n x:
T|TensorLike, segmentIds: Tensor1D|TensorLike, numSegments: number): T {\n const $x = convertToTensor(x, 'x',
'unsortedSegmentSum');\n const $segmentIds =\n convertToTensor(segmentIds, 'segmentIds',
'unsortedSegmentSum', 'int32');\n assert(isInt(numSegments),
 () => 'numSegments must be of dtype int');\n const inputs: UnsortedSegmentSumInputs = {x: $x, segmentIds:
$segmentIds};\n const attrs: UnsortedSegmentSumAttrs = {numSegments};\n return ENGINE.runKernel(\n
UnsortedSegmentSum, inputs as { } as NamedTensorMap,\n\n attrs as { } as NamedAttrMap);\n}\n\nexport const
unsortedSegmentSum = op({unsortedSegmentSum_});\n", "/*\n * @license\n * Copyright 2020 Google LLC. All
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file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n */

```

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```
=====
*
*import {ENGINE} from '../engine';import {Unpack, UnpackAttrs, UnpackInputs} from
'../kernel_names';import {NamedAttrMap} from '../kernel_registry';import {Tensor} from '../tensor';import
{NamedTensorMap} from '../tensor_types';import {convertToTensor} from '../tensor_util_env';import
{TensorLike} from '../types';import * as util from '../util';import {op} from '../operation';
`tf.Tensor` of rank-`R` into a list of rank-`(R-1)` `tf.Tensor`s.
*`js` const a = tf.tensor2d([1, 2, 3, 4], [2, 2]);
*tf.unstack(a).forEach(tensor => tensor.print());
*`@param x` A tensor object.
*`@param axis` The axis to unstack along. Defaults to 0 (the first dim).
*`@doc` {heading: 'Tensors', subheading: 'Slicing and Joining'}
*function unstack_(x: Tensor|TensorLike, axis = 0): Tensor[] {
 const $x = convertToTensor(x, 'x', 'unstack', 'string_or_numeric');
 util.assert((axis >= -$x.shape.length && axis < $x.shape.length, () =>
 `Axis = ${axis} is not in [-${$x.shape.length}, ${$x.shape.length}]`));
 const inputs: UnpackInputs = {value: $x};
 const attrs: UnpackAttrs = {axis};
 return ENGINE.runKernel(Unpack, inputs as { } as NamedTensorMap, attrs as { } as NamedAttrMap);
}
*next export const unstack = op({unstack_});
*"/**
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* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.
* See the License for the specific language governing permissions and
* limitations under the License.
*
=====
```

```

*
*import {ENGINE} from '../engine';import {Tensor, Variable} from '../tensor';import {DataType, Rank}
from '../types';
*`js`
* Creates a new variable with the provided initial value.
*`const x = tf.variable(tf.tensor([1, 2, 3]));`
*`x.assign(tf.tensor([4, 5, 6]));`
*`x.print();`
*`@param initialValue` Initial value for the tensor.
*`@param trainable` If true, optimizers are allowed to update it.
*`@param name` Name of the variable. Defaults to a unique id.
*`@param dtype` If set, initialValue will be converted to the given type.
*`@doc` {heading: 'Tensors', subheading: 'Creation'}
*function variable<R extends Rank>(initialValue: Tensor<R>, trainable = true, name?: string, dtype?: DataType): Variable<R> {
 return ENGINE.makeVariable(initialValue, trainable, name, dtype) as Variable<R>;
}
*"/**
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* distributed under the License is distributed on an "AS IS" BASIS,
* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.
* See the License for the specific language governing permissions and
* limitations under the License.
*
=====
```

```

*
*import {buffer} from '../ops/buffer';import {Tensor2D} from '../tensor';import {TypedArray} from '../types';
*function whereImpl(condShape: number[], condVals: TypedArray): Tensor2D {
 const indices = [];
 for (let i = 0; i < condVals.length; i++) {
 if (condVals[i]) {
 indices.push(i);
 }
 }
 const inBuffer = buffer(condShape, 'int32');
 const out = buffer([indices.length, condShape.length], 'int32');
 for (let i = 0; i < indices.length; i++) {
 const loc = inBuffer.indexToLoc(indices[i]);
 const offset = i * condShape.length;
 out.values.set(loc, offset);
 }
 return out.toTensor() as Tensor2D;
}
*"/**
* @license
* Copyright 2020
*
=====
```

```

*
*`js`
* An implementation of the Where kernel shared between cpu and webgl
*import {buffer} from
'../ops/buffer';import {Tensor2D} from
'../tensor';import {TypedArray} from
'../types';
*function whereImpl(condShape: number[], condVals: TypedArray): Tensor2D {
 const indices = [];
 for (let i = 0; i < condVals.length; i++) {
 if (condVals[i]) {
 indices.push(i);
 }
 }
 const inBuffer = buffer(condShape, 'int32');
 const out = buffer([indices.length, condShape.length], 'int32');
 for (let i = 0; i < indices.length; i++) {
 const loc = inBuffer.indexToLoc(indices[i]);
 const offset = i * condShape.length;
 out.values.set(loc, offset);
 }
 return out.toTensor() as Tensor2D;
}
*"/**
* @license
* Copyright 2020
*
=====
```

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```
=====
*\nimport {whereImpl} from '../backends/where_impl';\nimport {Tensor, Tensor2D} from '../tensor';\nimport {convertToTensor} from '../tensor_util_env';\nimport {TensorLike} from '../types';\n\n/**\n * Returns the coordinates of true elements of condition.\n *\n * The coordinates are returned in a 2-D tensor where the first dimension (rows)\n * represents the number of true elements, and the second dimension (columns)\n * represents the coordinates of the true elements. Keep in mind, the shape of\n * the output tensor can vary depending on how many true values there are in\n * input. Indices are output in row-major order. The resulting tensor has the\n * shape [numTrueElems, condition.rank]`.\n *\n * This is analogous to calling the\n * python `tf.where(cond)` without an x or y.\n *\n * ```js\n * const cond = tf.tensor1d([false, false, true], 'bool');\n * const result = await tf.whereAsync(cond);\n * result.print();\n * ```\n *\n * @doc {heading: 'Operations', subheading: 'Logical'}\n */\n\nasync function whereAsync_(condition: Tensor|TensorLike): Promise<Tensor2D> {\n const $condition =\n convertToTensor(condition, 'condition', 'whereAsync', 'bool');\n const vals = await $condition.data();\n const res = whereImpl($condition.shape, vals);\n if (condition !== $condition) {\n $condition.dispose();\n }\n return res;\n}\n\nexport const whereAsync = whereAsync_;\n\n", "*/\n\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====
*\n\nimport {Tensor} from '../tensor';\nimport {convertToTensor} from '../tensor_util_env';\nimport {TensorLike} from '../types';\nimport * as util from '../util';\n\nimport {gather} from './gather';\nimport {reshape} from './reshape';\nimport {squeeze} from './squeeze';\nimport {whereAsync} from './where_async';\n\n/**\n * Apply boolean mask to tensor.\n *\n * ```js\n * const tensor = tf.tensor2d([1, 2, 3, 4, 5, 6], [3, 2]);\n * const mask = tf.tensor1d([1, 0, 1], 'bool');\n * const result = await tf.booleanMaskAsync(tensor, mask);\n * result.print();\n * ```\n *\n * @param tensor N-D tensor.\n * @param mask K-D boolean tensor, K <= N and K must be known statically.\n * @param axis A 0-D int Tensor representing the axis in tensor to mask from.\n * By default, axis is 0 which will mask from the first dimension.\n * Otherwise K + axis <= N.\n *\n * @doc {heading: 'Tensors', subheading: 'Slicing and Joining'}\n */\n\nasync function booleanMaskAsync_(\n tensor: Tensor|TensorLike, mask: Tensor|TensorLike, axis?: number): Promise<Tensor> {\n const $tensor = convertToTensor(tensor, 'tensor', 'boolMask');\n const $mask = convertToTensor(mask, 'mask', 'boolMask', 'bool');\n const axisFrom = axis == null ? 0 : axis;\n const maskDim = $mask.rank;\n const tensorShape = $tensor.shape;\n util.assert(maskDim > 0, () => 'mask cannot be scalar');\n util.assertShapesMatch(\n tensorShape.slice(axisFrom, axisFrom + maskDim), $mask.shape,\n `mask's shape must match the first K dimensions of tensor's shape,`);\n let leadingSize = 1;\n for (let i = axisFrom; i < axisFrom + maskDim; i++)\n {\n leadingSize *= tensorShape[i];\n }\n const targetTensorShape =\n tensorShape.slice(0, axisFrom)\n .concat([leadingSize, tensorShape.slice(axisFrom + maskDim)]);\n const reshapedTensor = reshape($tensor, targetTensorShape);\n const reshapedMask = reshape($mask, [-1]);\n const positivePositions = await whereAsync(reshapedMask);\n const indices = squeeze(positivePositions, [1]);\n const res = gather(reshapedTensor, indices, axisFrom);\n // Ensure no memory leak.\n if (tensor !== $tensor) {\n
```

```

$tensor.dispose();\n }\n if (mask !== $mask) {\n $mask.dispose();\n }\n indices.dispose();\n
reshapedTensor.dispose();\n reshapedMask.dispose();\n positivePositions.dispose();\n\n return res;\n}\n\nexport
const booleanMaskAsync = booleanMaskAsync;\n", "/*\n * @license\n * Copyright 2018 Google LLC. All Rights
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"AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n
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=====
*\n\nimport {Tensor} from './tensor';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike}
from './types';\nimport {parseAxisParam} from './util';\n\nimport {abs} from './abs';\nimport * as axis_util from
 './axis_util';\nimport {max} from './max';\nimport {min} from './min';\nimport {op} from './operation';\nimport
 {pow} from './pow';\nimport {reshape} from './reshape';\nimport {scalar} from './scalar';\nimport {sqrt} from
 './sqrt';\nimport {square} from
 './square';\nimport {sum} from './sum';\n\n/**\n * Computes the norm of scalar, vectors, and matrices.\n * This
function can compute several different vector norms (the 1-norm, the\n * Euclidean or 2-norm, the inf-norm, and in
general the p-norm for p > 0)\n * and matrix norms (Frobenius, 1-norm, and inf-norm).\n *\n * const x =
tf.tensor1d([1, 2, 3, 4]);\n *\n * x.norm().print(); // or tf.norm(x)\n *\n * @param x The input array.\n *
@param ord Optional. Order of the norm. Supported norm types are\n * following:\n *\n * | ord | norm for
matrices | norm for vectors\n * |-----|-----|-----|\n * |'euclidean'|Frobenius
norm |2-norm\n * |'fro' |Frobenius norm|t |\n * |Infinity |max(sum(abs(x), axis=1))\n
|max(abs(x))\n * |-Infinity |min(sum(abs(x), axis=1)) |min(abs(x))\n * |1 |max(sum(abs(x), axis=0))\n
|sum(abs(x))\n * |2 |
|sum(abs(x)^2)^1/2*\n *\n * @param axis Optional. If axis is null (the default), the input is\n * considered a vector
and a single vector norm is computed over the entire\n * set of values in the Tensor, i.e. norm(x, ord) is equivalent\n
 * to norm(x.reshape([-1]), ord). If axis is a integer, the input\n * is considered a batch of vectors, and axis
determines the axis in x\n * over which to compute vector norms. If axis is a 2-tuple of integer it is\n * considered a
batch of matrices and axis determines the axes in NDArray\n * over which to compute a matrix norm.\n *\n * @param
keepDims Optional. If true, the norm have the same dimensionality\n * as the input.\n *\n * @doc {heading:
'Operations', subheading: 'Matrices'}\n\nfunction norm_(\n x: Tensor|TensorLike, ord: number|'euclidean'|'fro' =
'euclidean',\n axis: number|number[] = null, keepDims = false): Tensor {\n x = convertToTensor(x, 'x',
'norm');\n const norm = normImpl(x, ord, axis);\n let keepDimsShape = norm.shape;\n
 if (keepDims) {\n const axes = parseAxisParam(axis, x.shape);\n keepDimsShape =
axis_util.expandShapeToKeepDim(norm.shape, axes);\n }\n return reshape(norm,
keepDimsShape);\n}\n\nfunction normImpl(\n x: Tensor, p: number|string, axis: number|number[] = null): Tensor
{\n if (x.rank === 0) {\n return abs(x);\n }\n // consider vector when no axis is specified\n if (x.rank !== 1 &&
axis === null) {\n return normImpl(reshape(x, [-1]), p, axis);\n }\n // vector\n if (x.rank === 1 || typeof axis
=== 'number') {\n Array.isArray(axis) && axis.length === 1 {\n if (p === 1) {\n return sum(abs(x), axis);\n
 }\n if (p === Infinity) {\n return max(abs(x), axis);\n }\n if (p === -Infinity) {\n return min(abs(x),
axis);\n }\n if (p === 'euclidean' || p === 2) {\n // norm(x, 2) = sum(abs(xi) ^ 2) ^ 1/2\n return
sqrt(sum(pow(abs(x), scalar(2, 'int32')), axis));\n }\n throw new Error(`Error in norm: invalid ord value:
${p}`);\n }\n // matrix (assumption axis[0] < axis[1])\n if (Array.isArray(axis) && axis.length === 2) {\n if (p
=== 1) {\n return max(sum(abs(x), axis[0]), axis[1] - 1);\n }\n if (p === Infinity) {\n return
max(sum(abs(x), axis[1]), axis[0]);\n }\n if (p === -Infinity) {\n return min(sum(abs(x), axis[1]), axis[0]);\n
 }\n if (p === 'fro' || p === 'euclidean') {\n // norm(x) = sqrt(sum(pow(x, 2)))\n return sqrt(sum(square(x),
axis));\n }\n throw new Error(`Error in norm: invalid ord value: ${p}`);\n }\n throw new Error(`Error in
norm: invalid axis: ${axis}`);\n }\n}\n\nexport const norm = op({norm_});\n", "/*\n * @license\n * Copyright 2018

```

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```
=====
*\n\nimport {Scalar, Tensor} from '../tensor';\nimport {assertTypesMatch} from '../tensor_util';\nimport {convertToTensor} from '../tensor_util_env';\nimport {TensorLike} from '../types';\nimport * as util from '../util';\n\nimport {add} from './add';\nimport {div} from './div';\nimport {mul} from './mul';\nimport {op} from './operation';\nimport {pow} from './pow';\nimport {scalar} from './scalar';\nimport {sub} from './sub';\n\n/**\n * Compute the moving average of a variable.\n * \n * Without zeroDebias, the moving average operation is defined by:\n * $v += \delta$ where $\delta = (1 - \text{decay}) * (x - v)$ \n * \n * With zeroDebias (default), the δ term is scaled to debias the effect of the (assumed) zero-initialization of v . $\delta /= (1 - \text{decay}^{\text{step}})$ \n * \n * For more details on the zero-debiasing algorithm, see: https://arxiv.org/abs/1412.6980\n * \n * Note that this function is completely stateless and does not keep track of step count. The step count needs to be maintained by the caller and passed in as `step`.\n * \n * @param v The current moving average value.\n * @param x New input value, must have the same shape and dtype as `v`.\n * @param decay The decay factor. Typical values are 0.95 and 0.99.\n * @param step Step count.\n * @param zeroDebias: Whether zeroDebias is to be performed (default: `true`).\n * @returns The new moving average value.\n * \n * @doc {heading: 'Operations', subheading: 'Moving Average'}\n */\nfunction movingAverage<T extends Tensor>(\n v: T|TensorLike, x: T|TensorLike, decay: number|Scalar, step?: number|Scalar, zeroDebias = true): T {\n const $v = convertToTensor(v, 'v', 'movingAverage');\n const $x = convertToTensor(x, 'x', 'movingAverage');\n const $decay = convertToTensor(decay, 'decay', 'movingAverage');\n assertTypesMatch($v, $x);\n util.assert(\n util.arraysEqual($v.shape, $x.shape), () => 'Shape mismatch in v and x');\n const one = scalar(1);\n const oneMinusDecay = sub(one, $decay);\n let update = mul(sub($x, $v), oneMinusDecay);\n if (zeroDebias) {\n util.assert(\n step != null, () => 'When using zeroDebias: true, step is required.);\n const $step = convertToTensor(step, 'step', 'movingAverage');\n update = div(update, sub(one, pow($decay, $step)));\n }\n return add($v, update);\n}\n\nexport const movingAverage = op({movingAverage_});\n\n/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====
*\n\nimport {ENGINE} from '../engine';\nimport {ScatterNd, ScatterNdAttrs, ScatterNdInputs} from '../kernel_names';\nimport {NamedAttrMap} from '../kernel_registry';\nimport {Tensor} from '../tensor';\nimport {NamedTensorMap} from '../tensor_types';\nimport {convertToTensor} from '../tensor_util_env';\nimport {Rank, ShapeMap, TensorLike} from '../types';\nimport {op} from './operation';\nimport * as scatter_nd_util from './scatter_nd_util';\n\n/**\n * Creates a new tensor by applying sparse updates to individual values or slices within a zero tensor of the given shape tensor according to indices. This operator is the inverse of the `tf.gatherND` operator which extracts values or slices from a given tensor.\n * \n * $\text{const indices} = \text{tf.tensor2d}([4, 3, 1, 7], [4, 1], 'int32');$ \n * $\text{const updates} = \text{tf.tensor1d}([9, 10, 11, 12]);$ \n * $\text{const shape} = [8];$ \n * $\text{tf.scatterND}(\text{indices}, \text{updates}, \text{shape}).\text{print()} // [0, 11, 0, 10, 9, 0, 0, 12]$ \n * \n * @param indices The tensor contains the indices into the output tensor.\n * @param updates The tensor contains the value for the indices.\n * @param shape: The shape of the output tensor.\n * \n * @doc
```

```
{heading: 'Operations', subheading: 'Slicing and Joining'}\n *\nfunction scatterND<R extends Rank>(\n indices: Tensor|TensorLike, updates: Tensor|TensorLike,\n shape: ShapeMap[R]): Tensor<R> {\n const $indices =\n convertToTensor(indices, 'indices', 'scatterND', 'int32');\n const $updates\n = convertToTensor(updates, 'updates', 'scatterND');\n scatter_nd_util.validateInput($updates, $indices, shape);\n\n const inputs: ScatterNdInputs = {indices: $indices, updates: $updates};\n const attrs: ScatterNdAttrs = {shape};\n\n // tslint:disable-next-line: no-unnecessary-type-assertion\n return ENGINE.runKernel(\n ScatterNd, inputs\n as {} as NamedTensorMap,\n attrs as {} as NamedAttrMap) as Tensor<R>;\n}\n\nexport const scatterND =\n op({scatterND});\n\n"/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under\n the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the\n License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed\n on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express\n or implied.\n * See the License for the specific language governing permissions and\n * limitations under the\n License.\n */
```

```
=====\n\nimport {Tensor} from '../tensor';\n\n/**\n * Validate sparseToDense inputs.\n *\n * @param sparseIndices A 0-D, 1-D, or 2-D Tensor of type int32.\n * sparseIndices[i] contains the complete index where sparseValues[i] will\n be\n * placed.\n * @param sparseValues A 0-D or 1-D Tensor. Values\n * corresponding to each row of\n sparseIndices, or a scalar value to be used for\n * all sparse indices.\n * @param outputShape number[]. Shape of\n the dense output tensor.\n * @param validateIndices boolean. indice validation is not supported, error\n * will be\n thrown if it is set.\n */\nexport function validateInput(\n sparseIndices: Tensor, sparseValues: Tensor,\n outputShape: number[],\n defaultValues: Tensor) {\n if (sparseIndices.dtype !== 'int32') {\n throw new Error(\n 'tf.sparseToDense()\n expects the indices to be int32 type,' +\n ` but the dtype was ${sparseIndices.dtype}.`);\n }\n if\n (sparseIndices.rank > 2) {\n throw new Error(\n 'sparseIndices should be a scalar, vector, or matrix,' +\n ` but got shape ${sparseIndices.shape}.`);\n }\n const numElems = sparseIndices.rank > 0 ? sparseIndices.shape[0]\n : 1;\n const numDims = sparseIndices.rank > 1 ? sparseIndices.shape[1] : 1;\n if (outputShape.length !==\n numDims) {\n throw new Error(\n 'outputShape has incorrect number of elements,' +\n ` ${outputShape.length}, should be: ${numDims}.`);\n }\n const numValues = sparseValues.size;\n if\n (!(sparseValues.rank === 0 ||\n sparseValues.rank === 1 && numValues === numElems)) {\n throw new\n Error(\n 'sparseValues has incorrect shape ' +\n ` ${sparseValues.shape}, should be [] or\n [${numElems}]`);\n }\n if (sparseValues.dtype !== defaultValues.dtype) {\n throw new\n Error('sparseValues.dtype\n must match defaultValues.dtype');\n }\n}\n\n"/**\n * @license\n * Copyright 2018 Google LLC. All Rights\n Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file\n except in compliance with the License.\n * You may obtain a copy of the License at\n *\n http://www.apache.org/licenses/LICENSE-2.0\n *\n Unless required by applicable law or agreed to in writing,\n software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES\n OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n governing permissions and\n * limitations under the License.\n */
```

```
=====\n\nimport {ENGINE} from '../engine';\nimport {SparseToDense, SparseToDenseAttrs, SparseToDenseInputs}\n from '../kernel_names';\nimport {NamedAttrMap} from '../kernel_registry';\nimport * as sparse_to_dense from\n '../ops/sparse_to_dense_util';\nimport\n {Scalar, Tensor} from '../tensor';\nimport {NamedTensorMap} from '../tensor_types';\nimport {convertToTensor}\n from '../tensor_util_env';\nimport {Rank, ScalarLike, ShapeMap, TensorLike} from '../types';\nimport {op} from\n '../operation';\n\n/**\n * Converts a sparse representation into a dense tensor.\n *\n * Builds an array dense with\n shape outputShape such that:\n *\n * // If sparseIndices is scalar\n * dense[i] = (i === sparseIndices ? sparseValues :
```

```

defaultValue)\n * // If sparseIndices is a vector, then for each i\n * dense[sparseIndices[i]] = sparseValues[i]\n
*\n * // If sparseIndices is an n by d matrix, then for each i in [0, n)\n * dense[sparseIndices[i][0], ...,
sparseIndices[i][d-1]] = sparseValues[i]\n * All other values in dense are set to defaultValue. If sparseValues is a\n *
scalar, all sparse indices are set to this single value.\n *\n * If indices are repeated the final value is summed over all
values for those\n * indices.\n *\n * ```\n
* const indices = tf.tensor1d([4, 5, 6, 1, 2, 3], 'int32');\n * const values = tf.tensor1d([10, 11, 12, 13, 14, 15],
'float32');\n * const shape = [8];\n * tf.sparseToDense(indices, values, shape).print();\n * ```\n *\n * @param
sparseIndices A 0-D, 1-D, or 2-D Tensor of type int32.\n * sparseIndices[i] contains the complete index where
sparseValues[i] will be\n * placed.\n * @param sparseValues A 0-D or 1-D Tensor. Values\n * corresponding to
each row of sparseIndices, or a scalar value to be used for\n * all sparse indices.\n * @param outputShape Shape of
the dense output tensor. the type is inferred.\n * @param defaultValue Scalar. Value to set for indices not specified
in\n * sparseIndices. Defaults to zero.\n *\n * @doc {heading: 'Operations', subheading: 'Normalization'}\n
*\nfunction sparseToDense<R extends Rank>(\n sparseIndices: Tensor|TensorLike, sparseValues:
Tensor|TensorLike,\n outputShape: ShapeMap[R], defaultValue: Scalar|ScalarLike = 0): Tensor<R> {\n const
$sparseIndices =\n convertToTensor(sparseIndices, 'sparseIndices', 'sparseToDense', 'int32');\n const
$sparseValues =\n convertToTensor(sparseValues, 'sparseValues', 'sparseToDense');\n const $defaultValue =
convertToTensor(\n defaultValue, 'defaultValue', 'sparseToDense', $sparseValues.dtype);\n\n sparse_to_dense.validateInput(\n $sparseIndices, $sparseValues, outputShape, $defaultValue);\n\n const inputs:
SparseToDenseInputs = {\n sparseIndices: $sparseIndices,\n sparseValues: $sparseValues,\n defaultValue:
$defaultValue\n };\n\n const attrs: SparseToDenseAttrs = {outputShape};\n\n return ENGINE.runKernel(\n SparseToDense, inputs as { } as NamedTensorMap,\n attrs as { } as NamedAttrMap);\n}\n\nexport const
sparseToDense = op({sparseToDense_});\n", "/*\n * @license\n * Copyright 2018 Google LLC. All Rights
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distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n *
=====
*\nimport {ENGINE} from '../engine';\nimport {GatherNd, GatherNdInputs} from '../kernel_names';\nimport
{Tensor} from '../tensor';\nimport {NamedTensorMap} from '../tensor_types';\nimport {convertToTensor} from
'../tensor_util_env';\nimport {TensorLike} from '../types';\nimport {op} from './operation';\n\n/*\n * Gather slices
from input tensor into a Tensor with shape specified by\n * `indices`.\n *\n * `indices` is an K-dimensional integer
tensor, best thought of as
a\n * (K-1)-dimensional tensor of indices into input, where each element defines a\n * slice of input:\n *
output[\\(i_0, ..., i_{K-2}\\)] = input[indices[\\(i_0, ..., i_{K-2}\\)]]\n *\n * Whereas in `tf.gather`, `indices`
defines slices into the first dimension of\n * input, in `tf.gatherND`, `indices` defines slices into the first N
dimensions\n * of input, where N = indices.shape[-1].\n *\n * The last dimension of indices can be at most the rank
of input:\n * indices.shape[-1] <= input.rank\n *\n * The last dimension of `indices` corresponds to elements\n * (if
indices.shape[-1] == input.rank) or slices\n * (if indices.shape[-1] < input.rank) along dimension indices.shape[-1]
of\n * input.\n * The output tensor has shape\n * indices.shape[-1] + input.shape[indices.shape[-1]]\n *\n * Note
that on CPU, if an out of bound index is found, an error is returned. On\n * GPU, if an out of bound index is found,
a 0 is stored in the corresponding\n * output value.\n *\n * ```\n
const indices = tf.tensor2d([0, 1, 1, 0], [2,2], 'int32');\n * const input = tf.tensor2d([9, 10, 11, 12], [2, 2]);\n *
tf.gatherND(input, indices).print() // [10, 11]\n * ```\n *\n * @param x The tensor from which to gather values.\n *
@param indices Index tensor, must be of type int32.\n *\n * @doc {heading: 'Operations', subheading: 'Slicing and
Joining'}\n *\nfunction gatherND_(x: Tensor|TensorLike, indices: Tensor|TensorLike): Tensor {\n const $indices =

```

```

convertToTensor(indices, 'indices', 'gatherND', 'int32');\n const $x = convertToTensor(x, 'x', 'gatherND');\n\n const
inputs: GatherNdInputs = {params: $x, indices: $indices};\n\n return ENGINE.runKernel(GatherNd, inputs as { } as
NamedTensorMap);\n}\n\nexport const gatherND = op({gatherND_});\n", "/*\n * @license\n * Copyright 2019
Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you
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agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====
\n
*\n\nimport {Tensor} from './tensor';\nimport * as util from './util';\n\n/**\n * Normalize noise shape based on
provided tensor and noise shape.\n * \n * @param x Tensor.\n * @param noiseShape The shape for the randomly
generated keep/drop flags, as\n * an array of numbers. Optional.\n * @returns Normalized noise shape.\n
*\n\nexport function getNoiseShape(x: Tensor, noiseShape?: number[]): number[] {\n if (noiseShape == null) {\n
return x.shape.slice();\n }\n if (util.arraysEqual(x.shape, noiseShape))\n {\n return noiseShape;\n }\n if (x.shape.length === noiseShape.length) {\n const newDimension: number[] =
[];\n for (let i = 0; i < x.shape.length; i++) {\n if (noiseShape[i] == null && x.shape[i] != null) {\n
newDimension.push(x.shape[i]);\n } else {\n newDimension.push(noiseShape[i]);\n }\n }\n return
newDimension;\n }\n\n return noiseShape;\n}\n", "/*\n * @license\n * Copyright 2018 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions
and\n * limitations under the License.\n *
=====
\n
*\n\nimport {Tensor} from './tensor';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike}
from './types';\nimport * as util from './util';\n\nimport {add} from './add';\nimport {div} from './div';\nimport
{getNoiseShape} from './dropout_util';\nimport {floor} from './floor';\nimport {mul} from './mul';\nimport {op}
from './operation';\nimport {randomUniform} from './random_uniform';\n\n/**\n * Computes dropout.\n * \n * ```\n * const x = tf.tensor1d([1, 2, 2, 1]);\n * const rate = 0.75;\n * const output = tf.dropout(x, rate);\n * output.print();\n * ```\n * \n * @param x A floating point Tensor or TensorLike.\n * @param rate A float in the range [0, 1). The
probability that each element\n * of x is discarded.\n * @param noiseShape An array of numbers of type int32,
representing the\n * shape for randomly generated keep/drop flags. If the
noiseShape has null\n * value, it will be automatically replaced with the x's relative dimension\n * size. Optional.\n * @param seed Used to create random seeds. Optional.\n * @returns A Tensor of the same shape of x.\n * \n * @doc
{heading: 'Operations', subheading: 'Dropout'}\n */\nfunction dropout_(\n x: Tensor|TensorLike, rate: number,
noiseShape?: number[],\n seed?: number|string): Tensor {\n const $x = convertToTensor(x, 'x', 'dropout');\n\n
util.assert(\n $x.dtype === 'float32',\n () => `x has to be a floating point tensor since it's going to be ` +\n
`scaled, but got a ${$x.dtype} tensor instead.`);\n util.assert(\n rate >= 0 && rate < 1,\n () => `rate must be a
float in the range [0, 1), but got ${rate}.`);\n if (rate === 0) {\n return x instanceof Tensor ? $x.clone() : $x;\n
}\n\n const $noiseShape = getNoiseShape($x, noiseShape);\n const keepProb = 1 - rate;\n const multiplier = div(\n
floor(add(randomUniform($noiseShape,\n 0, 1, 'float32', seed), keepProb)),\n keepProb);\n\n return mul($x, multiplier);\n}\n\nexport const dropout =
op({dropout_});\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n *

```



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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or  
implied. See the License for the specific language governing permissions and  
limitations under the License.

```
=====
*/
import {Tensor1D} from './tensor';
import {tensor1d} from './tensor1d';
export function
enclosingPowerOfTwo(value: number) {
 // Return
 2**N for integer N such that 2**N >= value.
 return Math.floor(Math.pow(2, Math.ceil(Math.log(value) /
Math.log(2.0))));
}
export function cosineWindow(
 windowLength: number, a: number, b: number):
Tensor1D {
 const even = 1 - windowLength % 2;
 const newValues = new Float32Array(windowLength);
 for (let i = 0; i < windowLength; ++i) {
 const cosArg = (2.0 * Math.PI * i) / (windowLength + even - 1);
 newValues[i] = a - b * Math.cos(cosArg);
 }
 return tensor1d(newValues, 'float32');
}
"/**
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 * OR CONDITIONS OF ANY KIND, either express or implied.
 * See the License for the specific language
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 * limitations under the License.
 */
=====
```

```
*/
import {Tensor} from './tensor';
import {convertToTensor} from './tensor_util_env';
import {TensorLike}
from './types';
import {assert, assertShapesMatch, getTypedArrayFromDType} from './util';
import {tensor}
from './tensor';
/**
 * Returns whether the targets are in the top K predictions.
 *
 * @js
 * const predictions = tf.tensor2d([[20, 10, 40, 30], [30, 50, -20, 10]]);
 * const targets = tf.tensor1d([2, 0]);
 * const precision = await
tf.inTopKAsync(predictions, targets);
 * precision.print();
 *
 * @param predictions 2-D or higher `tf.Tensor`
with last dimension being
 * at least `k`.
 * @param targets 1-D or higher `tf.Tensor`.
 * @param k Optional
Number of top elements to look at for computing precision,
 * default to 1.
 * @doc {heading: 'Operations', subheading: 'Evaluation'}
 */
export function
inTopKAsync<T extends Tensor, U extends Tensor>(
 predictions: T|TensorLike, targets: U|TensorLike, k = 1):
Promise<U> {
 const $predictions = convertToTensor(predictions, 'predictions', 'inTopK');
 const $targets =
convertToTensor(targets, 'targets', 'inTopK');
 assert(
 $predictions.rank > 1,
 () => `inTopK() expects
the predictions to be of rank 2 or higher, ` +
 `but got ${$predictions.rank}`);
 assert(
 $predictions.rank
- 1 === $targets.rank,
 () => `predictions rank should be 1 larger than ` +
 `targets rank, but got
predictions rank ` +
 `${$predictions.rank} and targets rank ${$targets.rank}`);
 assertShapesMatch(
 $predictions.shape.slice(0, $predictions.shape.length - 1),
 $targets.shape,
 `predictions's shape should be
align with the targets' shape, ` +
 `except the
last dimension.`);
 const lastDim = $predictions.shape[$predictions.shape.length - 1];
 assert(
 k > 0 && k
<= lastDim,
 () => `k' passed to inTopK() must be > 0 && <= the predictions last ` +
 `dimension
(${lastDim}), but got ${k}`);
 const predictionsVals = await $predictions.data();
 const targetsVals = await
$targets.data();
 // Reshape predictionsVals into a 2d tensor [batch, lastDim]
 // and look up topK along
lastDim.
 const [batch, size] = [predictionsVals.length / lastDim, lastDim];
 const precision =
getTypedArrayFromDType('bool', batch);
 for (let b = 0; b < batch; b++) {
 const offset = b * size;
 const
vals = predictionsVals.subarray(offset, offset + size);
 const valAndInd: Array<{value: number, index: number}>
= [];
 for (let i = 0; i < vals.length; i++) {
 valAndInd.push({value: vals[i], index: i});
 }
 valAndInd.sort((a, b) => b.value - a.value);
 precision[b] = 0;
 for (let i = 0;
i < k; i++) {
 if (valAndInd[i].index === targetsVals[b]) {
 precision[b] = 1;
 break;
 }
 }
 }
 if (predictions !== $predictions) {
 $predictions.dispose();
 }
 if (targets !== $targets) {
 $targets.dispose();
 }
 // Output precision has the same shape as targets.
 return tensor(precision,
```

\$targets.shape, 'bool') as U;\n}\n\nexport const inTopKAsync = inTopKAsync\_;\n", "/\*\n \* @license\n \* Copyright 2020 Google LLC. All Rights Reserved.\n \* Licensed under the Apache License, Version 2.0 (the \"License\");\n \* you may not use this file except in compliance with the License.\n \* You may obtain a copy of the License at\n \* \n \* http://www.apache.org/licenses/LICENSE-2.0\n \* \n \* Unless required by applicable law or agreed to in writing, software\n \* distributed under the License is distributed on an \"AS IS\" BASIS,\n \* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*

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=====
*\nimport {ENGINE} from '../engine';\nimport {Conv2DBackpropFilter, Conv2DBackpropFilterAttrs,\nConv2DBackpropFilterInputs} from '../kernel_names';\nimport {NamedAttrMap} from '../kernel_registry';\nimport {Tensor3D, Tensor4D} from '../tensor';\nimport {NamedTensorMap} from '../tensor_types';\nimport * as util from '../util';\nimport * as conv_util from '../conv_util';\nimport {op} from '../operation';\nimport {reshape} from '../reshape';\n\n/**\n * Computes the derivative of the filter of a 2D convolution.\n *\n * @param x The input tensor, of rank 4 or rank 3 of shape\n * [batch, height, width, inChannels]. If rank 3, batch of 1 is assumed.\n * @param dy The dy image, of rank 4 or rank 3, of shape\n * [batch, height, width, outDepth]. If rank 3, batch of 1 is assumed.\n * @param filterShape The shape of the filter, length 4,\n * [filterHeight, filterWidth, inDepth, outDepth].\n * @param strides The strides of the convolution:\n * [strideHeight, strideWidth].\n * @param pad A string from: 'same', 'valid'. The type of padding algorithm\n * used in the forward prop of the op.\n * @param dataFormat: An optional string from: \"NHWC\", \"NCHW\".\n * Defaults to \"NHWC\". Specify the data format of the input and output data. With the\n * default format \"NHWC\", the data is stored in the order of: [batch,\n * height, width, channels].\n * @param dimRoundingMode A string from: 'ceil', 'round', 'floor'. If none is\n * provided, it will default to truncate.\n */\nfunction conv2DBackpropFilter_<T extends Tensor3D|Tensor4D>(\n x: T, dy: T, filterShape: [number, number, number, number],\n strides: [number, number], number, pad:\n 'valid'|'same'|number|conv_util.ExplicitPadding,\n dataFormat: 'NHWC'|'NCHW' = 'NHWC',\n dimRoundingMode?: 'floor'|'round'|'ceil'): Tensor4D {\n let x4D =\n x as Tensor4D;\n if (x.rank === 3) {\n x4D = reshape(x, [1, x.shape[0], x.shape[1], x.shape[2]]);\n }\n let dy4D =\n dy as Tensor4D;\n if (dy4D.rank === 3) {\n dy4D = reshape(dy, [1, dy.shape[0], dy.shape[1], dy.shape[2]]);\n }\n util.assert(\n x4D.rank === 4,\n () => `Error in conv2dDerFilter: input must be rank 4, but got shape ` +\n `${x4D.shape}.`);\n util.assert(\n dy4D.rank === 4,\n () => `Error in conv2dDerFilter: dy must be rank 4, but got shape ` +\n `${dy4D.shape}.`);\n util.assert(\n filterShape.length === 4,\n () => `Error in conv2dDerFilter: filterShape must be length 4, but got ` +\n `${filterShape}.`);\n const inDepth = dataFormat === 'NHWC' ? x4D.shape[3] : x4D.shape[1];\n const outDepth = dataFormat === 'NHWC' ? dy4D.shape[3] : dy4D.shape[1];\n util.assert(\n inDepth === filterShape[2],\n () => `Error in conv2dDerFilter: depth of input ${inDepth}) must ` +\n `match input depth in filter (${filterShape[2]}).`);\n util.assert(\n outDepth === filterShape[3],\n () => `Error in conv2dDerFilter: depth of dy (${outDepth}) must ` +\n `match output depth for filter (${filterShape[3]}).`);\n if (dimRoundingMode != null) {\n util.assert(\n util.isInt(pad as number),\n () => `Error in conv2dDerFilter: pad must be an integer when using, ` +\n `dimRoundingMode ${dimRoundingMode} but got pad ${pad}.`);\n }\n const inputs: Conv2DBackpropFilterInputs = {x: x4D, dy: dy4D};\n const attrs: Conv2DBackpropFilterAttrs = {\n strides, pad, dataFormat, dimRoundingMode, filterShape;\n };\n // tslint:disable-next-line: no-unnecessary-type-assertion\n return ENGINE.runKernel(\n Conv2DBackpropFilter, inputs as {} as NamedTensorMap,\n attrs as {} as NamedAttrMap) as Tensor4D;\n}\n\nexport const conv2DBackpropFilter = op({conv2DBackpropFilter_});\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
```

software\n \* distributed under the License is distributed on an \"AS IS\" BASIS,\n \* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*

```
=====
*\n\nimport {Tensor} from './tensor';\n\nimport * as broadcast_util from './broadcast_util';\nimport {elu} from './elu';\nimport {Activation} from './fused_types';\nimport {leakyRelu} from './leaky_relu';\nimport {mul} from './mul';\nimport {prelu} from './prelu';\nimport {relu} from './relu';\nimport {relu6} from './relu6';\nimport {reshape} from './reshape';\nimport {step} from './step';\nimport {sum} from './sum';\n\n// Returns gradient for fused activation.\nexport function getFusedDyActivation(\n dy: Tensor, y: Tensor, activation: Activation): Tensor {\n if (activation == null || activation === 'linear') {\n return dy;\n }\n if (activation === 'relu') {\n return mul(dy, step(y));\n }\n throw new Error(`Cannot compute gradient for fused activation ${activation}.`);\n}\n\n// Returns gradient for fused bias.\nexport function getFusedBiasGradient(\n bias: Tensor, dyActivation: Tensor): Tensor {\n let res = dyActivation;\n const reduceAxes = broadcast_util.getReductionAxes(bias.shape, dyActivation.shape);\n if (reduceAxes.length > 0) {\n res = sum(res, reduceAxes);\n }\n return reshape(res, bias.shape);\n}\n\nexport function applyActivation(\n x: Tensor, activation: Activation, preluActivationWeights?: Tensor,\n leakyreluAlpha?: number): Tensor {\n if (activation === 'linear') {\n return x;\n } else if (activation === 'relu') {\n return relu(x);\n } else if (activation === 'elu') {\n return elu(x);\n } else if (activation === 'relu6') {\n return relu6(x);\n } else if (activation === 'prelu') {\n return prelu(x, preluActivationWeights);\n } else if (activation === 'leakyrelu') {\n return leakyRelu(x, leakyreluAlpha);\n }\n throw new Error(`Unknown fused activation ${activation}.`);\n}\n\n// Whether we should call fused ops.\nexport const shouldFuse = (gradientDepth: number, activation: Activation) => {\n const gradientMode = gradientDepth > 0;\n return !gradientMode || activation === 'linear';\n};\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n
```

```
=====
*\n\nimport {ENGINE} from '../engine';\nimport {customGrad} from '../gradients';\nimport {FusedConv2D, FusedConv2DAttrs, FusedConv2DInputs} from '../kernel_names';\nimport {NamedAttrMap} from '../kernel_registry';\nimport {Tensor, Tensor3D, Tensor4D} from './tensor';\nimport {GradSaveFunc, NamedTensorMap} from './tensor_types';\nimport {makeTypesMatch} from './tensor_util';\nimport {convertToTensor} from './tensor_util_env';\nimport {TensorLike} from './types';\nimport * as util from './util';\nimport {add} from './add';\nimport * as broadcast_util from './broadcast_util';\nimport {conv2d as unfusedConv2d} from './conv2d';\nimport {conv2DBackpropFilter} from './conv2d_backprop_filter';\nimport {conv2DBackpropInput} from './conv2d_backprop_input';\nimport * as conv_util from './conv_util';\nimport {Activation} from './fused_types';\nimport {applyActivation, getFusedBiasGradient, getFusedDyActivation, shouldFuse} from './fused_util';\nimport {op} from './operation';\nimport {reshape} from './reshape';\n\n/**\n * Computes a 2D convolution over the input x, optionally fused with adding a\n * bias and applying an activation.\n */\nexport function conv2d(\n inputDepth: number, inShape: number[], outputDepth: number, fSize: number,\n pad: number, strides: number[], x: Tensor4D, w: Tensor4D, filter: number[],\n dataFormat: string, dilations: number[], bias: number, activation: string): Tensor {\n const inputShape = [2, 2, 2, inputDepth];\n const outputShape = [2, 2, 2, outputDepth];\n const x = tf.tensor4d([1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16], inShape);\n const w = tf.tensor4d([1, -2, 0.5], [fSize, fSize, inputDepth, outputDepth]);\n const filter = tf.fused.conv2d({x, filter: w, strides, pad, dataFormat, dilations, bias, activation});\n return filter;\n}\n\n/**\n * @param x The input tensor, of rank 4 or rank 3, of shape [batch, height, width, inChannels]. If rank 3, batch of 1 is assumed.\n * @param filter The filter, rank 4, of shape [height, width, inChannels, outChannels].\n */\n
```

`[filterHeight, filterWidth, inDepth, outDepth]` .\n \* @param strides The strides of the convolution: `[strideHeight,\n * strideWidth]` .\n \* @param pad The type of padding algorithm.\n \* - `same` and stride 1: output will be of same size as input,\n \* regardless of filter size.\n \* - `valid` output will be smaller than input if filter is larger\n \* than 1x1.\n \* - For more info, see this guide:\n \*

[https://www.tensorflow.org/api\\_guides/python/nn#Convolution](https://www.tensorflow.org/api_guides/python/nn#Convolution)(\n \*

[https://www.tensorflow.org/api\\_guides/python/nn#Convolution](https://www.tensorflow.org/api_guides/python/nn#Convolution))\n \* @param dataFormat An optional string from:

`"NHWC"`, `"NCHW"`. Defaults to\n \* `"NHWC"`.

Specify the data format of the input and output data. With the\n \* default format `"NHWC"`, the data is stored in the order of: `[batch,\n * height, width, channels]`. Only `"NHWC"` is currently supported.\n \* @param dilations The dilation rates: `[dilationHeight, dilationWidth]`\n \* in which we sample input values across the height and width dimensions\n \* in atrous convolution. Defaults to `[1, 1]`. If `dilations` is a single\n \* number, then `dilationHeight == dilationWidth`. If it is greater than\n \* 1, then all values of `strides` must be 1.\n \* @param dimRoundingMode A string from: `'ceil'`, `'round'`, `'floor'`. If none is\n \* provided, it will default to `truncate`.\n \* @param bias Tensor to be added to the result.\n \* @param activation Name of activation kernel (defaults to `'linear'`) to be\n \* applied\n \* after `biasAdd`.\n \* @param preluActivationWeights Tensor of prelu weights to be applied as part\n \* of a `'prelu'` activation, typically

the same shape as `x`.\n \* @param leakyreluAlpha Optional. Alpha to be applied as part of a `'leakyrelu'`\n \* activation.\n \*/\nfunction fusedConv2d<T extends Tensor3D|Tensor4D>(\n x: T, \n filter: Tensor4D|TensorLike, \n strides: [number, number], \n pad: 'valid'|'same'|number|conv\_util.ExplicitPadding, \n dataFormat = 'NHWC', \n dilations = [1, 1], \n dimRoundingMode, \n bias: Tensor|TensorLike, \n activation = 'linear', \n preluActivationWeights, \n leakyreluAlpha: number): T {\n x: T|TensorLike, \n filter: Tensor4D|TensorLike, \n strides: [number, number]|number, \n pad: 'valid'|'same'|number|conv\_util.ExplicitPadding, \n dataFormat?: 'NHWC'|'NCHW', \n dilations?: [number, number]|number, \n dimRoundingMode?: 'floor'|'round'|'ceil', \n bias?: Tensor|TensorLike, \n activation?: Activation, \n preluActivationWeights?: Tensor, \n leakyreluAlpha?: number): T {\n let result = unfusedConv2d(\n x, filter, strides, pad, dataFormat, dilations, dimRoundingMode);\n if (bias != null) {\n result = add(result, bias);\n }\n return applyActivation(\n result, activation, preluActivationWeights, leakyreluAlpha) as T;\n }\n\n const \$x = convertToTensor(x, 'x', 'conv2d');\n const \$filter = convertToTensor(filter, 'filter', 'conv2d');\n let x4D = \$x as Tensor4D;\n let reshapedTo4D = false;\n if (\$x.rank === 3) {\n reshapedTo4D = true;\n x4D = reshape(\$x, [1, \$x.shape[0], \$x.shape[1], \$x.shape[2]]);\n }\n util.assert(\n x4D.rank === 4, \n () => `Error in fused conv2d: input must be rank 4, but got rank ` +\n `\${x4D.rank}`);\n util.assert(\n \$filter.rank === 4, \n () => `Error in fused conv2d: filter must be rank 4, but got rank ` +\n `\${\$filter.rank}`);\n if (dimRoundingMode != null) {\n util.assert(\n util.isInt(pad as number), \n () => `Error in fused conv2d: pad must be an integer when using, ` +\n `\${dimRoundingMode}` but got pad \${pad}`);\n }\n\n util.assert(\n x4D.shape[3] === \$filter.shape[2], \n () => `Error in conv2d: depth of input (\$x4D.shape[3]) must match ` +\n `\${\$filter.shape[2]}`);\n util.assert(\n conv\_util.eitherStridesOrDilationsAreOne(strides, dilations), \n () => `Error in conv2D: Either strides or dilations must be 1.` +\n `\${`Got strides \${strides} and dilations \${dilations}`}`);\n util.assert(\n dataFormat === 'NHWC', \n () => `Error in conv2d: got dataFormat of \${dataFormat} but only NHWC is currently supported.`);\n\n const convInfo = conv\_util.computeConv2DInfo(\n x4D.shape, \$filter.shape, strides, dilations, pad, dimRoundingMode);\n let \$bias: Tensor;\n if (bias != null) {\n \$bias = convertToTensor(bias, 'bias', 'fused conv2d');\n [\$bias] = makeTypesMatch(\$bias, \$x);\n }\n\n broadcast\_util.assertAndGetBroadcastShape(convInfo.outShape, \$bias.shape);\n }\n\n let \$preluActivationWeights: Tensor;\n\n if (preluActivationWeights != null) {\n \$preluActivationWeights = convertToTensor(\n preluActivationWeights, 'prelu weights', 'fused conv2d');\n }\n\n const grad = (dy: Tensor4D, saved: Tensor[]) => {\n const [\$filter, x4D, y, \$bias] =\n saved as [Tensor4D, Tensor4D, Tensor4D, Tensor];\n\n const dyActivation = getFusedDyActivation(dy, y, activation) as Tensor4D;\n\n util.assert(\n

```
conv_util.tupleValuesAreOne(dilations),\n () => 'Error in gradient of fused conv2D: '+'\n '\ndilation rates\n greater than 1 `+\n \nare not yet supported in gradients. Got dilations '${dilations}');'\n const xDer =\nconv2DBackpropInput(x4D.shape, dyActivation, $filter, strides, pad);\n const filterDer =\nconv2DBackpropFilter(x4D, dyActivation, $filter.shape, strides, pad);\n const der: Tensor[] = [xDer,\n filterDer];\n if ($bias != null) {\n const biasDer = getFusedBiasGradient($bias, dyActivation);\n der.push(biasDer);\n }\n return der;\n};\n\nconst inputs: FusedConv2DInputs = {\n x: x4D,\n filter: $filter,\n bias: $bias,\n preluActivationWeights: $preluActivationWeights\n};\n\nconst attrs: FusedConv2DAattrs = {\n strides,\n pad,\n dataTypeFormat,\n dilations,\n dimRoundingMode,\n activation,\n leakyreluAlpha\n};\n\n// Depending on the the params passed in we will have different number of\n// inputs and thus a a different number of elements in the gradient.\nif (bias == null) {\n const customOp =\n customGrad((x4D: Tensor4D, filter:\nTensor4D, save: GradSaveFunc) => {\n let res: Tensor4D|Tensor3D =\n // tslint:disable-next-line: no-unnecessary-type-assertion\nENGINE.runKernel(\n FusedConv2D, inputs as { } as NamedTensorMap,\n attrs as { } as NamedAttrMap);\n save([filter, x4D, res]);\n if (reshapedTo4D) {\n // tslint:disable-next-line: no-unnecessary-type-assertion\nres = reshape(res, [res.shape[1], res.shape[2], res.shape[3]]) as\nTensor3D;\n }\n return { value: res, gradFunc: grad };}\n});\nreturn customOp(x4D, $filter) as T;\n} else {\n const customOpWithBias = customGrad(\n (x4D: Tensor4D, filter: Tensor4D, bias: Tensor,\nsave: GradSaveFunc) => {\n let res: Tensor4D|Tensor3D = ENGINE.runKernel(\n FusedConv2D,\ninputs as { } as NamedTensorMap,\n attrs as { } as NamedAttrMap);\n save([filter, x4D, res, bias]);\n if (reshapedTo4D) {\n // tslint:disable-next-line: no-unnecessary-type-assertion\nres =\nreshape(res, [res.shape[1], res.shape[2], res.shape[3]]) as\nTensor3D;\n }\n return { value: res, gradFunc: grad };}\n});\nreturn customOpWithBias(x4D, $filter, $bias) as T;\n})\n\nexport const conv2d = op({fusedConv2d_});\n";\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *\n=====\n*/\nimport {ENGINE} from '../engine';\nimport {DepthwiseConv2dNativeBackpropFilter,\nDepthwiseConv2dNativeBackpropFilterAttrs, DepthwiseConv2dNativeBackpropFilterInputs} from\n'./kernel_names';\nimport {NamedAttrMap} from './kernel_registry';\nimport {Tensor3D, Tensor4D} from\n'./tensor';\nimport\n{NamedTensorMap} from './tensor_types';\nimport {op} from './operation';\nimport {reshape} from\n'./reshape';\n\nfunction depthwiseConv2dNativeBackpropFilter_<(x: T, dy: T,\nfilterShape: [number, number, number, number],\nstrides: [number, number] | number, pad: 'valid'|'same'|number,\ndilations: [number, number]|number = [1, 1],\ndimRoundingMode?: 'floor'|'round'|'ceil'): Tensor4D {\nlet x4D\n= x as Tensor4D;\nif (x.rank === 3) {\n x4D = reshape(x, [1, x.shape[0], x.shape[1], x.shape[2]]);\n}\nlet\ndy4D = dy as Tensor4D;\nif (dy4D.rank === 3) {\n dy4D = reshape(dy, [1, dy.shape[0], dy.shape[1],\ndy.shape[2]]);\n}\n\nconst inputs: DepthwiseConv2dNativeBackpropFilterInputs = {x: x4D, dy: dy4D};\nconst\nattrs: DepthwiseConv2dNativeBackpropFilterAttrs = {\n strides, pad, dimRoundingMode, dilations,\n filterShape\n};\n\n// tslint:disable-next-line: no-unnecessary-type-assertion\nreturn ENGINE.runKernel(\n DepthwiseConv2dNativeBackpropFilter,\n inputs as { } as NamedTensorMap, attrs as { } as\nNamedAttrMap) as\nTensor4D;\n\nexport const depthwiseConv2dNativeBackpropFilter =\nop({depthwiseConv2dNativeBackpropFilter_});\n";\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights\nReserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file
```

except in compliance with the License.\n \* You may obtain a copy of the License at\n \*\n \*  
<http://www.apache.org/licenses/LICENSE-2.0>\n \*\n \* Unless required by applicable law or agreed to in writing,  
 software\n \* distributed under the License is distributed on an \"AS IS\" BASIS,\n \* WITHOUT WARRANTIES  
 OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language  
 governing permissions and\n \* limitations under the License.\n \*

```
=====
*\nimport {ENGINE} from '../engine';\nimport
{DepthwiseConv2dNativeBackpropInput, DepthwiseConv2dNativeBackpropInputAttrs,
DepthwiseConv2dNativeBackpropInputInputs} from '../kernel_names';\nimport {NamedAttrMap} from
 '../kernel_registry';\nimport {Tensor3D, Tensor4D} from '../tensor';\nimport {NamedTensorMap} from
 '../tensor_types';\n\nimport {op} from './operation';\nimport {reshape} from './reshape';\n\nfunction
depthwiseConv2dNativeBackpropInput_<T extends Tensor3D|Tensor4D>(\n xShape: [number, number, number,
number], dy: T, filter: Tensor4D,\n strides: [number, number]|number, pad: 'valid'|'same'|number,\n dilations:
[number, number]|number = [1, 1],\n dimRoundingMode?: 'floor'|'round'|'ceil'): T {\n let dy4D = dy as
Tensor4D;\n let reshapedTo4D = false;\n if (dy.rank === 3) {\n reshapedTo4D = true;\n dy4D = reshape(dy, [1,
dy.shape[0], dy.shape[1], dy.shape[2]]);\n }\n \n const inputs: DepthwiseConv2dNativeBackpropInputInputs = {dy:
dy4D, filter};\n const attrs: DepthwiseConv2dNativeBackpropInputAttrs
=
{\n strides, pad, dimRoundingMode, dilations, inputShape: xShape;\n }\n \n const res =\n // tslint:disable-next-
line: no-unnecessary-type-assertion\n ENGINE.runKernel(\n DepthwiseConv2dNativeBackpropInput,
inputs as {} as NamedTensorMap,\n attrs as {} as NamedAttrMap) as T;\n \n if (reshapedTo4D) {\n return
reshape(res, [res.shape[1], res.shape[2], res.shape[3]]) as T;\n }\n \n return res;\n}\n\nexport const
depthwiseConv2dNativeBackpropInput =\n op({depthwiseConv2dNativeBackpropInput_});\n\n"/**\n *
@license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version
2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n
* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License
for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====
*\n\nimport {ENGINE} from '../engine';\nimport {customGrad} from '../gradients';\nimport
{FusedDepthwiseConv2D, FusedDepthwiseConv2DAttrs, FusedDepthwiseConv2DInputs} from
 '../kernel_names';\nimport {NamedAttrMap} from '../kernel_registry';\nimport {Tensor, Tensor3D, Tensor4D}
from '../tensor';\nimport {GradSaveFunc, NamedTensorMap} from '../tensor_types';\nimport
{makeTypesMatch} from '../tensor_util';\nimport {convertToTensor} from '../tensor_util_env';\nimport
{TensorLike} from '../types';\nimport * as util from '../util';\n\nimport {add} from './add';\nimport * as
broadcast_util from './broadcast_util';\nimport * as conv_util from './conv_util';\nimport {depthwiseConv2d as
unfusedDepthwiseConv2d}
from './depthwise_conv2d';\nimport {depthwiseConv2dNativeBackpropFilter} from
 './depthwise_conv2d_native_backprop_filter';\nimport {depthwiseConv2dNativeBackpropInput} from
 './depthwise_conv2d_native_backprop_input';\nimport {Activation} from './fused_types';\nimport
{applyActivation, getFusedBiasGradient, getFusedDyActivation, shouldFuse} from './fused_util';\nimport {op}
from './operation';\nimport {reshape} from './reshape';\n\n/**\n * Computes depthwise 2D convolution, optionally
fused with adding a\n * bias and applying an activation.\n *\n * Given a 4D `input` array and a `filter` array of
shape\n * `[filterHeight, filterWidth, inChannels, channelMultiplier]` containing\n * `inChannels` convolutional
filters of depth 1, this op applies a\n * different filter to each input channel (expanding from 1 channel to\n *
`channelMultiplier` channels for each), then concatenates the results\n * together. The output has `inChannels *
channelMultiplier` channels.\n *\n
```

\* See [https://www.tensorflow.org/api\\_docs/python/tf/nn/depthwise\\_conv2d](https://www.tensorflow.org/api_docs/python/tf/nn/depthwise_conv2d) for more details.

**@param obj** An object with the following properties:

- x** The input tensor, of rank 4 or rank 3, of shape `[batch, height, width, inChannels]`. If rank 3, batch of 1 is assumed.
- filter** The filter tensor, rank 4, of shape `[filterHeight, filterWidth, inChannels, channelMultiplier]`.
- strides** The strides of the convolution: `[strideHeight, strideWidth]`. If strides is a single number, then `strideHeight == strideWidth`.
- pad** The type of padding algorithm. - `'same'` and stride 1: output will be of same size as input, regardless of filter size. - `'valid'`: output will be smaller than input if filter is larger than 1x1.
- For more info, see this guide: [https://www.tensorflow.org/api\\_guides/python/nn#Convolution](https://www.tensorflow.org/api_guides/python/nn#Convolution).
- dilations** The dilation rates: `[dilationHeight, dilationWidth]` in which we sample input values across the height and width dimensions in atrous convolution. Defaults to `[1, 1]`. If `rate` is a single number, then `dilationHeight == dilationWidth`. If it is greater than 1, then all values of `strides` must be 1.
- dataFormat** An optional string from: `'NHWC'`, `'NCHW'`. Defaults to `'NHWC'`. Specify the data format of the input and output data. With the default format `'NHWC'`, the data is stored in the order of: `[batch, height, width, channels]`. Only `'NHWC'` is currently supported.
- dimRoundingMode** A string from: `'ceil'`, `'round'`, `'floor'`. If none is provided, it will default to `truncate`.
- bias** Tensor to be added to the result.
- activation** Name of activation kernel (defaults to `'linear'`).
- preluActivationWeights** Tensor of prelu weights to be applied as part of a `'prelu'` activation, typically the same shape as `x`.
- leakyreluAlpha** Optional. Alpha to be applied as part of a `'leakyrelu'` activation.

```

function fusedDepthwiseConv2d<T extends Tensor3D|Tensor4D>({
 x: T|TensorLike,
 filter: Tensor4D|TensorLike,
 strides: [number, number]|number,
 pad: 'valid'|'same'|number,
 dataFormat?: 'NHWC'|'NCHW',
 dilations?: [number, number]|number,
 dimRoundingMode?: 'floor'|'round'|'ceil',
 bias?: Tensor|TensorLike,
 activation?: Activation,
 preluActivationWeights?: Tensor,
 leakyreluAlpha?: number
}): T {
 if (shouldFuse(ENGINE.state.gradientDepth, activation) === false) {
 let result = unfusedDepthwiseConv2d(
 x,
 filter,
 strides,
 pad,
 dataFormat,
 dilations,
 dimRoundingMode);
 if (bias != null) {
 result = add(result, bias);
 }
 return applyActivation(
 result,
 activation,
 preluActivationWeights,
 leakyreluAlpha) as T;
 }
 const $x = convertToTensor(x, 'x', 'depthwiseConv2d');
 const $filter = convertToTensor(filter, 'filter', 'depthwiseConv2d');
 let x4D = $x as Tensor4D;
 let reshapedTo4D = false;
 if ($x.rank === 3) {
 reshapedTo4D = true;
 x4D = reshape($x, [1, $x.shape[0], $x.shape[1], $x.shape[2]]);
 }
 util.assert(x4D.rank === 4, () => `Error in fused depthwiseConv2d: input must be rank 4, but got ` + x4D.rank);
 util.assert($filter.rank === 4, () => `Error in fused depthwiseConv2d: filter must be rank 4, ` + $filter.rank);
 util.assert(x4D.shape[3] === $filter.shape[2], () => `Error in fused depthwiseConv2d: number of input channels ` + x4D.shape[3] + ` must match the inChannels dimension in ` + $filter.shape[2]);
 if (dilations == null) {
 dilations = [1, 1];
 }
 util.assert(conv_util.eitherStridesOrDilationsAreOne(strides, dilations), () => `Error in fused depthwiseConv2d: Either strides or dilations must ` + dilations + `be 1. Got strides ${strides} and dilations ${dilations}`);
 if (dimRoundingMode != null) {
 util.assert(util.isInt(pad as number), () => `Error in fused depthwiseConv2d: pad must be an integer when ` + dimRoundingMode + `using dimRoundingMode ${dimRoundingMode} but got pad ${pad}`);
 }
 const convInfo = conv_util.computeConv2DInfo(x4D.shape, $filter.shape, strides, dilations, pad, dimRoundingMode, true /* depthwise */);
 let $bias: Tensor;
 if (bias != null) {
 $bias = convertToTensor(bias, 'bias', 'fused conv2d');
 [$bias] = makeTypesMatch($bias, $x);
 broadcast_util.assertAndGetBroadcastShape(convInfo.outShape, $bias.shape);
 }
 let $preluActivationWeights: Tensor;
 if (preluActivationWeights != null) {
 $preluActivationWeights =

```

```

convertToTensor(\n preluActivationWeights, 'prelu weights', 'fused depthwiseConv2d');\n }\n\n const grad =
(dy: Tensor4D, saved: Tensor[]) => {\n util.assert(\n conv_util.tupleValuesAreOne(dilations),\n () =>
'Error in gradient of fused depthwiseConv2d: dilation rates ' +\n `greater than 1 are not yet supported. Got
dilations ` +\n `${dilations}`);\n const [$filter, x4D, y, bias] = saved;\n\n const dyActivation =
getFusedDyActivation(dy, y, activation) as Tensor4D;\n\n const xDer = depthwiseConv2dNativeBackpropInput(\n
(x4D as Tensor4D).shape, dyActivation, $filter as Tensor4D, strides,\n pad, dilations,
dimRoundingMode);\n const filterDer = depthwiseConv2dNativeBackpropFilter(\n x4D as Tensor4D,
dyActivation, ($filter
as Tensor4D).shape, strides,\n pad, dilations, dimRoundingMode);\n\n if (bias != null) {\n const biasDer =
getFusedBiasGradient($bias, dyActivation);\n return [xDer, filterDer, biasDer];\n }\n return [xDer,
filterDer];\n };\n\n const inputs: FusedDepthwiseConv2DInputs = {\n x: x4D,\n filter: $filter,\n bias: $bias,\n preluActivationWeights: $preluActivationWeights\n };\n\n const attrs: FusedDepthwiseConv2DAttrs = {\n
strides,\n pad,\n dataFormat,\n dilations,\n dimRoundingMode,\n activation,\n leakyreluAlpha\n };\n\n
// Depending on the the params passed in we will have different number of\n // inputs and thus a a different number
of elements in the gradient.\n if (bias == null) {\n const customOp =\n customGrad((x4D: Tensor4D, filter:
Tensor4D, save: GradSaveFunc) => {\n // tslint:disable-next-line: no-unnecessary-type-assertion\n let
res: Tensor4D|Tensor3D = ENGINE.runKernel(\n
 FusedDepthwiseConv2D, inputs as {} as NamedTensorMap,\n attrs as {} as NamedAttrMap);\n\n
save([filter, x4D, res]);\n\n if (reshapedTo4D) {\n // tslint:disable-next-line: no-unnecessary-type-
assertion\n res = reshape(res, [res.shape[1], res.shape[2], res.shape[3]]) as\n Tensor3D;\n }\n\n
 return {value: res, gradFunc: grad};\n });\n return customOp(x4D, $filter) as T;\n } else {\n const
customOpWithBias = customGrad(\n (x4D: Tensor4D, filter: Tensor4D, bias: Tensor, save: GradSaveFunc) =>
{\n // tslint:disable-next-line: no-unnecessary-type-assertion\n let res: Tensor4D|Tensor3D =
ENGINE.runKernel(\n FusedDepthwiseConv2D, inputs as {} as NamedTensorMap,\n attrs as {} as
NamedAttrMap);\n\n save([filter, x4D, res, bias]);\n\n if (reshapedTo4D) {\n // tslint:disable-next-
line: no-unnecessary-type-assertion\n
 res = reshape(res, [res.shape[1], res.shape[2], res.shape[3]]) as\n Tensor3D;\n }\n\n
 return {value: res, gradFunc: grad};\n });\n return customOpWithBias(x4D, $filter, $bias) as T;\n
}\n}\n\nexport const depthwiseConv2d = op({fusedDepthwiseConv2d_});\n\n"/**\n * @license\n * Copyright 2019
Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you
may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*/\n\nimport {ENGINE} from '../engine';\nimport {customGrad} from '../gradients';\nimport {_FusedMatMul,
_FusedMatMulAttrs, _FusedMatMulInputs} from '../kernel_names';\nimport {NamedAttrMap} from
'../kernel_registry';\nimport {Tensor, Tensor3D} from '../tensor';\nimport {GradSaveFunc, NamedTensorMap}
from '../tensor_types';\nimport {makeTypesMatch} from '../tensor_util';\nimport {convertToTensor} from
'../tensor_util_env';\nimport {TensorLike} from '../types';\nimport * as util from '../util';\nimport {add} from
'../add';\nimport * as broadcast_util from '../broadcast_util';\nimport {Activation} from '../fused_types';\nimport
{applyActivation, getFusedBiasGradient, getFusedDyActivation, shouldFuse} from '../fused_util';\nimport {matMul
as unfusedMatMul} from '../mat_mul';\nimport {op} from '../operation';\nimport {reshape} from
'../reshape';\n\n/**\n * Computes the dot product of two matrices with optional activation and
bias.\n *\n *`js\n * const a = tf.tensor2d([-1, -2], [1, 2]);\n * const b = tf.tensor2d([1, 2, 3, 4], [2, 2]);\n * const
bias = tf.tensor2d([1, 2], [1, 2]);\n *\n * tf.fused.matMul({a, b, bias, activation: 'relu'}).print();\n *`
\n *\n * @param obj An object with the following properties:\n * - `a` First matrix in dot product operation.\n * - `b` Second

```



```

matrix in dot product operation.\n * - `transposeA` If true, `a` is transposed before multiplication.\n * - `transposeB`
If true, `b` is transposed before multiplication.\n * - `bias` Matrix to be added to the result.\n * - `activation` Name
of activation kernel (defaults to `linear`).\n * - `preluActivationWeights` Tensor of prelu weights.\n * -
`leakyreluAlpha` Alpha of leakyrelu.\n */\nfunction fusedMatMul<T extends Tensor>({\n a,\n b,\n transposeA =
false,\n transposeB = false,\n bias,\n activation = 'linear',\n preluActivationWeights,\n leakyreluAlpha,\n}): {\n a:
T|TensorLike,\n b: T|TensorLike,\n transposeA?: boolean,\n transposeB?: boolean,\n bias?: Tensor|TensorLike,\n activation?: Activation,\n preluActivationWeights?:
Tensor,\n leakyreluAlpha?: number\n}): T {\n if (shouldFuse(ENGINE.state.gradientDepth, activation) === false) {\n
 let result = unfusedMatMul(a, b, transposeA, transposeB);\n if (bias != null) {\n result = add(result,
bias);\n }\n return applyActivation(\n result, activation, preluActivationWeights, leakyreluAlpha
) as T;\n }\n let $a = convertToTensor(a, 'a', 'fused matMul');\n let $b = convertToTensor(b, 'b', 'fused
matMul');\n [$a, $b] = makeTypesMatch($a, $b);\n const innerShapeA =\n transposeA ? $a.shape[$a.rank
- 2] : $a.shape[$a.rank - 1];\n const innerShapeB =\n transposeB ? $b.shape[$b.rank - 1] : $b.shape[$b.rank -
2];\n const outerShapeA =\n transposeA ? $a.shape[$a.rank - 1] : $a.shape[$a.rank - 2];\n const
outerShapeB =\n transposeB ? $b.shape[$b.rank
- 2] : $b.shape[$b.rank - 1];\n const outerDimsA = $a.shape.slice(0, -2);\n const outerDimsB =
$b.shape.slice(0, -2);\n const batchDimA = util.sizeFromShape(outerDimsA);\n const batchDimB =
util.sizeFromShape(outerDimsB);\n util.assert(\n $a.rank >= 2 && $b.rank >= 2 && $a.rank === $b.rank,\n
 () => `Error in fused matMul: inputs must have the same rank of at least 2, got ranks ${$a.rank}
and ${$b.rank}.`,\n util.assert(\n util.arraysEqual(outerDimsA, outerDimsB),\n () => `Error in fused
matMul: outer dimensions (${outerDimsA}) and (${outerDimsB}) of Tensors with shapes ${$a.shape}
and ${$b.shape} must match.`,\n util.assert(\n innerShapeA === innerShapeB,\n () =>
`Error in fused matMul: inner shapes (${innerShapeA}) and (${innerShapeB}) of Tensors with shapes
${$a.shape} and ${$b.shape} and transposeA=${transposeA} and\n ` and transposeB=${transposeB} must match.`);\n const outShape = $a.shape.slice(0, -
2).concat([outerShapeA, outerShapeB]);\n const a3D: Tensor3D = transposeA ?\n reshape($a, [batchDimA,
innerShapeA, outerShapeA]) : reshape($a, [batchDimA, outerShapeA, innerShapeA]);\n const b3D:
Tensor3D = transposeB ?\n reshape($b, [batchDimB, outerShapeB, innerShapeB]) : reshape($b,
[batchDimB, innerShapeB, outerShapeB]);\n let $bias: Tensor;\n if (bias != null) {\n $bias =
convertToTensor(bias, 'bias', 'fused matMul');\n [$bias] = makeTypesMatch($bias, $a);\n broadcast_util.assertAndGetBroadcastShape(outShape, $bias.shape);\n }\n let $preluActivationWeights:
Tensor;\n if (preluActivationWeights != null) {\n $preluActivationWeights = convertToTensor(\n preluActivationWeights, 'prelu weights', 'fused matMul');\n }\n const grad = (dy: Tensor3D, saved: Tensor[])
=> {\n const [a3D, b3D,
y, $bias] = saved;\n // we reshape dy because the result of the forward is not\n // necessarily going to be a 3d
tensor due to a reshape done at the end of\n // the customOp.\n const dyActivation =\n getFusedDyActivation(reshape(dy, y.shape), y, activation);\n let aDer: Tensor;\n let bDer: Tensor;\n if
(!transposeA && !transposeB) {\n aDer = unfusedMatMul(dyActivation, b3D, false, true);\n bDer =
unfusedMatMul(a3D, dyActivation, true, false);\n } else if (!transposeA && transposeB) {\n aDer =
unfusedMatMul(dyActivation, b3D, false, false);\n bDer = unfusedMatMul(dyActivation, a3D, true, false);\n }
else if (transposeA && !transposeB) {\n aDer = unfusedMatMul(b3D, dyActivation, false, true);\n bDer =
unfusedMatMul(a3D, dyActivation, false, false);\n } else {\n aDer = unfusedMatMul(b3D, dyActivation,
true, true);\n bDer = unfusedMatMul(dyActivation, a3D, true, true);\n }\n if (bias != null) {\n const biasDer = getFusedBiasGradient($bias, dyActivation);\n return [aDer,
bDer, biasDer];\n } else {\n return [aDer, bDer];\n }\n };\n const inputs: _FusedMatMulInputs = {\n a: a3D,\n b: b3D,\n bias: $bias,\n preluActivationWeights: $preluActivationWeights\n };\n const
attrs: _FusedMatMulAttrs =\n {transposeA, transposeB, activation, leakyreluAlpha};\n // Depending on the
the params passed in we will have different number of\n // inputs and thus a a different number of elements in the

```

```

gradient.\n if (bias == null) {\n const customOp =\n customGrad((a3D: Tensor3D, b3D: Tensor3D, save:
GradSaveFunc) => {\n const res =\n // tslint:disable-next-line: no-unnecessary-type-assertion\n ENGINE.runKernel(\n _FusedMatMul, inputs as { } as NamedTensorMap,\n attrs as { }
as NamedAttrMap) as
T;\n\n save([a3D, b3D, res]);\n\n return { value: reshape(res, outShape), gradFunc: grad};\n });\n return customOp(a3D, b3D) as T;\n } else {\n const customOpWithBias = customGrad(\n (a3D:
Tensor3D, b3D: Tensor3D, $bias: Tensor, save: GradSaveFunc) => {\n const res =\n //
tslint:disable-next-line: no-unnecessary-type-assertion\n ENGINE.runKernel(\n _FusedMatMul, inputs as { } as NamedTensorMap,\n attrs as { } as NamedAttrMap) as T;\n\n save([a3D, b3D, res, $bias]);\n\n return { value: reshape(res, outShape), gradFunc: grad};\n });\n return customOpWithBias(a3D, b3D, $bias) as T;\n }\n}\n\nexport const matMul =
op({ fusedMatMul_ });\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed
under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance
with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-
2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is
distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n *
=====
\n
*\n\nimport { conv2d } from './fused/conv2d';\nimport { depthwiseConv2d } from
'./fused/depthwise_conv2d';\nimport { matMul } from './fused/mat_mul';\nimport { Activation } from
'./fused_types';\n\nexport { Activation, conv2d, depthwiseConv2d, matMul};\n", "/*\n * @license\n * Copyright
2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n *
you may not use this file except in compliance with the License.\n * You may
obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by
applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\"
BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the
License for the specific language governing permissions and\n * limitations under the License.\n *
=====
\n
*\n\nimport { Tensor1D } from '../tensor';\nimport { op } from '../operation';\nimport { cosineWindow } from
'./signal_ops_util';\n\n/*\n * Generate a hamming window.\n * See:
https://en.wikipedia.org/wiki/Window_function#Hann_and_Hamming_windows\n * ``js\n *
tf.signal.hammingWindow(10).print();\n * ``\n * @param The length of window\n * @doc {heading:
'Operations', subheading: 'Signal', namespace: 'signal'}\n */\nfunction hammingWindow_(windowLength: number):
Tensor1D {\n return
cosineWindow(windowLength, 0.54, 0.46);\n}\n\nexport const hammingWindow =
op({ hammingWindow_ });\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n *
Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in
compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
\n
*\n\nimport { Tensor1D } from '../tensor';\nimport { op } from '../operation';\nimport { cosineWindow } from
'./signal_ops_util';\n\n/*\n * Generate a Hann window.\n * See:
https://en.wikipedia.org/wiki/Window_function#Hann_and_Hamming_windows\n

```

```

*\n * ``js\n * tf.signal.hannWindow(10).print();\n * ``\n * @param The length of window\n * @doc {heading:
'Operations', subheading: 'Signal', namespace: 'signal'}\n *\nfunction hannWindow_(windowLength: number):
Tensor1D {\n return cosineWindow(windowLength, 0.5, 0.5);\n}\n\nexport const hannWindow =
op({hannWindow_});\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed
under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions
and\n * limitations under the License.\n *

```

```

=====
*\n\nimport {Tensor, Tensor1D} from '../tensor';\nimport {concat} from '../concat';\nimport {fill} from
'../fill';\nimport {op} from '../operation';\nimport {reshape} from '../reshape';\nimport {slice} from '../slice';\nimport
{tensor2d} from '../tensor2d';\n\n/**\n * Expands input into frames of frameLength.\n * Slides a window size with
frameStep.\n *\n * ``js\n * tf.signal.frame([1, 2, 3], 2, 1).print();\n * ``\n * @param signal The input tensor to be
expanded\n * @param frameLength Length of each frame\n * @param frameStep The frame hop size in samples.\n
* @param padEnd Whether to pad the end of signal with padValue.\n * @param padValue An number to use where
the input signal does\n * not exist when padEnd is True.\n *\n * @doc {heading: 'Operations', subheading:
'Signal', namespace: 'signal'}\n *\nfunction frame_(\n signal: Tensor1D, frameLength:
number, frameStep: number, padEnd = false,\n padValue = 0): Tensor {\n let start = 0;\n const output: Tensor[]
= [];\n while (start + frameLength <= signal.size) {\n output.push(slice(signal, start, frameLength));\n start +=
frameStep;\n }\n if (padEnd) {\n while (start < signal.size) {\n const padLen = (start + frameLength) -
signal.size;\n const pad = concat([\n slice(signal, start, frameLength - padLen), fill([padLen], padValue)\n
]);\n output.push(pad);\n start += frameStep;\n }\n }\n if (output.length === 0) {\n return tensor2d([],
[0, frameLength]);\n }\n return reshape(concat(output), [output.length, frameLength]);\n}\n\nexport const frame =
op({frame_});\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *

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=====
*\n\nimport {Tensor, Tensor1D} from '../tensor';\nimport {concat} from '../concat';\nimport {mul} from
'../mul';\nimport {op} from '../operation';\nimport {enclosingPowerOfTwo} from '../signal_ops_util';\nimport {slice}
from '../slice';\nimport {rfft} from '../spectral/rfft';\nimport {frame} from './frame';\nimport {hannWindow} from
'./hann_window';\n\n/**\n * Computes the Short-time Fourier Transform of signals\n * See:
https://en.wikipedia.org/wiki/Short-time_Fourier_transform\n *\n * ``js\n * const input = tf.tensor1d([1, 1,
1, 1, 1]);\n * tf.signal.stft(input, 3, 1).print();\n * ``\n * @param signal 1-dimensional real value tensor.\n * @param
frameLength The window length of samples.\n * @param frameStep The number of samples to step.\n * @param
fftLength The size of the FFT to apply.\n * @param windowFn A callable that takes a window length and returns 1-
d tensor.\n *\n * @doc {heading: 'Operations', subheading: 'Signal', namespace: 'signal'}\n *\nfunction stft_(\n
signal: Tensor1D, frameLength: number, frameStep: number,\n fftLength?: number,\n windowFn: (length:
number) => Tensor1D = hannWindow): Tensor {\n if (fftLength == null) {\n fftLength =
enclosingPowerOfTwo(frameLength);\n }\n const framedSignal = frame(signal, frameLength, frameStep);\n const
windowedSignal = mul(framedSignal, windowFn(frameLength));\n const output: Tensor[] = [];\n for (let i = 0; i <
framedSignal.shape[0]; i++) {\n output.push(\n rfft(slice(windowedSignal, [i, 0], [1, frameLength]),
fftLength);\n }\n }\n return tensor2d(output, [output.length, fftLength]);\n}\n\nexport const stft =
op({stft_});\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *

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 }\n return concat(output);\n}\n\nexport const stft = op({stft_});\n", "/*\n * @license\n * Copyright 2020 Google\n * LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not\n * use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *

http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\n * OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n * governing permissions and\n * limitations under the License.\n *

===== \n
*\n\nimport {ENGINE} from '../engine';\nimport {CropAndResize, CropAndResizeAttrs, CropAndResizeInputs}\nfrom '../kernel_names';\nimport {NamedAttrMap} from '../kernel_registry';\nimport {Tensor1D, Tensor2D,\nTensor4D} from '../tensor';\nimport {NamedTensorMap} from '../tensor_types';\nimport {convertToTensor}\nfrom '../tensor_util_env';\nimport {TensorLike} from '../types';\nimport * as util from '../util';\nimport {op}\nfrom './operation';\n\n/**\n * Extracts crops from the input image tensor and resizes them using bilinear\n * sampling or nearest neighbor sampling (possibly with aspect ratio change)\n * to a common output size specified by\n * cropSize.\n * \n * @param image 4d tensor of shape `[batch,imageHeight,imageWidth, depth]`,\n * where\n * imageHeight and imageWidth must be positive, specifying the\n * batch of images from which to take crops\n * \n * @param boxes 2d float32 tensor of shape `[numBoxes, 4]`. Each entry is\n * `[y1, x1, y2, x2]`, where `(y1, x1)`\n * and `(y2, x2)` are the normalized\n * coordinates of the box in the boxInd[i]th image in the batch\n * \n * @param boxInd 1d int32 tensor of shape `[numBoxes]` with values in range\n * `[0, batch)`\n * that specifies the image that the `i`-th box refers to.\n * \n * @param cropSize 1d int32 tensor of 2 elements\n * `[cropHeight, cropWidth]`\n * specifying the size to which all crops are resized to.\n * \n * @param method Optional\n * string from `bilinear` | `nearest`,\n * defaults to bilinear, which specifies the sampling method for resizing\n * \n * @param extrapolationValue A threshold for deciding when to remove boxes based\n * on score. Defaults to 0.\n * \n * @return A 4D tensor of the shape `[numBoxes,cropHeight,cropWidth,depth]`\n * \n * @doc {heading: 'Operations',\n * subheading: 'Images', namespace: 'image'}\n */\nfunction cropAndResize_(\n image: Tensor4D|TensorLike,\n boxes: Tensor2D|TensorLike,\n boxInd: Tensor1D|TensorLike,\n cropSize: [number, number],\n method:\n 'bilinear'|'nearest' = 'bilinear',\n extrapolationValue = 0,\n): Tensor4D {\n const $image =\n convertToTensor(image, 'image', 'cropAndResize');\n const $boxes = convertToTensor(boxes, 'boxes',\n 'cropAndResize',\n 'float32');\n const $boxInd = convertToTensor(boxInd, 'boxInd', 'cropAndResize', 'int32');\n\n const numBoxes =\n $boxes.shape[0];\n\n util.assert(\n $image.rank === 4,\n () => `Error in cropAndResize: image must be rank\n 4,` +\n `but got rank ${$image.rank}.`);\n util.assert(\n $boxes.rank === 2 && $boxes.shape[1] === 4,\n () => `Error in cropAndResize: boxes must be have size [${numBoxes},4]` +\n `but had shape\n ${$boxes.shape}.`);\n util.assert(\n $boxInd.rank === 1 && $boxInd.shape[0] === numBoxes,\n () => `Error\n in cropAndResize: boxInd must be have size [${numBoxes}]` +\n `but had shape ${$boxes.shape}.`);\n util.assert(\n cropSize.length === 2,\n () => `Error in cropAndResize: cropSize must be of length 2, but got`\n `length ${cropSize.length}.`);\n util.assert(\n cropSize[0] >= 1 && cropSize[1] >= 1,\n () =>\n `cropSize must be atleast [1,1], but was ${cropSize}`);\n util.assert(\n method === 'bilinear' || method === 'nearest',\n () => `method must be bilinear or nearest, but was\n ${method}`);\n\n const inputs:\n CropAndResizeInputs = {image: $image, boxes: $boxes, boxInd: $boxInd};\n const attrs: CropAndResizeAttrs = {method, extrapolationValue, cropSize};\n const res = ENGINE.runKernel(\n CropAndResize, inputs as {} as NamedTensorMap,\n attrs as {} as NamedAttrMap);\n return res as\n Tensor4D;\n}\n\nexport const cropAndResize = op({cropAndResize_});\n", "/*\n * @license\n * Copyright 2020\n * Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you\n * may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *

http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\n * OR CONDITIONS OF

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ANY KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*

```
=====
*\n\nimport {ENGINE} from '../engine';\nimport {FlipLeftRight, FlipLeftRightInputs} from
'../kernel_names';\nimport {Tensor4D} from '../tensor';\nimport {NamedTensorMap} from
'../tensor_types';\nimport {convertToTensor} from '../tensor_util_env';\nimport {TensorLike} from
'../types';\nimport * as util from '../util';\nimport {op} from './operation';\n\n/**\n * Flips the image left to right.
Currently available in the CPU, WebGL, and\n * WASM backends.\n *\n * @param image 4d tensor of shape
`[batch, imageHeight, imageWidth, depth]`\n *\n * @doc {heading: 'Operations', subheading: 'Images',
namespace: 'image'}
*/\nfunction flipLeftRight_(image: Tensor4D|TensorLike): Tensor4D {\n const $image =
convertToTensor(image, 'image', 'flipLeftRight',
'float32');\n util.assert(\n $image.rank === 4,\n () => 'Error in flipLeftRight: image must be rank 4,' +\n
`but got rank ${$image.rank}.`);\n const inputs: FlipLeftRightInputs = {image: $image};\n const res =\nENGINE.runKernel(FlipLeftRight, inputs as {} as NamedTensorMap, {});\n return res as Tensor4D;\n}\n\nexport
const flipLeftRight = op({flipLeftRight_});\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions
and\n * limitations under the License.\n *
```

```
=====
*\n\nimport {ENGINE} from '../engine';\nimport {RotateWithOffset, RotateWithOffsetAttrs,
RotateWithOffsetInputs} from '../kernel_names';\nimport {NamedAttrMap} from '../kernel_registry';\nimport
{Tensor4D} from '../tensor';\nimport {NamedTensorMap} from '../tensor_types';\nimport {convertToTensor}
from '../tensor_util_env';\nimport {TensorLike} from '../types';\nimport * as util from '../util';\n\nimport {op}
from './operation';\n\n/**\n * Rotates the input image tensor counter-clockwise with an optional offset\n * center of
rotation. Currently available in the CPU, WebGL, and WASM backends.\n *\n * @param image 4d tensor of shape
`[batch, imageHeight, imageWidth, depth]`\n *\n * @param radians The amount of rotation.\n * @param fillValue The
value to fill in the empty space leftover\n * after rotation. Can be either a single grayscale
value (0-255), or an\n * array of three numbers `[red, green, blue]` specifying the red, green,\n * and blue
channels. Defaults to `0` (black).\n * @param center The center of rotation. Can be either a single value (0-1), or\n *
an array of two numbers `[centerX, centerY]`. Defaults to `0.5` (rotates\n * the image around its center).\n *\n *
@doc {heading: 'Operations', subheading: 'Images', namespace: 'image'}
*/\nfunction rotateWithOffset_(\n image: Tensor4D|TensorLike, radians: number,\n fillValue: number|[number, number, number] = 0,\n center:
number|[number, number] = 0.5): Tensor4D {\n const $image = convertToTensor(image, 'image',
'rotateWithOffset', 'float32');\n util.assert(\n $image.rank === 4,\n () => 'Error in rotateWithOffset: image
must be rank 4,' +\n
`but got rank ${$image.rank}.`);\n const inputs: RotateWithOffsetInputs = {image:
$image};\n const attrs: RotateWithOffsetAttrs = {radians, fillValue, center};\n const
res = ENGINE.runKernel(\n RotateWithOffset, inputs as {} as NamedTensorMap,\n attrs as {} as
NamedAttrMap);\n return res as Tensor4D;\n}\n\nexport const rotateWithOffset =
op({rotateWithOffset_});\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed
under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
```

License.\n \*

```
=====
*\n\nimport {Tensor1D, Tensor2D} from '../tensor';\nimport * as util
from '../util';\n\nfunction nonMaxSuppSanityCheck(\n boxes: Tensor2D, scores: Tensor1D, maxOutputSize:
number,\n iouThreshold: number, scoreThreshold: number, softNmsSigma?: number): {\n maxOutputSize:
number,\n iouThreshold: number,\n scoreThreshold: number,\n softNmsSigma: number\n} {\n if (iouThreshold
== null) {\n iouThreshold = 0.5;\n }\n if (scoreThreshold == null) {\n scoreThreshold =
Number.NEGATIVE_INFINITY;\n }\n if (softNmsSigma == null) {\n softNmsSigma = 0.0;\n }\n\n const
numBoxes = boxes.shape[0];\n maxOutputSize = Math.min(maxOutputSize, numBoxes);\n\n util.assert(\n 0 <=
iouThreshold && iouThreshold <= 1,\n () => `iouThreshold must be in [0, 1], but was '${iouThreshold}'`);\n
util.assert(\n boxes.rank === 2,\n () => `boxes must be a 2D tensor, but was of rank '${boxes.rank}'`);\n
util.assert(\n boxes.shape[1] === 4,\n () => `boxes must have 4 columns, but 2nd dimension was
${boxes.shape[1]}`);\n
 util.assert(scores.rank === 1, () => 'scores must be a 1D tensor');\n util.assert(\n scores.shape[0] ===
numBoxes,\n () => `scores has incompatible shape with boxes. Expected ${numBoxes}, ` +\n `but was
${scores.shape[0]}`);\n util.assert(\n 0 <= softNmsSigma && softNmsSigma <= 1,\n () => `softNmsSigma
must be in [0, 1], but was '${softNmsSigma}'`);\n return {maxOutputSize, iouThreshold, scoreThreshold,
softNmsSigma};\n }\n\n export {nonMaxSuppSanityCheck};\n /**\n * @license\n * Copyright 2020 Google LLC.
All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either
express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n */
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```
*\n\nimport {ENGINE} from '../engine';\nimport {NonMaxSuppressionV3} from '../kernel_names';\nimport
{Tensor1D, Tensor2D} from '../tensor';\nimport {convertToTensor} from '../tensor_util_env';\nimport
{TensorLike} from '../types';\n\nimport {nonMaxSuppSanityCheck} from './nonmax_util';\nimport {op} from
'./operation';\n\n/**\n * Performs non maximum suppression of bounding boxes based on\n * iou (intersection over
union).\n * \n * @param boxes a 2d tensor of shape `[numBoxes, 4]`. Each entry is\n * `[y1, x1, y2, x2]`, where
`[y1, x1]` and `[y2, x2]` are the corners of\n * the bounding box.\n * \n * @param scores a 1d tensor providing the
box scores of shape `[numBoxes]`.\n * \n * @param maxOutputSize The maximum number of boxes to be selected.\n *
\n * @param iouThreshold
```

```
 A float representing the threshold for deciding whether\n * boxes overlap too much with respect to IOU. Must be
between [0, 1].\n * Defaults to 0.5 (50% box overlap).\n * \n * @param scoreThreshold A threshold for deciding when
to remove boxes based\n * on score. Defaults to -inf, which means any score is accepted.\n * \n * @return A 1D
tensor with the selected box indices.\n * \n * @doc {heading: 'Operations', subheading: 'Images', namespace:
'image'}\n */\n\nfunction nonMaxSuppression_(\n boxes: Tensor2D|TensorLike, scores: Tensor1D|TensorLike,\n maxOutputSize: number, iouThreshold = 0.5,\n scoreThreshold = Number.NEGATIVE_INFINITY): Tensor1D
{\n const $boxes = convertToTensor(boxes, 'boxes', 'nonMaxSuppression');\n const $scores =
convertToTensor(scores, 'scores', 'nonMaxSuppression');\n const inputs = nonMaxSuppSanityCheck(\n
 $boxes, $scores, maxOutputSize, iouThreshold, scoreThreshold);\n maxOutputSize = inputs.maxOutputSize;\n
 iouThreshold = inputs.iouThreshold;\n
```

```
 scoreThreshold = inputs.scoreThreshold;\n\n const attrs = {maxOutputSize, iouThreshold, scoreThreshold};\n
 return ENGINE.runKernel(\n NonMaxSuppressionV3, {boxes: $boxes, scores: $scores}, attrs);\n\n \n export
const nonMaxSuppression = op({nonMaxSuppression_});\n /**\n * @license\n * Copyright 2019 Google LLC.
All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this
```

```

file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *

=====
*\n\n/**\n * Inserts a value into a sorted array. This method allows duplicate, meaning it\n * allows inserting
duplicate value, in which case, the element will be inserted\n * at the lowest index of the value.\n * @param arr The
array to modify.\n * @param element The element to insert.\n * @param comparator Optional. If no comparator is
specified, elements are\n * compared using array_util.defaultComparator, which is suitable for Strings\n * and
Numbers in ascending arrays. If the array contains multiple instances of\n * the target value, the left-most instance
will be returned. To provide a\n * comparator, it should take 2 arguments to compare and return a negative,\n * zero,
or a positive number.\n */\n\nexport function binaryInsert<T>(\n arr: T[], element: T, comparator?: (a: T, b: T) =>
number) {\n const index = binarySearch(arr, element, comparator);\n const insertionPoint = index < 0 ? -(index +
1) : index;\n arr.splice(insertionPoint, 0, element);\n}\n\n/**\n * Searches
the array for the target using binary search, returns the index\n * of the found element, or position to insert if
element not found. If no\n * comparator is specified, elements are compared using array_
util.defaultComparator, which is suitable for Strings and Numbers in\n * ascending arrays. If the array contains
multiple instances of the target\n * value, the left-most instance will be returned.\n * @param arr The array to be
searched in.\n * @param target The target to be searched for.\n * @param comparator Should take 2 arguments to
compare and return a negative,\n * zero, or a positive number.\n * @return Lowest index of the target value if
found, otherwise the insertion\n * point where the target should be inserted, in the form of\n * (-insertionPoint -
1).\n */\n\nexport function binarySearch<T>(\n arr: T[], target: T, comparator?: (a: T, b: T) => number) {\n return
binarySearch_(arr, target, comparator || defaultComparator);\n}\n\n/**\n * Compares its two
arguments for order.\n * @param a The first element to be compared.\n * @param b The second element to be
compared.\n * @return A negative number, zero, or a positive number as the first\n * argument is less than, equal
to, or greater than the second.\n */\n\nfunction defaultComparator<T>(a: T, b: T): number {\n return a > b ? 1 : a < b
? -1 : 0;\n}\n\nfunction binarySearch_<T>(\n arr: T[], target: T, comparator: (a: T, b: T) => number) {\n let left =
0;\n let right = arr.length;\n let middle = 0;\n let found = false;\n while (left < right) {\n middle = left + ((right -
left) >>> 1);\n const compareResult = comparator(target, arr[middle]);\n if (compareResult > 0) {\n left =
middle + 1;\n } else {\n right = middle;\n // If compareResult is 0, the value is found. We record it is
found,\n // and then keep looking because there may be duplicate.\n found = !compareResult;\n }\n }\n return found ? left : -left - 1;\n}\n\n", "/*\n * @license\n
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\"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
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agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *

=====
*\n\nimport { TypedArray } from '../types';\nimport { binaryInsert } from './non_max_suppression_util';\n\n/**\n *
Implementation of the NonMaxSuppression kernel shared between webgl and cpu.\n */\n\ninterface Candidate {\n score: number;\n boxIndex: number;\n suppressBeginIndex: number;\n}\n\ninterface
NonMaxSuppressionResult {\n selectedIndices: number[];\n selectedScores?: number[];\n validOutputs?:
number;\n}\n\nexport function nonMaxSuppressionV3Impl(\n boxes: TypedArray, scores: TypedArray,\n maxOutputSize: number,\n iouThreshold: number, scoreThreshold: number): NonMaxSuppressionResult {\n return nonMaxSuppressionImpl_(\n boxes, scores, maxOutputSize, iouThreshold, scoreThreshold,\n 0 /*
softNmsSigma */);\n}\n\nexport function nonMaxSuppressionV4Impl(\n boxes: TypedArray, scores: TypedArray,

```

```

maxOutputSize: number,\n iouThreshold: number, scoreThreshold: number,\n padToMaxOutputSize: boolean):
NonMaxSuppressionResult {\n return nonMaxSuppressionImpl_(\n boxes, scores, maxOutputSize,
iouThreshold, scoreThreshold,\n 0 /* softNmsSigma */, false /* returnScoresTensor */,\n padToMaxOutputSize /* padToMaxOutputSize */, true\n /* returnValidOutputs */);\n}\n\nexport function
nonMaxSuppressionV5Impl(\n boxes: TypedArray, scores:
TypedArray, maxOutputSize: number,\n iouThreshold: number, scoreThreshold: number,\n softNmsSigma:
number): NonMaxSuppressionResult {\n return nonMaxSuppressionImpl_(\n boxes, scores, maxOutputSize,
iouThreshold, scoreThreshold, softNmsSigma,\n true /* returnScoresTensor */);\n}\n\nfunction
nonMaxSuppressionImpl_(\n boxes: TypedArray, scores: TypedArray, maxOutputSize: number,\n
iouThreshold: number, scoreThreshold: number, softNmsSigma: number,\n returnScoresTensor = false,
padToMaxOutputSize = false,\n returnValidOutputs = false): NonMaxSuppressionResult {\n // The list is sorted
in ascending order, so that we can always pop the\n // candidate with the largest score in O(1) time.\n const
candidates = [];\n for (let i = 0; i < scores.length; i++) {\n if (scores[i] > scoreThreshold) {\n
candidates.push({score: scores[i], boxIndex: i, suppressBeginIndex: 0});\n }\n }\n candidates.sort(ascendingComparator);\n // If softNmsSigma is 0,
the outcome of this algorithm is exactly same as\n // before.\n const scale = softNmsSigma > 0 ? (-0.5 /
softNmsSigma) : 0.0;\n const selectedIndices: number[] = [];\n const selectedScores: number[] = [];\n while
(selectedIndices.length < maxOutputSize && candidates.length > 0) {\n const candidate = candidates.pop();\n
const {score: originalScore, boxIndex, suppressBeginIndex} = candidate;\n if (originalScore < scoreThreshold)
{\n break;\n }\n // Overlapping boxes are likely to have similar scores, therefore we\n // iterate through
the previously selected boxes backwards in order to\n // see if candidate's score should be suppressed. We use\n
// suppressBeginIndex to track and ensure a candidate can be suppressed\n // by a selected box no more than once.
Also, if the overlap exceeds\n // iouThreshold, we simply ignore the candidate.\n let ignoreCandidate = false;\n
for (let j = selectedIndices.length - 1; j >= suppressBeginIndex; --j)
{\n const iou = intersectionOverUnion(boxes, boxIndex, selectedIndices[j]);\n if (iou >= iouThreshold) {\n
ignoreCandidate = true;\n break;\n }\n }\n candidate.score =\n candidate.score *
suppressWeight(iouThreshold, scale, iou);\n if (candidate.score <= scoreThreshold) {\n break;\n }\n
}\n // At this point, if `candidate.score` has not dropped below\n // `scoreThreshold`, then we know that we
went through all of the\n // previous selections and can safely update `suppressBeginIndex` to the\n // end of the
selected array. Then we can re-insert the candidate with\n // the updated score and suppressBeginIndex back in the
candidate list.\n // If on the other hand, `candidate.score` has dropped below the score\n // threshold, we will not
add it back to the candidates list.\n candidate.suppressBeginIndex = selectedIndices.length;\n if
(!ignoreCandidate) {\n // Candidate has passed all the
tests, and is not suppressed, so\n // select the candidate.\n if (candidate.score === originalScore) {\n
selectedIndices.push(boxIndex);\n selectedScores.push(candidate.score);\n } else if (candidate.score >
scoreThreshold) {\n // Candidate's score is suppressed but is still high enough to be\n // considered, so add
back to the candidates list.\n binaryInsert(candidates, candidate, ascendingComparator);\n }\n }\n }\n //
NonMaxSuppressionV4 feature: padding output to maxOutputSize.\n const validOutputs = selectedIndices.length;\n
const elemsToPad = maxOutputSize - validOutputs;\n if (padToMaxOutputSize && elemsToPad > 0) {\n
selectedIndices.push(...new Array(elemsToPad).fill(0));\n selectedScores.push(...new
Array(elemsToPad).fill(0.0));\n }\n const result: NonMaxSuppressionResult = {selectedIndices};\n if
(returnScoresTensor) {\n result['selectedScores'] = selectedScores;\n }\n if (returnValidOutputs)
{\n result['validOutputs'] = validOutputs;\n }\n return result;\n}\n\nfunction intersectionOverUnion(boxes:
TypedArray, i: number, j: number) {\n const iCoord = boxes.subarray(i * 4, i * 4 + 4);\n const jCoord =
boxes.subarray(j * 4, j * 4 + 4);\n const yminI = Math.min(iCoord[0], iCoord[2]);\n const xminI =
Math.min(iCoord[1], iCoord[3]);\n const ymaxI = Math.max(iCoord[0], iCoord[2]);\n const xmaxI =
Math.max(iCoord[1], iCoord[3]);\n const yminJ = Math.min(jCoord[0], jCoord[2]);\n const xminJ =
Math.min(jCoord[1], jCoord[3]);\n const ymaxJ = Math.max(jCoord[0], jCoord[2]);\n const xmaxJ =

```



```

Math.max(jCoord[1], jCoord[3]);\n const areaI = (ymaxI - yminI) * (xmaxI - xminI);\n const areaJ = (ymaxJ -
yminJ) * (xmaxJ - xminJ);\n if (areaI <= 0 || areaJ <= 0) {\n return 0.0;\n }\n const intersectionYmin =
Math.max(yminI, yminJ);\n const intersectionXmin = Math.max(xminI, xminJ);\n const intersectionYmax =
Math.min(ymaxI, ymaxJ);\n const intersectionXmax = Math.min(xmaxI,
xmaxJ);\n const intersectionArea = Math.max(intersectionYmax - intersectionYmin, 0.0) *\nMath.max(intersectionXmax - intersectionXmin, 0.0);\n return intersectionArea / (areaI + areaJ -
intersectionArea);\n}\n\n// A Gaussian penalty function, this method always returns values in [0, 1].\n// The weight
is a function of similarity, the more overlap two boxes are, the\n// smaller the weight is, meaning highly overlapping
boxe will be significantly\n// penalized. On the other hand, a non-overlapping box will not be penalized.\nfunction
suppressWeight(iouThreshold: number, scale: number, iou: number) {\n const weight = Math.exp(scale * iou *
iou);\n return iou <= iouThreshold ? weight : 0.0;\n}\n\nfunction ascendingComparator(c1: Candidate, c2:
Candidate) {\n // For objects with same scores, we make the object with the larger index go\n // first. In an array
that pops from the end, this means that the object with\n // the smaller index will be popped first. This ensures
the same output as\n // the TensorFlow python version.\n return (c1.score - c2.score) ||\n ((c1.score ===
c2.score) && (c2.boxIndex - c1.boxIndex));\n}\n\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {nonMaxSuppressionV3Impl} from '../backends/non_max_suppression_impl';\nimport {Tensor1D,
Tensor2D}
from '../tensor';\nimport {convertToTensor} from '../tensor_util_env';\nimport {TensorLike} from
'../types';\nimport {nonMaxSuppSanityCheck} from '../nonmax_util';\nimport {tensor1d} from
'../tensor1d';\n\n/**\n * Performs non maximum suppression of bounding boxes based on\n * iou (intersection over
union).\n * This is the async version of `nonMaxSuppression`\n * @param boxes a 2d tensor of shape
`[numBoxes, 4]`. Each entry is\n * `[y1, x1, y2, x2]`, where `(y1, x1)` and `(y2, x2)` are the corners of\n * the
bounding box.\n * @param scores a 1d tensor providing the box scores of shape `[numBoxes]`.\n * @param
maxOutputSize The maximum number of boxes to be selected.\n * @param iouThreshold A float representing the
threshold for deciding whether\n * boxes overlap too much with respect to IOU. Must be between [0, 1].\n *
Defaults to 0.5 (50% box overlap).\n * @param scoreThreshold A threshold for deciding when to remove boxes
based\n * on score. Defaults
to -inf, which means any score is accepted.\n * @return A 1D tensor with the selected box indices.\n *\n * @doc
{heading: 'Operations', subheading: 'Images', namespace: 'image'}\n */\n\nasync function
nonMaxSuppressionAsync_(\n boxes: Tensor2D|TensorLike, scores: Tensor1D|TensorLike,\n maxOutputSize:
number, iouThreshold = 0.5,\n scoreThreshold = Number.NEGATIVE_INFINITY): Promise<Tensor1D> {\n
const $boxes = convertToTensor(boxes, 'boxes', 'nonMaxSuppressionAsync');\n const $scores =
convertToTensor(scores, 'scores', 'nonMaxSuppressionAsync');\n\n const inputs = nonMaxSuppSanityCheck(\n
$boxes, $scores, maxOutputSize, iouThreshold, scoreThreshold);\n maxOutputSize = inputs.maxOutputSize;\n
iouThreshold = inputs.iouThreshold;\n scoreThreshold = inputs.scoreThreshold;\n\n const boxesAndScores = await
Promise.all([$boxes.data(), $scores.data()]);\n const boxesVals = boxesAndScores[0];\n const scoresVals =
boxesAndScores[1];\n\n // We call a cpu based impl directly
with the typedarray data here rather\n // than a kernel because all kernels are synchronous (and thus cannot await\n
// .data()).\n const {selectedIndices} = nonMaxSuppressionV3Impl(\n boxesVals, scoresVals, maxOutputSize,
iouThreshold, scoreThreshold);\n if ($boxes !== boxes) {\n $boxes.dispose();\n }\n if ($scores !== scores) {\n
$scores.dispose();\n }\n\n return tensor1d(selectedIndices, 'int32');\n}\n\nexport const nonMaxSuppressionAsync =

```

```

nonMaxSuppressionAsync_;\n","/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n *
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http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND,
either express or implied.\n * See the License for the specific language governing permissions and\n * limitations
under the License.\n *
=====
*\n\nimport {ENGINE} from '../engine';\nimport {NonMaxSuppressionV5, NonMaxSuppressionV5Attrs,
NonMaxSuppressionV5Inputs} from '../kernel_names';\nimport {NamedAttrMap} from
'../kernel_registry';\nimport {Tensor, Tensor1D, Tensor2D} from '../tensor';\nimport {NamedTensorMap} from
'../tensor_types';\nimport {convertToTensor} from '../tensor_util_env';\nimport {TensorLike} from
'../types';\n\nimport {nonMaxSupSanityCheck} from '../nonmax_util';\nimport {op} from '../operation';\n\n/*\n * Performs non maximum suppression of bounding boxes based on\n * iou (intersection over union).\n *\n * This op
also supports a Soft-NMS mode (c.f.\n * Bodla et al, https://arxiv.org/abs/1704.04503) where boxes reduce the
score\n * of other overlapping boxes, therefore
favoring different regions of the image\n * with high scores. To enable this Soft-NMS mode, set the
`softNmsSigma`\n * parameter to be larger than 0.\n *\n * @param boxes a 2d tensor of shape `[numBoxes, 4]`.
Each entry is\n * `[y1, x1, y2, x2]`, where `(y1, x1)` and `(y2, x2)` are the corners of\n * the bounding box.\n *
@param scores a 1d tensor providing the box scores of shape `[numBoxes]`.\n * @param maxOutputSize The
maximum number of boxes to be selected.\n * @param iouThreshold A float representing the threshold for deciding
whether\n * boxes overlap too much with respect to IOU. Must be between [0, 1].\n * Defaults to 0.5 (50% box
overlap).\n * @param scoreThreshold A threshold for deciding when to remove boxes based\n * on score.
Defaults to -inf, which means any score is accepted.\n * @param softNmsSigma A float representing the sigma
parameter for Soft NMS.\n * When sigma is 0, it falls back to nonMaxSuppression.\n * @return A map with the
following
properties:\n * - selectedIndices: A 1D tensor with the selected box indices.\n * - selectedScores: A 1D tensor
with the corresponding scores for each\n * selected box.\n *\n * @doc {heading: 'Operations', subheading:
'Images', namespace: 'image'}\n\nfunction nonMaxSuppressionWithScore_(\n boxes: Tensor2D|TensorLike,
scores: Tensor1D|TensorLike,\n maxOutputSize: number, iouThreshold = 0.5,\n scoreThreshold =
Number.NEGATIVE_INFINITY,\n softNmsSigma = 0.0): NamedTensorMap {\n const $boxes =
convertToTensor(boxes, 'boxes', 'nonMaxSuppression');\n const $scores = convertToTensor(scores, 'scores',
'nonMaxSuppression');\n\n const params = nonMaxSupSanityCheck(\n $boxes, $scores, maxOutputSize,
iouThreshold, scoreThreshold,\n softNmsSigma);\n maxOutputSize = params.maxOutputSize;\n iouThreshold =
params.iouThreshold;\n scoreThreshold = params.scoreThreshold;\n softNmsSigma = params.softNmsSigma;\n\n
const inputs: NonMaxSuppressionV5Inputs
= {boxes: $boxes, scores: $scores};\n const attrs: NonMaxSuppressionV5Attrs = {\n maxOutputSize,
iouThreshold, scoreThreshold, softNmsSigma};\n\n // tslint:disable-next-line: no-unnecessary-type-assertion\n
const result = ENGINE.runKernel(\n NonMaxSuppressionV5, inputs as {} as NamedTensorMap,\n
attrs as {} as NamedAttrMap) as Tensor[];\n\n return {selectedIndices: result[0], selectedScores:
result[1]};\n}\n\nexport const nonMaxSuppressionWithScore = op({nonMaxSuppressionWithScore_});\n\n",/*\n *
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2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a
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law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
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```

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 \*

\* Asynchronously performs

non maximum suppression of bounding boxes based on `iou` (intersection over union), with an option to pad results.

`boxes` a 2d tensor of shape `[numBoxes, 4]`. Each entry is `[y1, x1, y2, x2]`, where `(y1, x1)` and `(y2, x2)` are the corners of the bounding box.

`scores` a 1d tensor providing the box scores of shape `[numBoxes]`.

`maxOutputSize` The maximum number of boxes to be selected.

`iouThreshold` A float representing the threshold for deciding whether boxes overlap too much with respect to IOU. Must be between `[0, 1]`. Defaults to `0.5` (50% box overlap).

`scoreThreshold` A threshold for deciding when to remove boxes based on score. Defaults to `-inf`, which means any score is accepted.

`padToMaxOutputSize` Defaults to `false`. If true, size of output `selectedIndices` is padded to `maxOutputSize`.

`return` A map with the following properties:

- `selectedIndices`: A 1D tensor with the selected box indices.
- `validOutputs`: A scalar denoting how many elements in `selectedIndices` are valid. Valid elements occur first, then padding.

`@doc {heading: 'Operations', subheading: 'Images', namespace: 'image'}`

```
function nonMaxSuppressionPadded_(boxes:
Tensor2D|TensorLike, scores: Tensor1D|TensorLike,
maxOutputSize: number, iouThreshold = 0.5,
scoreThreshold = Number.NEGATIVE_INFINITY,
padToMaxOutputSize = false): NamedTensorMap {
 const $boxes = convertToTensor(boxes, 'boxes', 'nonMaxSuppression');
 const $scores = convertToTensor(scores, 'scores', 'nonMaxSuppression');
 const params = nonMaxSuppSanityCheck($boxes, $scores,
maxOutputSize, iouThreshold, scoreThreshold,
null /* softNmsSigma */);
 const $maxOutputSize = params.maxOutputSize;
 const $iouThreshold = params.iouThreshold;
 const $scoreThreshold = params.scoreThreshold;
 const inputs: NonMaxSuppressionV4Inputs = {boxes:
$boxes, scores: $scores};
 const attrs: NonMaxSuppressionV4Attrs = {maxOutputSize: $maxOutputSize,
iouThreshold: $iouThreshold,
scoreThreshold: $scoreThreshold,
padToMaxOutputSize};
 tslint:disable-next-line: no-unnecessary-type-assertion
 const result = ENGINE.runKernel(
NonMaxSuppressionV4, inputs as {} as NamedTensorMap,
attrs as {} as NamedAttrMap) as
Tensor[];
 return {selectedIndices: result[0], validOutputs: result[1]};
}

export const
nonMaxSuppressionPadded = op({nonMaxSuppressionPadded_});
"/**
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 * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.
 * See the License for the specific language governing permissions and
 * limitations under the License.
 */
=====
```

```
import {nonMaxSuppressionV4Impl} from '../backends/non_max_suppression_impl';
import {Tensor1D, Tensor2D} from '../tensor';
import {NamedTensorMap} from '../tensor_types';
import {convertToTensor} from '../tensor_util_env';
import {TensorLike} from '../types';
import {nonMaxSuppSanityCheck} from '../nonmax_util';
import {scalar} from '../scalar';
import {tensor1d} from '../tensor1d';

/**
 * Asynchronously performs non maximum suppression of bounding boxes based on
 * iou (intersection over union), with an option to pad results.
 *
 * @param boxes a 2d tensor of shape [numBoxes, 4]. Each entry is [y1, x1, y2, x2],
 * where (y1, x1) and (y2, x2) are the corners of the bounding box.
 *
 * @param scores a 1d tensor providing the box scores of shape [numBoxes].
 *
 * @param maxOutputSize The maximum number of boxes to be selected.
 *
 * @param iouThreshold A float representing the threshold for deciding whether boxes overlap too much with respect to IOU. Must be between [0, 1]. Defaults to 0.5 (50% box overlap).
 *
 * @param scoreThreshold A threshold for deciding when to remove boxes based on score. Defaults to -inf, which means any score is accepted.
 *
 * @param padToMaxOutputSize Defaults to false. If true, size of output selectedIndices is padded to maxOutputSize.
 *
 * @return A map with the following properties:
 *
 * - selectedIndices: A 1D tensor with the

```



```

line: no-unnecessary-type-assertion\n const res = ENGINE.runKernel(\n ResizeBilinear, inputs as { } as
NamedTensorMap,\n attrs as { } as NamedAttrMap) as
T;\n\n if (reshapedTo4D) {\n return reshape(res, [res.shape[1], res.shape[2], res.shape[3]]) as T;\n } \n return
res;\n}\n\nexport const resizeBilinear = op({resizeBilinear_});\n\n", "/*\n * @license\n * Copyright 2020 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not
use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
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===== \n
*\n\nimport {ENGINE} from '../engine';\nimport {ResizeNearestNeighbor, ResizeNearestNeighborAttrs,
ResizeNearestNeighborInputs} from '../kernel_names';\nimport {NamedAttrMap} from
'../kernel_registry';\nimport {Tensor3D, Tensor4D} from '../tensor';\nimport {NamedTensorMap} from
'../tensor_types';\nimport {convertToTensor} from '../tensor_util_env';\nimport {TensorLike} from
'../types';\nimport * as util from '../util';\n\nimport {op} from '../operation';\nimport {reshape} from
'../reshape';\n\n/**\n * NearestNeighbor resize a batch of 3D images to a new shape.\n * \n * @param images The
images, of rank 4 or rank 3, of shape\n * [batch, height, width, inChannels]. If rank 3, batch of 1 is assumed.\n *
\n * @param size The new shape [newHeight, newWidth] to resize the\n * images to. Each channel is resized
individually.\n * \n * @param alignCorners Defaults to False. If true, rescale\n * input by (new_height - 1) / (height -
1), which exactly aligns the 4\n * corners of images and resized images. If false, rescale by\n * new_height /
height`.\n
\n * Treat similarly the width dimension.\n * \n * @param halfPixelCenters Defaults to `false`. Whether to assumes pixels
are of\n * half the actual dimensions, and yields more accurate resizes. This flag\n * would also make the
floating point coordinates of the top left pixel\n * 0.5, 0.5.\n * \n * @doc {heading: 'Operations', subheading:
'Images', namespace: 'image'}\n * \nfunction resizeNearestNeighbor_<T extends Tensor3D|Tensor4D>(\n images:
T|TensorLike, size: [number, number], alignCorners = false,\n halfPixelCenters = false): T {\n const $images =
convertToTensor(images, 'images', 'resizeNearestNeighbor');\n\n util.assert(\n $images.rank === 3 ||
$images.rank === 4,\n () => `Error in resizeNearestNeighbor: x must be rank 3 or 4, but got `+\n `rank
${$images.rank}`);\n util.assert(\n size.length === 2,\n () =>\n `Error in resizeNearestNeighbor: new
shape must 2D, but got shape `+\n `${size}`);\n util.assert(\n $images.dtype === 'float32' || $images.dtype === 'int32',\n () => `images` must have `int32` or `float32` as
dtype);\n util.assert(\n halfPixelCenters === false || alignCorners === false,\n () => `Error in
resizeNearestNeighbor: If halfPixelCenters is true, `+\n `alignCorners must be false.`);\n let batchImages =
$images as Tensor4D;\n let reshapedTo4D = false;\n if ($images.rank === 3) {\n reshapedTo4D = true;\n batchImages = reshape(\n $images, [1, $images.shape[0], $images.shape[1], $images.shape[2]]);\n }\n const []
= size;\n\n const inputs: ResizeNearestNeighborInputs = {images: batchImages};\n const attrs:\n ResizeNearestNeighborAttrs = {alignCorners, halfPixelCenters, size};\n\n // tslint:disable-next-line: no-
unnecessary-type-assertion\n const res = ENGINE.runKernel(\n ResizeNearestNeighbor, inputs as { } as
NamedTensorMap,\n attrs as { } as NamedAttrMap) as T;\n\n if (reshapedTo4D) {\n return
reshape(res, [res.shape[1], res.shape[2], res.shape[3]]) as T;\n }\n return res;\n}\n\nexport const
resizeNearestNeighbor = op({resizeNearestNeighbor_});\n\n", "/*\n * @license\n * Copyright 2020 Google LLC. All
Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *

```

```

=====
*\n\nimport {Tensor} from '../tensor';\nimport {convertToTensor} from '../tensor_util_env';\nimport
{TensorLike}
from '../types';\nimport {assert} from '../util';\n\nimport {greaterEqual} from '../greater_equal';\nimport
{lessEqual} from '../less_equal';\nimport {logicalAnd} from '../logical_and';\nimport {op} from
'../operation';\nimport {range} from '../range';\nimport {reshape} from '../reshape';\nimport {scalar} from
'../scalar';\nimport {stack} from '../stack';\nimport {sub} from '../sub';\nimport {unstack} from '../unstack';\nimport
{where} from '../where';\nimport {zeros} from '../zeros';\n\n**\n * Copy a tensor setting everything outside a
central band in each innermost\n * matrix to zero.\n * \n * The band part is computed as follows: Assume input has
`k` dimensions\n * `[I, J, K, ..., M, N]`, then the output is a tensor with the same shape where\n * `band[i, j, k, ..., m,
n] = in_band(m, n) * input[i, j, k, ..., m, n]`.\n * The indicator function\n * `in_band(m, n) = (num_lower < 0 || (m-n)
<= num_lower)`\n * `&& (num_upper < 0 || (n-m) <= num_upper)`\n * \n * ```\n *
const x = tf.tensor2d([[0, 1, 2, 3],\n * [-1, 0, 1, 2],\n * [-2, -1, 0, 1],\n *
 [-3, -2, -1, 0]]);\n * let y = tf.linalg.bandPart(x, 1, -1);\n * y.print(); // [[0, 1, 2, 3],\n *
 // [-1, 0, 1, 2],\n *
 // [0, -1, 0, 1],\n * // [0, 0, -1, 0]]\n * let z = tf.linalg.bandPart(x, 2, 1);\n * z.print(); // [[0, 1, 0, 0],\n *
 // [-1, 0, 1, 0],\n * // [-2, -1, 0, 1],\n * // [0, -2, -1, 0]]\n * ```\n * \n * @param x Rank `k`
tensor\n * @param numLower Number of subdiagonals to keep.\n * If negative, keep entire lower triangle.\n *
@param numUpper Number of subdiagonals to keep.\n * If negative, keep entire upper triangle.\n * @returns
Rank `k` tensor of the same shape as input.\n * The extracted banded tensor.\n * \n * @doc {heading:'Operations',
subheading:'Linear Algebra', namespace:'linalg'}\n * \nfunction bandPart_<T extends Tensor>(\n
 a: T|TensorLike, numLower: number, numUpper: number): T {\n assert(\n numLower % 1 === 0,\n () =>
`bandPart(): numLower must be an integer, got ${numLower}.`);\n assert(\n numUpper % 1 === 0,\n () =>
`bandPart(): numUpper must be an integer, got ${numUpper}.`);\n\n const $a = convertToTensor(a, 'a',
'bandPart');\n\n assert(\n $a.rank >= 2,\n () => `bandPart(): Rank must be at least 2, got ${$a.rank}.`);\n\n
const shape = $a.shape;\n const [M, N] = $a.shape.slice(-2);\n\n if (!(numLower <= M)) {\n throw new Error(\n
 `bandPart(): numLower (${numLower})` +\n ` must not be greater than the number of rows (${M}).`);\n }\n
if (!(numUpper <= N)) {\n throw new Error(\n `bandPart(): numUpper (${numUpper})` +\n ` must not be
greater than the number of columns (${N}).`);\n }\n\n if (numLower < 0) {\n numLower = M;\n }\n if
(numUpper < 0) {\n numUpper = N;\n }\n\n const i = reshape(range(0, M, 1, 'int32'),
[-1, 1]);\n const j = range(0, N, 1, 'int32');\n const ij = sub(i, j);\n\n const inBand = logicalAnd(\n lessEqual(ij,
scalar(+numLower, 'int32')),\n greaterEqual(ij, scalar(-numUpper, 'int32')));\n\n const zero = zeros([M, N],
$a.dtype);\n\n return reshape(\n stack(unstack(reshape($a, [-1, M, N]))\n .map(mat =>
where(inBand, mat, zero))),\n shape) as T;\n}\n\nexport const bandPart = op({bandPart_});\n\n"/**\n *
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2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n *
* See the License for the specific language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {ENGINE} from '../engine';\nimport {Tensor1D, Tensor2D} from '../tensor';\nimport {assert} from
'../util';\n\nimport {div} from '../div';\nimport {mul} from '../mul';\nimport {norm} from '../norm';\nimport {op}
from '../operation';\nimport {split} from '../split';\nimport {squeeze} from '../squeeze';\nimport {stack} from
'../stack';\nimport {sub} from '../sub';\nimport {sum} from '../sum';\n\n**\n * Gram-Schmidt orthogonalization.\n *
\n * ```\n * \n * const x = tf.tensor2d([[1, 2], [3, 4]]);\n * let y = tf.linalg.gramSchmidt(x);\n * y.print();\n *
console.log('Orthogonalized:');\n * y.dot(y.transpose()).print(); // should be nearly the identity matrix.\n *
console.log('First row direction maintained:');\n * const data = await y.array();\n * console.log(data[0][1] /
data[0][0]);

```

```

// should be nearly 2.\n * ```\n * @param xs The vectors to be orthogonalized, in one of the two following\n *
formats:\n * - An Array of `tf.Tensor1D`.\n * - A `tf.Tensor2D`, i.e., a matrix, in which case the vectors are the
rows\n * of `xs`.\n * In each case, all the vectors must have the same length and the length\n * must be greater
than or equal to the number of vectors.\n * @returns The orthogonalized and normalized vectors or matrix.\n *
Orthogonalization means that the vectors or the rows of the matrix\n * are orthogonal (zero inner products).
Normalization means that each\n * vector or each row of the matrix has an L2 norm that equals `1`.\n * @doc
{heading: 'Operations', subheading: 'Linear Algebra', namespace: 'linalg'}\n */\nfunction gramSchmidt_(xs:
Tensor1D[]|Tensor2D): Tensor1D[]|Tensor2D {\n let inputIsTensor2D: boolean;\n if (Array.isArray(xs)) {\n inputIsTensor2D = false;\n assert(\n xs != null && xs.length > 0,\n () => 'Gram-Schmidt
process: input must not be null, undefined, or '\n 'empty');\n const dim = xs[0].shape[0];\n for (let i = 1;\n i < xs.length; ++i) {\n assert(\n xs[i].shape[0] === dim,\n () =>\n 'Gram-Schmidt: Non-unique
lengths found in the input vectors: '\n `(${xs as Tensor1D[]}[i].shape[0] vs. ${dim})`);\n }\n } else {\n inputIsTensor2D = true;\n xs = split(xs, xs.shape[0], 0).map(x => squeeze(x, [0]));\n }\n }\n assert(\n xs.length
<= xs[0].shape[0],\n () => `Gram-Schmidt: Number of vectors (${xs as Tensor1D[]}.length)\n exceeds ` +\n `number of dimensions (${xs as Tensor1D[]}[0].shape[0]).`);\n const ys: Tensor1D[] = [];\n const xs1d = xs;\n for (let i = 0; i < xs.length; ++i) {\n ys.push(ENGINE.tidy(() => {\n let x = xs1d[i];\n if
(i > 0) {\n for (let j = 0; j < i; ++j) {\n const proj = mul(sum(mul(ys[j], x)), ys[j]);\n x
= sub(x, proj);\n }\n }\n return div(x, norm(x, 'euclidean'));\n }));\n }\n if (inputIsTensor2D) {\n return stack(ys, 0) as Tensor2D;\n } else {\n return ys;\n }\n }\n}\n\nexport const gramSchmidt =
op({gramSchmidt_});\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed
under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
=====
\n
*/\nimport {ENGINE} from '../engine';\nimport
{dispose} from '../globals';\nimport {Tensor, Tensor2D} from '../tensor';\nimport {assert} from
'../util';\n\nimport {clone} from '../clone';\nimport {concat} from '../concat';\nimport {div} from '../div';\nimport
{eye} from '../eye';\nimport {greater} from '../greater';\nimport {matMul} from '../mat_mul';\nimport {mul} from
'../mul';\nimport {neg} from '../neg';\nimport {norm} from '../norm';\nimport {op} from '../operation';\nimport
{reshape} from '../reshape';\nimport {slice} from '../slice';\nimport {stack} from '../stack';\nimport {sub} from
'../sub';\nimport {tensor2d} from '../tensor2d';\nimport {transpose} from '../transpose';\nimport {unstack} from
'../unstack';\nimport {where} from '../where';\n\n/**\n * Compute QR decomposition of m-by-n matrix using
Householder transformation.\n *\n * Implementation based on\n *
[http://www.cs.cornell.edu/~bindel/class/cs6210-f09/lec18.pdf]\n *\n * (http://www.cs.cornell.edu/~bindel/class/cs6210-f09/lec18.pdf)\n *\n *
```\n * const a = tf.tensor2d([[1, 2], [3, 4]]);\n * let [q, r] = tf.linalg.qr(a);\n * console.log('Q');\n * q.print();\n *
console.log('R');\n * r.print();\n * console.log('Orthogonalized');\n * q.dot(q.transpose()).print() // should be nearly
the identity matrix.\n * console.log('Reconstructed');\n * q.dot(r).print(); // should be nearly [[1, 2], [3, 4]];\n *
```\n *\n * @param x The `tf.Tensor` to be QR-decomposed. Must have rank >= 2. Suppose\n * it has the shape `[..., M,
N]`.\n *\n * @param fullMatrices An optional boolean parameter. Defaults to `false`.\n * If `true`, compute full-sized
`Q`. If `false` (the default),\n * compute only the leading N columns of `Q` and `R`.\n *\n * @returns An `Array` of
two `tf.Tensor`s: `[Q, R]`. `Q` is a unitary matrix,\n * i.e., its columns all have unit norm and are mutually
orthogonal.\n * If `M >= N`,\n * If `fullMatrices` is `false` (default),\n * - `Q` has a shape of `[..., M, N]`,\n *
- `R` has a shape of `[..., N,`

```



```

N]`. \n * If `fullMatrices` is `true` (default), \n * - `Q` has a shape of `[..., M, M]`, \n * - `R` has a shape of
`[..., M, N]`. \n * If `M < N`, \n * - `Q` has a shape of `[..., M, M]`, \n * - `R` has a shape of `[..., M, N]`. \n *
@throws If the rank of `x` is less than 2. \n * \n * @doc {heading: 'Operations', \n * subheading: 'Linear Algebra', \n
* namespace: 'linalg'} \n * \n function qr_(x: Tensor, fullMatrices = false): [Tensor, Tensor] { \n assert(\n
x.rank >= 2, \n () => `qr` requires input tensor to have a rank >= 2, but got rank ${\n x.rank}`); \n \n if
(x.rank === 2) { \n return qr2d(x as Tensor2D, fullMatrices); \n } else { \n // Rank > 2. \n // TODO(cais): Below
we split the input into individual 2D tensors, \n // perform QR decomposition on them and then stack the results
back \n // together. We should explore whether this can be parallelized. \n const outerDimsProd =
x.shape.slice(0, x.shape.length - 2) \n
.reduce((value, prev) => value * prev); \n const x2ds = unstack(\n reshape(\n x, \n
[\n outerDimsProd, x.shape[x.shape.length - 2], \n x.shape[x.shape.length - 1] \n]), \n 0); \n
const q2ds: Tensor2D[] = []; \n const r2ds: Tensor2D[] = []; \n x2ds.forEach(x2d => { \n const [q2d, r2d] =
qr2d(x2d as Tensor2D, fullMatrices); \n q2ds.push(q2d); \n r2ds.push(r2d); \n }); \n const q =
reshape(stack(q2ds, 0), x.shape); \n const r = reshape(stack(r2ds, 0), x.shape); \n return [q, r]; \n } \n } \n \n function
qr2d(x: Tensor2D, fullMatrices = false): [Tensor2D, Tensor2D] { \n return ENGINE.tidy(() => { \n assert(\n
x.shape.length === 2, \n () => `qr2d` requires a 2D Tensor, but got a ${\n x.shape.length}D
Tensor.`); \n \n const m = x.shape[0]; \n const n = x.shape[1]; \n \n let q = eye(m); // Orthogonal transform so
far. \n let r = clone(x); //
Transformed matrix so far. \n \n const one2D = tensor2d([1], [1, 1]); \n let w: Tensor2D = clone(one2D); \n \n
const iters = m >= n ? n : m; \n for (let j = 0; j < iters; ++j) { \n // This tidy within the for-loop ensures we clean
up temporary \n // tensors as soon as they are no longer needed. \n const rTemp = r; \n const wTemp = w; \n
const qTemp = q; \n [w, r, q] = ENGINE.tidy(): [Tensor2D, Tensor2D, Tensor2D] => { \n // Find H = I - tau
* w * w', to put zeros below R(j, j). \n const rjEnd1 = slice(r, [j, j], [m - j, 1]); \n const normX =
norm(rjEnd1); \n const rjj = slice(r, [j, j], [1, 1]); \n \n // The sign() function returns 0 on 0, which causes
division by zero. \n const s = where(greater(rjj, 0), tensor2d([-1]), tensor2d([1])); \n \n const u1 = sub(rjj,
mul(s, normX)); \n const wPre = div(rjEnd1, u1); \n if (wPre.shape[0] === 1) { \n w = clone(one2D); \n
} else { \n
w = concat(\n [\n one2D, \n slice(wPre, [1, 0], [wPre.shape[0] - 1, wPre.shape[1]]) \n] as \n
Tensor2D \n), \n 0); \n } \n const tau = neg(div(matMul(s, u1), normX)) as
Tensor2D; \n \n // -- R := HR, Q := QH. \n const rjEndAll = slice(r, [j, 0], [m - j, n]); \n const tauTimesW:
Tensor2D = mul(tau, w); \n const wT: Tensor2D = transpose(w); \n if (j === 0) { \n r = sub(rjEndAll,
matMul(tauTimesW, matMul(wT, rjEndAll))); \n } else { \n const rTimesTau: Tensor2D = \n
sub(rjEndAll, matMul(tauTimesW, matMul(wT, rjEndAll))); \n r = concat([slice(r, [0, 0], [j, n]), rTimesTau],
0); \n } \n const tauTimesWT: Tensor2D = transpose(tauTimesW); \n const qAllJEnd = slice(q, [0, j],
[m, q.shape[1] - j]); \n if (j === 0) { \n q = sub(qAllJEnd, matMul(matMul(qAllJEnd, w), tauTimesWT)); \n
} else { \n
const qTimesTau: Tensor2D = \n sub(qAllJEnd, matMul(matMul(qAllJEnd, w), tauTimesWT)); \n
q = concat([slice(q, [0, 0], [m, j]), qTimesTau, 1); \n } \n return [w, r, q]; \n }); \n \n dispose([rTemp,
wTemp, qTemp]); \n } \n \n if (!fullMatrices && m > n) { \n q = slice(q, [0, 0], [m, n]); \n r = slice(r, [0, 0],
[n, n]); \n } \n \n return [q, r]; \n }) as [Tensor2D, Tensor2D]; \n } \n \n \n export const qr = op({qr_}); \n "/* \n *
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2.0 (the "License"); \n * you may not use this file except in compliance with the License. \n * You may obtain a
copy of the License at \n * http://www.apache.org/licenses/LICENSE-2.0 \n * Unless required by applicable
law or agreed to in writing, software \n * distributed under the License is distributed on an "AS IS" BASIS, \n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied. \n *
* See the License for the specific language governing permissions and \n * limitations under the License. \n *
===== \n
/ \n \n export enum Reduction { \n NONE, \n MEAN, \n SUM, \n SUM_BY_NONZERO_WEIGHTS \n } \n "/ \n *

```

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```
=====
*/\nimport {Tensor} from '../tensor';\nimport {convertToTensor} from '../tensor_util_env';\nimport {TensorLike} from '../types';\nimport {cast} from './cast';\nimport {div} from './div';\nimport {Reduction} from './loss_ops_utils';\nimport {mean} from './mean';\nimport {mul} from './mul';\nimport {notEqual} from './not_equal';\nimport {ones} from './ones';\nimport {op} from './operation';\nimport {scalar} from './scalar';\nimport {sum} from './sum';\n\n/**\n * Computes the weighted loss between two tensors.\n *\n * @param losses Tensor of shape `[batch_size, d1, ... dN]`.\n * @param weights Tensor whose rank is either 0, or the same rank as\n * `losses`, and must be broadcastable to `losses` (i.e., all\n * dimensions must be either `1`, or the same as the corresponding\n * `losses` dimension).\n *\n * @doc {heading: 'Training', subheading: 'Losses', namespace: 'losses'}\n *\nfunction computeWeightedLoss_<T extends Tensor, O extends Tensor>(\n losses: T|TensorLike, weights?: Tensor|TensorLike,\n reduction = Reduction.SUM_BY_NONZERO_WEIGHTS): O {\n const $losses = convertToTensor(losses, 'losses', 'computeWeightedLoss');\n let $weights: Tensor = null;\n if (weights != null) {\n $weights = convertToTensor(weights, 'weights', 'computeWeightedLoss');\n }\n\n const weightedLoss = ($weights == null) ? $losses : mul($losses, $weights);\n\n if (reduction === Reduction.NONE) {\n return weightedLoss as O;\n }\n if (reduction === Reduction.SUM) {\n return sum(weightedLoss);\n }\n if (reduction === Reduction.MEAN) {\n if ($weights == null) {\n return mean(weightedLoss);\n } else {\n const broadcastFactor = $losses.size / $weights.size;\n const result = div(sum(weightedLoss), sum($weights));\n return broadcastFactor > 1 ? div(result, scalar(broadcastFactor)) :\n result as O;\n }\n }\n if (reduction === Reduction.SUM_BY_NONZERO_WEIGHTS) {\n if ($weights == null) {\n return div(sum(weightedLoss), scalar($losses.size));\n } else {\n const broadcastedWeights = mul($weights, ones($losses.shape));\n const numNonZeros = cast(sum(notEqual(broadcastedWeights, scalar(0))), 'float32');\n return div(sum(weightedLoss), numNonZeros);\n }\n }\n throw Error(`Unknown reduction: ${reduction}`);\n}\n\nexport const computeWeightedLoss = op({computeWeightedLoss_});\n\n**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific
```

language governing permissions and\n \* limitations under the License.\n \*\n=====

```
*/\n\nimport {Tensor} from '../tensor';\nimport {convertToTensor} from '../tensor_util_env';\nimport {TensorLike} from '../types';\nimport {assertShapesMatch} from '../util';\nimport {abs} from './abs';\nimport {Reduction} from './loss_ops_utils';\nimport {op} from './operation';\nimport {sub} from './sub';\n\nimport {computeWeightedLoss} from './compute_weighted_loss';\n\n/**\n * Computes the absolute difference loss between two tensors.\n *\n * @param labels The ground truth output tensor, same dimensions as\n * 'predictions'.
\n * @param predictions The predicted outputs.
\n * @param weights Tensor whose rank is either 0, or the same rank as\n * `labels`, and must be broadcastable to `labels` (i.e., all dimensions\n * must be either `1`, or the same as the corresponding `losses`\n * dimension).\n *\n * @param reduction Type of reduction to apply to loss. Should be of type\n * `Reduction`.\n *\n * @doc {heading: 'Training', subheading: 'Losses', namespace: 'losses'}\n *\nfunction absoluteDifference_<T extends Tensor, O extends Tensor>(\n labels: T|TensorLike, predictions: T|TensorLike,\n weights?: Tensor|TensorLike,\n reduction = Reduction.SUM)
```

```

reduction = Reduction.SUM_BY_NONZERO_WEIGHTS): O {\n const $labels = convertToTensor(labels, 'labels',
'absoluteDifference');\n const $predictions =\n convertToTensor(predictions, 'predictions',
'absoluteDifference');\n let $weights: Tensor = null;\n if (weights != null) {\n $weights =
convertToTensor(weights, 'weights', 'absoluteDifference');\n }\n assertShapesMatch(\n $labels.shape,
$predictions.shape, 'Error in absoluteDifference: ');\n const losses = abs(sub($labels, $predictions));\n return
computeWeightedLoss(losses, $weights, reduction);\n}\n\nexport const absoluteDifference =
op({absoluteDifference_});\n", "/*\n * @license\n * Copyright
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you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *

```

```

=====
*\nimport {Tensor} from '../tensor';\nimport {convertToTensor} from '../tensor_util_env';\nimport
{TensorLike} from '../types';\nimport {assertShapesMatch} from '../util';\nimport {Reduction} from
'./loss_ops_utils';\nimport {mul} from './mul';\nimport {op} from './operation';\nimport {scalar}
from './scalar';\nimport {sub} from './sub';\nimport {sum} from './sum';\n\nimport {computeWeightedLoss} from
'./compute_weighted_loss';\n\n/**\n * Computes the cosine distance loss between two tensors.\n *\n * @param
labels The ground truth output tensor, same dimensions as\n * 'predictions'.\n * @param predictions The predicted
outputs.\n * @param axis The dimension along which the cosine distance is computed.\n * @param weights Tensor
whose rank is either 0, or the same rank as\n * `labels`, and must be broadcastable to `labels` (i.e., all dimensions\n
* must be either `1`, or the same as the corresponding `losses` dimension).\n * @param reduction Type of
reduction to apply to loss. Should be of type\n * `Reduction`\n *\n * @doc {heading: 'Training', subheading:
'Losses', namespace: 'losses'}\n *\nfunction cosineDistance_<T extends Tensor, O extends Tensor>(\n labels:
T|TensorLike, predictions: T|TensorLike, axis: number,\n weights?: Tensor|TensorLike,\n reduction = Reduction.SUM_BY_NONZERO_WEIGHTS): O {\n const $labels = convertToTensor(labels,
'labels', 'cosineDistance');\n const $predictions =\n convertToTensor(predictions, 'predictions',
'cosineDistance');\n let $weights: Tensor = null;\n if (weights != null) {\n $weights = convertToTensor(weights,
'weights', 'cosineDistance');\n }\n assertShapesMatch(\n $labels.shape, $predictions.shape, 'Error in
cosineDistance: ');\n const one = scalar(1);\n const losses = sub(one, sum(mul($labels, $predictions), axis,
true));\n return computeWeightedLoss(losses, $weights, reduction);\n}\n\nexport const cosineDistance =
op({cosineDistance_});\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed
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License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required
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BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the
License for the specific language governing permissions and\n * limitations under the License.\n *

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=====
*\nimport {Tensor} from '../tensor';\nimport {convertToTensor} from '../tensor_util_env';\nimport
{TensorLike} from '../types';\nimport {assertShapesMatch} from '../util';\nimport {Reduction} from
'./loss_ops_utils';\nimport {mul} from './mul';\nimport {op} from './operation';\nimport {relu} from
'./relu';\nimport {scalar} from './scalar';\nimport {sub} from './sub';\n\nimport {computeWeightedLoss} from
'./compute_weighted_loss';\n\n/**\n * Computes the Hinge loss between two tensors.\n *\n * @param labels The
ground truth output tensor, same dimensions as\n * 'predictions'.

* @param predictions The predicted outputs.\n * @param weights Tensor whose rank is either 0, or the same rank
as\n * `labels`, and must be broadcastable to `labels` (i.e., all dimensions\n * must be either `1`, or the same as

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the corresponding `losses` \n * dimension).\n * @param reduction Type of reduction to apply to loss. Should be of
type\n * `Reduction`\n * \n * @doc {heading: 'Training', subheading: 'Losses', namespace: 'losses'}\n * \nfunction
hingeLoss_<T extends Tensor, O extends Tensor>(\n labels: T|TensorLike, predictions: T|TensorLike,\n
weights?: Tensor|TensorLike,\n reduction = Reduction.SUM_BY_NONZERO_WEIGHTS): O {\n let $labels =
convertToTensor(labels, 'labels', 'hingeLoss');\n const $predictions = convertToTensor(predictions, 'predictions',
'hingeLoss');\n let $weights: Tensor = null;\n if (weights != null) {\n $weights = convertToTensor(weights,
'weights', 'hingeLoss');\n }\n assertShapesMatch($labels.shape, $predictions.shape, 'Error
in hingeLoss: '); \n\n const one = scalar(1);\n // Convert binary labels to (-1, 1)\n $labels = sub(mul(scalar(2),
$labels), one);\n const losses = relu(sub(one, mul($labels, $predictions))); \n return computeWeightedLoss(losses,
$weights, reduction);\n} \n\nexport const hingeLoss = op({hingeLoss_}); \n", "/*\n * @license\n * Copyright 2020
Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you
may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *

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===== \n
*\n\nimport {Tensor} from '../tensor';\nimport {convertToTensor} from '../tensor_util_env';\nimport
{TensorLike} from '../types';\nimport {assertShapesMatch} from '../util';\nimport {abs} from '../abs';\nimport
{add} from '../add';\nimport {Reduction} from '../loss_ops_utils';\nimport {minimum} from '../minimum';\nimport
{mul} from '../mul';\nimport {op} from '../operation';\nimport {scalar} from '../scalar';\nimport {square} from
'../square';\nimport {sub} from '../sub';\n\nimport {computeWeightedLoss} from
'./compute_weighted_loss'; \n\n/*\n * Computes the huber loss between two tensors.\n * \n * @param labels The
ground truth output tensor, same dimensions as\n * `predictions`.\n * @param predictions The predicted outputs.\n
* @param weights Tensor whose rank is either 0, or the same rank as\n * `labels`, and must be broadcastable to
`labels` (i.e., all dimensions\n * must be either `1`, or the same as the corresponding `losses`\n * dimension).\n
* @param delta Point where huber loss changes from quadratic to linear.\n * @param reduction Type of reduction
to apply to loss. Should be of type\n * `Reduction`.\n * \n * @doc {heading: 'Training', subheading: 'Losses',
namespace: 'losses'}\n * \nfunction huberLoss_<T extends Tensor, O extends Tensor>(\n labels: T|TensorLike,
predictions: T|TensorLike,\n weights?: Tensor|TensorLike, delta = 1.0,\n reduction =
Reduction.SUM_BY_NONZERO_WEIGHTS): O {\n const $labels = convertToTensor(labels, 'labels',
'huberLoss');\n const $predictions = convertToTensor(predictions, 'predictions', 'huberLoss');\n let $weights:
Tensor = null;\n if (weights != null) {\n $weights = convertToTensor(weights, 'weights', 'huberLoss');\n }\n
assertShapesMatch($labels.shape, $predictions.shape, 'Error in huberLoss: '); \n\n const deltaScalar =
scalar(delta);\n const error = abs(sub($predictions, $labels));\n const quadratic = minimum(error, deltaScalar);\n
const linear = sub(error,
quadratic);\n\n const losses =\n add(mul(scalar(0.5), square(quadratic)), mul(deltaScalar, linear));\n return
computeWeightedLoss(losses, $weights, reduction);\n} \n\nexport const huberLoss = op({huberLoss_}); \n", "/*\n *
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2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific
language governing permissions and\n * limitations under the License.\n *

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===== \n
*\n\nimport {Tensor} from '../tensor';\nimport {convertToTensor}
from '../tensor_util_env';\nimport {TensorLike} from '../types';\nimport {assertShapesMatch} from
'../util';\nimport {add} from '../add';\nimport {log} from '../log';\nimport {Reduction} from

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'./loss_ops_utils';\nimport {mul} from './mul';\nimport {neg} from './neg';\nimport {op} from
'./operation';\nimport {scalar} from './scalar';\nimport {sub} from './sub';\n\nimport {computeWeightedLoss} from
'./compute_weighted_loss';\n\n/**\n * Computes the log loss between two tensors.\n * \n * @param labels The
ground truth output tensor, same dimensions as\n * `predictions`.\n * @param predictions The predicted outputs.\n
* @param weights Tensor whose rank is either 0, or the same rank as\n * `labels`, and must be broadcastable to
`labels` (i.e., all dimensions\n * must be either `1`, or the same as the corresponding `losses`\n * dimension).\n
* @param epsilon A small increment to avoid taking log of zero\n * @param reduction Type of reduction to apply to
loss. Should be of type\n * `Reduction`\n * \n * @doc {heading: 'Training', subheading: 'Losses', namespace:
'losses'}\n *\nfunction logLoss<T extends Tensor, O extends Tensor>(\n labels: T|TensorLike, predictions:
T|TensorLike,\n weights?: Tensor|TensorLike, epsilon = 1e-7,\n reduction =
Reduction.SUM_BY_NONZERO_WEIGHTS): O {\n const $labels = convertToTensor(labels, 'labels', 'logLoss');\n
const $predictions = convertToTensor(predictions, 'predictions', 'logLoss');\n let $weights: Tensor = null;\n if
(weights != null) {\n $weights = convertToTensor(weights, 'weights', 'logLoss');\n }\n assertShapesMatch($labels.shape, $predictions.shape, 'Error in logLoss: ');\n const one = scalar(1);\n const
epsilonScalar = scalar(epsilon);\n const l1 = neg(mul($labels, log(add($predictions, epsilonScalar))));\n const l2
=\n mul(sub(one, $labels), log(add(sub(one, $predictions), epsilonScalar)));\n const losses = sub(l1, l2);\n return
computeWeightedLoss(losses,\n $weights, reduction);\n}\n\nexport const logLoss = op({logLoss_});\n\n", "/*\n * @license\n * Copyright 2020 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not
use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
\n\nimport {Tensor} from './../tensor';\nimport {convertToTensor} from './../tensor_util_env';\nimport
{TensorLike} from './../types';\nimport {assertShapesMatch} from './../util';\nimport {Reduction} from
'./loss_ops_utils';\nimport {op} from './operation';\nimport {squaredDifference} from
'./squared_difference';\n\nimport {computeWeightedLoss} from './compute_weighted_loss';\n\n/**\n * Computes
the mean squared error between two tensors.\n * \n * @param labels The ground truth output tensor, same
dimensions as\n * `predictions`.\n * @param predictions The predicted outputs.\n * @param weights Tensor whose
rank is either 0, or the same rank as\n * `labels`, and must be broadcastable to `labels` (i.e., all dimensions\n
* must be either `1`, or the same as the corresponding `losses`\n * dimension).\n * @param reduction Type of
reduction to apply to loss. Should be of type\n * `Reduction`\n * \n * @doc {heading: 'Training', subheading:
'Losses', namespace: 'losses'}\n *\nfunction meanSquaredError<T extends Tensor, O extends Tensor>(\n labels:
T|TensorLike, predictions: T|TensorLike,\n weights?: Tensor|TensorLike,\n reduction =
Reduction.SUM_BY_NONZERO_WEIGHTS): O
{\n const $labels = convertToTensor(labels, 'labels', 'meanSquaredError');\n const $predictions =\n convertToTensor(predictions, 'predictions', 'meanSquaredError');\n let $weights: Tensor = null;\n if (weights !=
null) {\n $weights = convertToTensor(weights, 'weights', 'meanSquaredError');\n }\n assertShapesMatch(\n
$labels.shape, $predictions.shape, 'Error in meanSquaredError: ');\n const losses = squaredDifference($labels,\n
$predictions);\n return computeWeightedLoss(losses, $weights, reduction);\n}\n\nexport const meanSquaredError =
op({meanSquaredError_});\n\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n *
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compliance with the License.\n * You may obtain a copy of the License at\n * \n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License

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```
=====
*
import { Tensor } from '../tensor';
import { convertToTensor } from '../tensor_util_env';
import { TensorLike } from '../types';
import { assertShapesMatch } from '../util';
import { abs } from '../abs';
import { add } from '../add';
import { exp } from '../exp';
import { log1p } from '../log1p';
import { Reduction } from '../loss_ops_utils';
import { mul } from '../mul';
import { neg } from '../neg';
import { op } from '../operation';
import { relu } from '../relu';
import { scalar } from '../scalar';
import { sub } from '../sub';
import { computeWeightedLoss } from '../compute_weighted_loss';
import function sigmoidCrossEntropyWithLogits_<T extends Tensor, O extends Tensor>(\n
 labels: T|TensorLike, logits: T|TensorLike): O {\n
 const $labels =\n convertToTensor(labels, 'labels',\n 'sigmoidCrossEntropyWithLogits');\n
 const $logits =\n convertToTensor(logits, 'logits',\n 'sigmoidCrossEntropyWithLogits');\n
 assertShapesMatch(\n $labels.shape, $logits.shape, 'Error in\n sigmoidCrossEntropyWithLogits: ');
 /**\n * Implementation Details:\n * For brevity, let `x = logits`, `z = labels`. The logistic loss is\n *
$$z * -\log(\text{sigmoid}(x)) + (1 - z) * -\log(1 - \text{sigmoid}(x))$$
\n *
$$= z * -\log(1 / (1 + \exp(-x))) + (1 - z) * -\log(\exp(-x) / (1 + \exp(-x)))$$
\n *
$$= z * \log(1 + \exp(-x)) + (1 - z) * (-\log(\exp(-x)) + \log(1 + \exp(-x)))$$
\n *
$$= z * \log(1 + \exp(-x)) + (1 - z) * (x + \log(1 + \exp(-x)))$$
\n *
$$= (1 - z) * x + \log(1 + \exp(-x))$$
\n *
$$= x - x * z + \log(1 + \exp(-x))$$
\n * For $x < 0$, to avoid overflow in $\exp(-x)$, we reformulate the above\n *
$$x - x * z + \log(1 + \exp(-x)) = \log(\exp(x)) - x * z + \log(1 + \exp(-x))$$
\n *
$$= -x * z + \log(1 + \exp(x))$$
\n * Hence, to ensure stability and avoid overflow, the implementation uses\n * this equivalent formulation:\n *
$$\max(x, 0) - x * z + \log(1 + \exp(-\text{abs}(x)))$$
\n *\n * const maxOutput =\n * relu($logits);\n * const outputXTarget = mul($logits, $labels);\n * const sigmoidOutput =\n * log1p(exp(neg(abs($logits))));\n * return add(sub(maxOutput, outputXTarget), sigmoidOutput);\n */\n /**\n * Computes the sigmoid cross entropy loss between two tensors.\n * If labelSmoothing is nonzero, smooth the labels towards 1/2.\n * newMulticlassLabels = multiclassLabels * (1 - labelSmoothing) +\n * 0.5 * labelSmoothing\n * @param multiClassLabels The ground truth output tensor of shape [batch_size, num_classes], same dimensions as 'predictions'.\n * @param logits The predicted outputs.\n * @param weights Tensor whose rank is either 0, or the same rank as `labels`, and must be broadcastable to `labels` (i.e., all dimensions\n * must be either `1`, or the same as the corresponding `losses` dimension).\n * @param labelSmoothing If greater than 0, then smooth the labels.\n * @param reduction Type of reduction to apply to loss. Should be of type\n * `Reduction`\n * @doc { heading: 'Training', subheading: 'Losses', namespace: 'losses' }\n */\n function\n sigmoidCrossEntropy_<T extends Tensor, O extends Tensor>(\n multiClassLabels: T|TensorLike, logits:\n T|TensorLike,\n weights?: Tensor|TensorLike, labelSmoothing = 0,\n reduction =\n Reduction.SUM_BY_NONZERO_WEIGHTS): O {\n let $multiClassLabels = convertToTensor(\n multiClassLabels, 'multiClassLabels', 'sigmoidCrossEntropy');\n const $logits = convertToTensor(logits, 'logits',\n 'sigmoidCrossEntropy');\n let $weights: Tensor = null;\n if (weights != null) {\n $weights =\n convertToTensor(weights, 'weights', 'sigmoidCrossEntropy');\n }\n assertShapesMatch(\n $multiClassLabels.shape, $logits.shape, 'Error in sigmoidCrossEntropy:\n '\n);\n if (labelSmoothing > 0) {\n const labelSmoothingScalar = scalar(labelSmoothing);\n const one =\n scalar(1);\n const half = scalar(0.5);\n $multiClassLabels =\n add(mul($multiClassLabels, sub(one,\n labelSmoothingScalar)),\n mul(half, labelSmoothingScalar));\n }\n const losses =\n sigmoidCrossEntropyWithLogits_($multiClassLabels, $logits);\n return computeWeightedLoss(losses, $weights,\n reduction);\n }\n export const sigmoidCrossEntropy = op({sigmoidCrossEntropy_});\n /**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\n * License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or
```

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OF ANY KIND, either express or implied.\n \* See the License for the specific language governing permissions  
and\n \* limitations under the License.\n \*

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=====
\n
*\nimport {customGrad} from '.././gradients';\nimport {Tensor} from '.././tensor';\nimport {GradSaveFunc} from
'.././tensor_types';\nimport {convertToTensor} from '.././tensor_util_env';\nimport {TensorLike} from
'.././types';\nimport {assertShapesMatch} from '.././util';\nimport {add} from '.././add';\nimport
{expandShapeToKeepDim} from '.././axis_util';\nimport {cast} from '.././cast';\nimport {div} from '.././div';\nimport
{exp} from '.././exp';\nimport {logSumExp} from '.././log_sum_exp';\nimport {Reduction} from
'.././loss_ops_utils';\nimport {mul} from '.././mul';\nimport {neg} from '.././neg';\nimport {op} from
'.././operation';\nimport {reshape} from '.././reshape';\nimport {scalar} from '.././scalar';\nimport {sub} from
'.././sub';\nimport {sum} from '.././sum';\n\nimport
{computeWeightedLoss} from '.././compute_weighted_loss';\n\n**\n * Computes softmax cross entropy between
logits and labels.\n * \n * Measures the probability error in discrete classification tasks in which\n * the classes are
mutually exclusive (each entry is in exactly one class).\n * For example, each CIFAR-10 image is labeled with one
and only one label: an\n * image can be a dog or a truck, but not both.\n * \n * `NOTE`: While the classes are
mutually exclusive, their probabilities need\n * not be. All that is required is that each row of labels is a valid\n *
probability distribution. If they are not, the computation of the gradient\n * will be incorrect.\n * \n * `WARNING`:
This op expects unscaled logits, since it performs a softmax on\n * logits internally for efficiency. Do not call this op
with the output of\n * softmax, as it will produce incorrect results.\n * \n * logits and labels must have the same
shape, e.g. [batch_size, num_classes]\n * and the same dtype.\n * @param
labels The labels array.\n * @param logits The logits array.\n * @param dim The dimension softmax would be
performed on. Defaults to -1\n * which indicates the last dimension.\n */\nfunction
softmaxCrossEntropyWithLogits_<T extends Tensor, O extends Tensor>(\n labels: T, logits: T, dim = -1): O {\n
if (dim === -1) {\n dim = logits.rank - 1;\n }\n\n if (dim !== logits.rank - 1) {\n throw Error(\n `Softmax
cross entropy along a non-last dimension is not yet ` +\n `supported. Labels / logits was rank ${logits.rank} `
+\n `and dim was ${dim}`);\n }\n\n // Use a custom gradient for numerical stability.\n const customOp =\n customGrad((labels: Tensor, logits: Tensor, save: GradSaveFunc) => {\n // Reference:\n // 1.
http://cs231n.github.io/linear-classify/#softmax\n // 2. https://blog.feedly.com/tricks-of-the-trade-logsumexp/\n
const keepDims = true;\n const lse = logSumExp(logits, [dim], keepDims);\n
const logResult = sub(cast(logits, 'float32'), lse);\n save([labels, logResult]);\n\n const costVector =
neg(mul(logResult, labels));\n const value: O = sum(costVector, [dim]);\n\n const gradFunc = (dy: O,
saved: Tensor[]) => {\n const [labels, logResult] = saved;\n const dyShape =
expandShapeToKeepDim(dy.shape, [dim]);\n return [\n mul(reshape(dy, dyShape),\n
sub(cast(labels, 'float32'), exp(logResult))),\n mul(reshape(dy, dyShape),\n sub(exp(logResult),
cast(labels, 'float32'))),\n];\n });\n return {value, gradFunc};\n });\n\n return customOp(labels,
logits);\n}\n\n**\n * Computes the softmax cross entropy loss between two tensors.\n * \n * If labelSmoothing is
nonzero, smooth the labels towards 1/2:\n * \n * newOnehotLabels = onehotLabels * (1 - labelSmoothing)\n *
+ labelSmoothing / numClasses\n * \n * @param onehotLabels One
hot encoded labels\n * [batch_size, num_classes], same dimensions as 'predictions'.\n * @param logits The
predicted outputs.\n * @param weights Tensor whose rank is either 0, or 1, and must be\n * broadcastable to `loss`
of shape [batch_size]\n * @param labelSmoothing If greater than 0, then smooth the labels.\n * @param reduction
Type of reduction to apply to loss. Should be of type\n * `Reduction`\n * \n * @doc { heading: 'Training',
subheading: 'Losses', namespace: 'losses' }\n\nfunction softmaxCrossEntropy_<T extends Tensor, O extends
Tensor>(\n onehotLabels: T|TensorLike, logits: T|TensorLike,\n weights?: Tensor|TensorLike, labelSmoothing
= 0,\n reduction = Reduction.SUM_BY_NONZERO_WEIGHTS): O {\n let $onehotLabels =\n convertToTensor(onehotLabels, 'onehotLabels', 'softmaxCrossEntropy');\n const $logits = convertToTensor(logits,
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'logits', 'softmaxCrossEntropy');\n let $weights: Tensor = null;\n\n if (weights != null) {\n $weights =
convertToTensor(weights,
'weights', 'softmaxCrossEntropy');\n }\n\n assertShapesMatch(\n $onehotLabels.shape, $logits.shape, 'Error in
softmaxCrossEntropy: ');\n\n if (labelSmoothing > 0) {\n const labelSmoothingScalar = scalar(labelSmoothing);\n const one = scalar(1);\n const numClasses = scalar($onehotLabels.shape[1]);\n\n $onehotLabels =\nadd(mul($onehotLabels, sub(one, labelSmoothingScalar)),\n div(labelSmoothingScalar, numClasses));\n}\n\n const losses = softmaxCrossEntropyWithLogits_($onehotLabels, $logits);\n\n return
computeWeightedLoss(losses, $weights, reduction);\n}\n\n\nexport const softmaxCrossEntropy =
op({softmaxCrossEntropy_});\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n *
Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in
compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless
required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an
"AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n
* See the License for the specific language governing permissions and\n * limitations under the License.\n *
=====
*\n\n// Modularized ops.\nexport {abs} from './abs';\nexport {acos} from './acos';\nexport {acosh} from
'./acosh';\nexport {add} from './add';\nexport {addN} from './add_n';\nexport {all} from './all';\nexport {any} from
'./any';\nexport {argMax} from './arg_max';\nexport {argMin} from './arg_min';\nexport {asin} from './asin';\nexport
{asinh} from './asinh';\nexport {atan} from './atan';\nexport {atan2} from './atan2';\nexport {atanh} from
'./atanh';\nexport {avgPool} from './avg_pool';\nexport {avgPool3d} from './avg_pool_3d';\nexport
{basicLSTMCell} from './basic_lstm_cell';\nexport {batchToSpaceND}
from './batch_to_space_nd';\nexport {batchNorm} from './batchnorm';\nexport {batchNorm2d} from
'./batchnorm2d';\nexport {batchNorm3d} from './batchnorm3d';\nexport {batchNorm4d} from
'./batchnorm4d';\nexport {bincount} from './bincount';\nexport {broadcastTo} from './broadcast_to';\nexport {buffer}
from './buffer';\nexport {cast} from './cast';\nexport {ceil} from './ceil';\nexport {clipByValue} from
'./clip_by_value';\nexport {clone} from './clone';\nexport {complex} from './complex';\nexport {concat} from
'./concat';\nexport {concat1d} from './concat_1d';\nexport {concat2d} from './concat_2d';\nexport {concat3d} from
'./concat_3d';\nexport {concat4d} from './concat_4d';\nexport {conv1d} from './conv1d';\nexport {conv2d} from
'./conv2d';\nexport {conv2dTranspose} from './conv2d_transpose';\nexport {conv3d} from './conv3d';\nexport
{conv3dTranspose} from './conv3d_transpose';\nexport {cos} from './cos';\nexport {cosh} from './cosh';\nexport
{cumsum} from './cumsum';\nexport
{denseBincount} from './dense_bincount';\nexport {depthToSpace} from './depth_to_space';\nexport
{depthwiseConv2d} from './depthwise_conv2d';\nexport {diag} from './diag';\nexport {dilation2d} from
'./dilation2d';\nexport {div} from './div';\nexport {divNoNaN} from './div_no_nan';\nexport {dot} from
'./dot';\nexport {elu} from './elu';\nexport {equal} from './equal';\nexport {erf} from './erf';\nexport {exp} from
'./exp';\nexport {expandDims} from './expand_dims';\nexport {expm1} from './expm1';\nexport {eye} from
'./eye';\nexport {fill} from './fill';\nexport {floor} from './floor';\nexport {floorDiv} from './floorDiv';\nexport
{gather} from './gather';\nexport {greater} from './greater';\nexport {greaterEqual} from './greater_equal';\nexport
{imag} from './imag';\nexport {isFinite} from './is_finite';\nexport {isInf} from './is_inf';\nexport {isNaN} from
'./is_nan';\nexport {leakyRelu} from './leaky_relu';\nexport {less} from './less';\nexport {lessEqual} from
'./less_equal';\nexport
{linspace} from './linspace';\nexport {localResponseNormalization} from './local_response_normalization';\nexport
{log} from './log';\nexport {log1p} from './log1p';\nexport {logSigmoid} from './log_sigmoid';\nexport
{logSoftmax} from './log_softmax';\nexport {logSumExp} from './log_sum_exp';\nexport {logicalAnd} from
'./logical_and';\nexport {logicalNot} from './logical_not';\nexport {logicalOr} from './logical_or';\nexport
{logicalXor} from './logical_xor';\nexport {matMul} from './mat_mul';\nexport {max} from './max';\nexport
{maxPool} from './max_pool';\nexport {maxPool3d} from './max_pool_3d';\nexport {maxPoolWithArgmax} from

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'/max_pool_with_argmax';\nextport {maximum} from './maximum';\nextport {mean} from './mean';\nextport {min}
from './min';\nextport {minimum} from './minimum';\nextport {mirrorPad} from './mirror_pad';\nextport {mod} from
'/mod';\nextport {moments} from './moments';\nextport {mul} from './mul';\nextport {LSTMCellFunc,
multiRNNCell} from './multi_rnn_cell';\nextport
{multinomial} from './multinomial';\nextport {neg} from './neg';\nextport {notEqual} from './not_equal';\nextport
{oneHot} from './one_hot';\nextport {ones} from './ones';\nextport {onesLike} from './ones_like';\nextport
{outerProduct} from './outer_product';\nextport {pad} from './pad';\nextport {pad1d} from './pad1d';\nextport {pad2d}
from './pad2d';\nextport {pad3d} from './pad3d';\nextport {pad4d} from './pad4d';\nextport {pool} from
'/pool';\nextport {pow} from './pow';\nextport {prelu} from './prelu';\nextport {print} from './print';\nextport {prod}
from './prod';\nextport {rand} from './rand';\nextport {randomGamma} from './random_gamma';\nextport
{randomNormal} from './random_normal';\nextport {randomUniform} from './random_uniform';\nextport {range}
from './range';\nextport {real} from './real';\nextport {reciprocal} from './reciprocal';\nextport {relu} from
'/relu';\nextport {relu6} from './relu6';\nextport {reshape} from './reshape';\nextport {reverse} from './reverse';\nextport
{reverse1d} from './reverse_1d';\nextport
{reverse2d} from './reverse_2d';\nextport {reverse3d} from './reverse_3d';\nextport {reverse4d} from
'/reverse_4d';\nextport {round} from './round';\nextport {rsqrt} from './rsqrt';\nextport {scalar} from './scalar';\nextport
{selu} from './selu';\nextport {separableConv2d} from './separable_conv2d';\nextport {setdiff1dAsync} from
'/setdiff1d_async';\nextport {sigmoid} from './sigmoid';\nextport {sign} from './sign';\nextport {sin} from
'/sin';\nextport {sinh} from './sinh';\nextport {slice} from './slice';\nextport {slice1d} from './slice1d';\nextport
{slice2d} from './slice2d';\nextport {slice3d} from './slice3d';\nextport {slice4d} from './slice4d';\nextport {softmax}
from './softmax';\nextport {softplus} from './softplus';\nextport {spaceToBatchND} from
'/space_to_batch_nd';\nextport {fft} from './spectral/fft';\nextport {ifft} from './spectral/ifft';\nextport {irfft} from
'/spectral/irfft';\nextport {rfft} from './spectral/rfft';\nextport {split} from './split';\nextport {sqrt} from
'/sqrt';\nextport {square} from './square';\nextport {squaredDifference} from './squared_difference';\nextport
{squeeze} from './squeeze';\nextport {stack} from './stack';\nextport {step} from './step';\nextport {stridedSlice} from
'/strided_slice';\nextport {sub} from './sub';\nextport {sum} from './sum';\nextport {tan} from './tan';\nextport {tanh}
from './tanh';\nextport {tensor} from './tensor';\nextport {tensor1d} from './tensor1d';\nextport {tensor2d} from
'/tensor2d';\nextport {tensor3d} from './tensor3d';\nextport {tensor4d} from './tensor4d';\nextport {tensor5d} from
'/tensor5d';\nextport {tensor6d} from './tensor6d';\nextport {tile} from './tile';\nextport {topk} from './topk';\nextport
{truncatedNormal} from './truncated_normal';\nextport {unique} from './unique';\nextport {unsortedSegmentSum}
from './unsorted_segment_sum';\nextport {unstack} from './unstack';\nextport {variable} from './variable';\nextport
{where} from './where';\nextport {whereAsync} from './where_async';\nextport {zeros} from
'/zeros';\nextport {zerosLike} from './zeros_like';\n\nexport * from './boolean_mask';\nextport * from
'/transpose';\nextport * from './norm';\nextport * from './moving_average';\nextport * from './scatter_nd';\nextport *
from './sparse_to_dense';\nextport * from './gather_nd';\nextport * from './dropout';\nextport * from
'/signal_ops_util';\nextport * from './in_top_k';\n\nexport {op, OP_SCOPE_SUFFIX} from './operation';\n\nimport
{rfft} from './spectral/rfft';\nimport {fft} from './spectral/fft';\nimport {ifft} from './spectral/ifft';\nimport {irfft} from
'/spectral/irfft';\nconst spectral = {\n fft,\n ifft,\n rfft,\n irfft\n};\n\nimport * as fused from './fused_ops';\n\nimport
{hammingWindow} from './signal/hamming_window';\nimport {hannWindow} from
'/signal/hann_window';\nimport {frame} from './signal/frame';\nimport {stft} from './signal/stft';\nconst signal = {\n
 hammingWindow,\n hannWindow,\n frame,\n stft\n};\n\n// Image Ops namespace\nimport {cropAndResize}
from './image/crop_and_resize';\nimport
{flipLeftRight} from './image/flip_left_right';\nimport {rotateWithOffset} from
'/image/rotate_with_offset';\nimport {nonMaxSuppression} from './image/non_max_suppression';\nimport
{nonMaxSuppressionAsync} from './image/non_max_suppression_async';\nimport
{nonMaxSuppressionWithScore} from './image/non_max_suppression_with_score';\nimport
{nonMaxSuppressionWithScoreAsync} from './image/non_max_suppression_with_score_async';\nimport
{nonMaxSuppressionPadded} from './image/non_max_suppression_padded';\nimport

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{nonMaxSuppressionPaddedAsync} from './image/non_max_suppression_padded_async';\nimport {resizeBilinear}
from './image/resize_bilinear';\nimport {resizeNearestNeighbor} from './image/resize_nearest_neighbor';\nconst
image = {\n flipLeftRight,\n resizeNearestNeighbor,\n resizeBilinear,\n rotateWithOffset,\n cropAndResize,\n
nonMaxSuppression,\n nonMaxSuppressionAsync,\n nonMaxSuppressionWithScore,\n
nonMaxSuppressionWithScoreAsync,\n nonMaxSuppressionPadded,\n
nonMaxSuppressionPaddedAsync\n};\n\n// linalg namespace\nimport {bandPart} from
'/linalg/band_part';\nimport {gramSchmidt} from './linalg/gram_schmidt';\nimport {qr} from './linalg/qr';\nconst
linalg = {\n bandPart,\n gramSchmidt,\n qr\n};\n\n// losses namespace;\nimport {absoluteDifference} from
'/losses/absolute_difference';\nimport {computeWeightedLoss} from './losses/compute_weighted_loss';\nimport
{cosineDistance} from './losses/cosine_distance';\nimport {hingeLoss} from './losses/hinge_loss';\nimport
{huberLoss} from './losses/huber_loss';\nimport {logLoss} from './losses/log_loss';\nimport {meanSquaredError}
from './losses/mean_squared_error';\nimport {sigmoidCrossEntropy} from './losses/sigmoid_cross_entropy';\nimport
{softmaxCrossEntropy} from './losses/softmax_cross_entropy';\nconst losses = {\n absoluteDifference,\n
computeWeightedLoss,\n cosineDistance,\n hingeLoss,\n huberLoss,\n logLoss,\n meanSquaredError,\n
sigmoidCrossEntropy,\n softmaxCrossEntropy\n};\n\n//
Second level exports.\nexport {image, linalg, losses, spectral, fused, signal};\n", "/*\n * @license\n * Copyright
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http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {dispose} from './globals';\nimport {variableGrads} from './gradients';\nimport {scalar} from
'./ops/ops';\nimport {Serializable} from './serialization';\nimport
{Scalar, Variable} from './tensor';\nimport {NamedTensor, NamedTensorMap} from './tensor_types';\n\n/**\n * A
variable that belongs to an optimizer.\n * \n * The `originalName` field is required for keeping track of the
canonical\n * name of the variable, which is usually the name of the model weight that\n * the variable is related to
plus a suffix, e.g., 'dense1/kernel/momentum'.\n * The name of the `Variable` object itself cannot be used directly
due to\n * possible deduplication: Every `Variable` must have a unique name but more\n * than one optimizer
objects of the same type may be created for the same model\n * or the same `Variable`.\n */\n\nexport interface
OptimizerVariable {\n originalName: string;\n variable: Variable;\n}\n\n/**\n * @doc {heading: 'Training',
subheading: 'Classes', namespace: 'train'}\n */\n\nexport abstract class Optimizer extends Serializable {\n protected
iterations_: number;\n\n /**\n * Executes `f()` and minimizes the scalar output of `f()` by computing\n
* gradients of y with respect to the list of trainable variables provided by\n * `varList`. If no list is provided, it
defaults to all trainable variables.\n * \n * @param f The function to execute and whose output to minimize.\n *
@param returnCost Whether to return the scalar cost value produced by\n * executing `f()`.\n * \n * @param varList
An optional list of variables to update. If specified, only\n * the trainable variables in varList will be updated by
minimize. Defaults to\n * all trainable variables.\n * \n * @doc {heading: 'Training', subheading: 'Optimizers'}\n
*\n\n minimize(f: () => Scalar, returnCost = false, varList?: Variable[]): Scalar\n | null {\n const {value, grads} =
this.computeGradients(f, varList);\n if (varList != null) {\n const gradArray: NamedTensor[] =\n
varList.map(v => ({name: v.name, tensor: grads[v.name]}));\n this.applyGradients(gradArray);\n } else {\n
this.applyGradients(grads);\n }\n\n // Dispose gradients.\n dispose(grads);\n\n if (returnCost) {\n return value;\n } else {\n
value.dispose();\n return null;\n }\n }\n\n /**\n * The number of iterations that this optimizer instance has
been invoked for.\n * \n * @get iterations(): number {\n if (this.iterations_ == null) {\n this.iterations_ = 0;\n
}\n return this.iterations_;\n }\n\n protected incrementIterations() {\n this.iterations_ = this.iterations + 1;\n
}\n\n /**\n * Executes f() and computes the gradient of the scalar output of f() with\n * respect to the list of

```

trainable variables provided by `varList`. If no `\* list` is provided, it defaults to all trainable variables.  
`@param f` The function to execute and whose output to use for computing `\* gradients` with respect to variables.  
`\* @param varList` An optional list of variables to compute gradients with `\*` respect to. If specified, only the trainable variables in `varList` will have

```
 * gradients computed with respect to. Defaults to all trainable variables.
 * @doc {heading: 'Training',
 subheading: 'Optimizers'}
 * ^\n computeGradients(f: () => Scalar, varList?: Variable[]):
 { value: Scalar,
 grads: NamedTensorMap }
 {\n return variableGrads(f, varList);\n }
 /**
 * Updates variables by using the computed gradients.
 * @param variableGradients A mapping of variable name to its gradient value.
 * @doc {heading: 'Training', subheading: 'Optimizers'}
 * ^\n abstract applyGradients(variableGradients:
 NamedTensorMap)\n NamedTensor[]: void;
 /**
 * Dispose the variables (if any) owned by this optimizer instance.
 * ^\n dispose(): void {\n if (this.iterations_ != null) {\n dispose(this.iterations_);\n }\n }\n async saveIterations(): Promise<NamedTensor> {\n if (this.iterations_ == null) {\n this.iterations_ = 0;\n }\n return {\n name: 'iter', // Named for
 Python compatibility.
 // TODO(cais): Use 'int64' type when available.
 tensor: scalar(this.iterations_, 'int32')\n };
 }\n async getWeights(): Promise<NamedTensor[]> {\n throw new Error('getWeights() is not implemented for this optimizer yet.);\n }\n async setWeights(weightValues: NamedTensor[]): Promise<void> {\n throw new Error(`setWeights() is not implemented for this optimizer class ` +
 `${this.getClassName()}`);\n }\n /**
 * Extract the first element of the weight values and set it
 * as the iterations counter variable of this instance of optimizer.
 * @param weightValues
 * @returns Weight values with the first element consumed and excluded.
 * ^\n protected async extractIterations(weightValues:
 NamedTensor[]):
 Promise<NamedTensor[]> {\n this.iterations_ = (await weightValues[0].tensor.data())[0];
 return weightValues.slice(1);\n }\n }\n Object.defineProperty(Optimizer, Symbol.hasInstance,
 {\n value: (instance: Optimizer) => {\n return instance.minimize != null && instance.computeGradients != null
 && instance.applyGradients != null;\n }\n });
 "*/
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 * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.
 * See the License for the specific language governing permissions and
 * limitations under the License.
```

```
=====
*\n\nimport {ENGINE} from '../engine';
import {dispose, tidy} from '../globals';
import {add} from '../ops/add';
import {div} from '../ops/div';
import {mul} from '../ops/mul';
import {sqrt} from '../ops/ops';
import {square} from '../ops/square';
import {zerosLike} from '../ops/zeros_like';
import {ConfigDict, registerClass, Serializable, SerializableConstructor} from '../serialization';
import {NamedTensor, NamedVariableMap} from '../tensor_types';
import {Optimizer, OptimizerVariable} from './optimizer';
/** @doclink Optimizer */
^\nexport class AdadeltaOptimizer extends Optimizer {\n /** @nocollapse */
 static className = 'Adadelta';
 // Name matters for Python compatibility.
 private accumulatedGrads: OptimizerVariable[] = [];
 private accumulatedUpdates: OptimizerVariable[] = [];
 constructor(protected learningRate: number, protected rho: number,
 protected epsilon: number = null) {\n super();
 if (epsilon == null) {\n this.epsilon = ENGINE.backend.epsilon();
 }\n }\n applyGradients(variableGradients: NamedVariableMap|NamedTensor[])
 {\n const variableNames = Array.isArray(variableGradients) ?
 variableGradients.map(item => item.name) :
 Object.keys(variableGradients);\n variableNames.forEach((name, i) => {\n const value = ENGINE.registeredVariables[name];
 const trainable = false;
 if (this.accumulatedGrads[i] == null) {\n this.accumulatedGrads[i] = {\n originalName: `${name}/accum_grad`,
 variable: tidy(() => zerosLike(value).variable(trainable))\n };
 }\n if (this.accumulatedUpdates[i] == null) {\n this.accumulatedUpdates[i] = {\n originalName: `${name}/accum_var`,
 variable: tidy(() =>
```

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zerosLike(value).variable(trainable))\n }\n }\n const gradient = Array.isArray(variableGradients) ?\n variableGradients[i].tensor :\n variableGradients[name];\n if (gradient == null) {\n return;\n }\n const accumulatedGrad = this.accumulatedGrads[i].variable;\n const accumulatedUpdate = this.accumulatedUpdates[i].variable;\n tidy() => {\n const\n newAccumulatedGrad =\n add(mul(accumulatedGrad, this.rho),\n mul(square(gradient), 1 -\n this.rho));\n const updates =\n mul(div(sqrt(add(accumulatedUpdate, this.epsilon)),\n sqrt(add(accumulatedGrad, this.epsilon))),\n gradient);\n const newAccumulatedUpdate =\n add(mul(accumulatedUpdate, this.rho),\n mul(square(updates), 1 - this.rho));\n accumulatedGrad.assign(newAccumulatedGrad);\n accumulatedUpdate.assign(newAccumulatedUpdate);\n const newValue = add(mul(updates, -this.learningRate), value);\n value.assign(newValue);\n });\n });\n this.incrementIterations();\n }\n dispose(): void {\n if (this.accumulatedUpdates != null) {\n dispose(this.accumulatedGrads.map(v => v.variable));\n dispose(this.accumulatedUpdates.map(v\n => v.variable));\n }\n }\n async getWeights(): Promise<NamedTensor[]> {\n // Order matters for Python\n compatibility.\n const variables: OptimizerVariable[] =\n [...this.accumulatedGrads,\n ...this.accumulatedUpdates];\n return [await this.saveIterations()].concat(\n variables.map(v => ({ name:\n v.originalName, tensor: v.variable}));\n }\n }\n async setWeights(weightValues: NamedTensor[]): Promise<void>\n {\n weightValues = await this.extractIterations(weightValues);\n const variableCount = weightValues.length /\n 2;\n const trainable = false;\n this.accumulatedGrads =\n weightValues.slice(0, variableCount).map(v =>\n ({\n originalName: v.name,\n variable:\n v.tensor.variable(\n trainable)\n }));\n this.accumulatedUpdates =\n weightValues.slice(variableCount, variableCount * 2)\n .map(v => ({\n originalName:\n v.name,\n variable: v.tensor.variable(trainable)\n }));\n }\n getConfig(): ConfigDict {\n return {\n 'learningRate': this.learningRate,\n 'rho': this.rho,\n 'epsilon': this.epsilon\n };}\n /**\n @nocollapse *\n static fromConfig<T extends Serializable>(\n cls: SerializableConstructor<T>, config:\n ConfigDict): T {\n return new cls(config['learningRate'], config['rho'], config['epsilon']);\n }\n }\n registerClass(AdadeltaOptimizer);\n ", "/*\n * @license\n * Copyright 2018 Google LLC. All Rights\n Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file\n except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,\n software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\n OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n governing permissions and\n * limitations under the License.\n *\n =====\n *\n *\n import {ENGINE} from '../engine';\n import {dispose, tidy} from '../globals';\n import {add} from\n '../ops/add';\n import {div} from '../ops/div';\n import {fill} from '../ops/fill';\n import {mul} from '../ops/mul';\n import\n {sqrt} from '../ops/sqrt';\n import {square} from '../ops/square';\n import {ConfigDict, registerClass, Serializable,\n SerializableConstructor} from '../serialization';\n import {NamedTensor, NamedVariableMap} from\n '../tensor_types';\n import {Optimizer, OptimizerVariable} from './optimizer';\n /** @doclink Optimizer\n *\n *\n export class AdagradOptimizer extends Optimizer {\n /** @nocollapse *\n static className = 'Adagrad';\n // Note: Name matters for Python compatibility.\n private accumulatedGrads: OptimizerVariable[] = [];\n constructor(\n protected learningRate: number, private initialAccumulatorValue = 0.1) {\n super();\n }\n applyGradients(variableGradients: NamedVariableMap|NamedTensor[]) {\n const variableNames =\n Array.isArray(variableGradients) ?\n variableGradients.map(item => item.name) :\n Object.keys(variableGradients);\n variableNames.forEach((name, i) => {\n const value =\n ENGINE.registeredVariables[name];\n if (this.accumulatedGrads[i] == null) {\n const trainable = false;\n this.accumulatedGrads[i] = {\n originalName: `${name}/accumulator`,\n variable: tidy(\n () =>\n fill(value.shape, this.initialAccumulatorValue)\n .variable(trainable))\n };\n }\n const

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gradient = Array.isArray(variableGradients) ?\n variableGradients[i].tensor :\nvariableGradients[name];\n\n if (gradient == null) {\n return;\n }\n\n const accumulatedGrad =\nthis.accumulatedGrads[i].variable;\n\n tidy(() => {\n const newAccumulatedGrad = add(accumulatedGrad,\nsquare(gradient));\n accumulatedGrad.assign(newAccumulatedGrad);\n\n const newValue = add(\nmul(div(gradient,\n sqrt(add(newAccumulatedGrad, ENGINE.backend.epsilon()))),\n- \nthis.learningRate),\n value);\n value.assign(newValue);\n });\n});\n\nthis.incrementIterations();\n}\n\n dispose(): void {\n if (this.accumulatedGrads != null) {\n dispose(this.accumulatedGrads.map(v =>\nv.variable));\n }\n}\n\n async getWeights(): Promise<NamedTensor[]> {\n // Order matters for Python\ncompatibility.\n return [await this.saveIterations()].concat(this.accumulatedGrads.map(\n v => ({ name:\nv.originalName, tensor: v.variable}));\n]\n}\n\n async setWeights(weightValues:\nNamedTensor[]): Promise<void> {\n weightValues = await this.extractIterations(weightValues);\n const\ntrainable = false;\n this.accumulatedGrads = weightValues.map(\n v => ({ originalName: v.name, variable:\nv.tensor.variable(trainable)}));\n }\n\n getConfig(): ConfigDict {\n return {\n 'learningRate':\nthis.learningRate,\n 'initialAccumulatorValue': this.initialAccumulatorValue,\n };\n }\n\n /** @nocollapse\n * /\n static fromConfig<T extends Serializable>(<n cls: SerializableConstructor<T>, config: ConfigDict): T {\nreturn new cls(config['learningRate'], config['initialAccumulatorValue']);\n}\n\nregisterClass(AdagradOptimizer);"}\n"/**\n * @license\n * Copyright 2018 Google LLC. All Rights\nReserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file\nexcept in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless\nrequired by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an\n\"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n*\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n\n======\n*/\n\nimport {ENGINE} from '../engine';\nimport {dispose, tidy} from '../globals';\nimport {add} from\n../ops/add';\nimport {div} from '../ops/div';\nimport {mul} from '../ops/mul';\nimport {pow} from\n../ops/pow';\nimport {scalar} from '../ops/scalar';\nimport {sqrt} from '../ops/sqrt';\nimport {square} from\n../ops/square';\nimport {sub} from '../ops/sub';\nimport {zerosLike} from '../ops/zeros_like';\nimport {ConfigDict,\nregisterClass, Serializable, SerializableConstructor} from '../serialization';\nimport {Variable} from\n../tensor';\nimport {NamedTensor, NamedVariableMap} from '../tensor_types';\n\nimport\n{Optimizer, OptimizerVariable} from './optimizer';\n\nexport class AdamOptimizer extends Optimizer {\n /**\n@nocollapse */\n static className = 'Adam';\n // Note: Name matters for Python compatibility.\n private accBeta1:\nVariable;\n private accBeta2: Variable;\n\n private accumulatedFirstMoment: OptimizerVariable[] = [];\n private\naccumulatedSecondMoment: OptimizerVariable[] = [];\n\n constructor(\n protected learningRate: number,\nprotected beta1: number,\n protected beta2: number, protected epsilon: number = null) {\n super();\n tidy(()\n=> {\n // accB* will be updated by batch.\n this.accBeta1 = scalar(beta1).variable();\n this.accBeta2 =\nscalar(beta2).variable();\n });\n\n if (epsilon == null) {\n this.epsilon = ENGINE.backend.epsilon();\n }\n }\n\n applyGradients(variableGradients: NamedVariableMap|NamedTensor[]) {\n const varNames =\nArray.isArray(variableGradients) ?\n variableGradients.map(v => v.name)\n : Object.keys(variableGradients);\n\n tidy(() => {\n const oneMinusAccBeta1 = sub(1, this.accBeta1);\nconst oneMinusAccBeta2 = sub(1, this.accBeta2);\n\n varNames.forEach((name, i) => {\n const value =\nENGINE.registeredVariables[name];\n const trainable = false;\n if (this.accumulatedFirstMoment[i] ==\nnull) {\n this.accumulatedFirstMoment[i] = {\n originalName: `${name}/m`,\n variable: tidy(()\n=> zerosLike(value).variable(trainable))\n };\n }\n\n if (this.accumulatedSecondMoment[i] == null) {\n this.accumulatedSecondMoment[i] = {\n originalName: `${name}/v`,\n variable: tidy(() =>\nzerosLike(value).variable(trainable))\n };\n }\n\n const gradient = Array.isArray(variableGradients)\n? variableGradients[i].tensor :\n variableGradients[name];\n\n if (gradient == null) {\n
```

```

return;\n }\n\n const firstMoment = this.accumulatedFirstMoment[i].variable;\n const secondMoment = this.accumulatedSecondMoment[i].variable;\n const newFirstMoment =\n add(mul(firstMoment, this.beta1), mul(gradient, 1 - this.beta1));\n const newSecondMoment =\n add(mul(secondMoment, this.beta2),\n mul(square(gradient), 1 - this.beta2));\n const biasCorrectedFirstMoment =\n div(newFirstMoment, oneMinusAccBeta1);\n const biasCorrectedSecondMoment =\n div(newSecondMoment, oneMinusAccBeta2);\n firstMoment.assign(newFirstMoment);\n secondMoment.assign(newSecondMoment);\n const newValue =\n add(mul(div(biasCorrectedFirstMoment,\n -this.learningRate),\n add(sqrt(biasCorrectedSecondMoment), this.epsilon)),\n value);\n value.assign(newValue);\n });\n\n this.accBeta1.assign(mul(this.accBeta1, this.beta1));\n this.accBeta2.assign(mul(this.accBeta2, this.beta2));\n });\n this.incrementIterations();\n }\n\n dispose(): void {\n this.accBeta1.dispose();\n this.accBeta2.dispose();\n if (this.accumulatedFirstMoment != null) {\n dispose(this.accumulatedFirstMoment.map(v => v.variable));\n }\n if (this.accumulatedSecondMoment != null) {\n dispose(this.accumulatedSecondMoment.map(v => v.variable));\n }\n }\n\n async getWeights(): Promise<NamedTensor[]> {\n // Order matters for Python compatibility.\n const variables: OptimizerVariable[] =\n [...this.accumulatedFirstMoment, ...this.accumulatedSecondMoment];\n return [await this.saveIterations()].concat(\n variables.map(v => ({name: v.originalName, tensor: v.variable}))); \n }\n\n async setWeights(weightValues: NamedTensor[]): Promise<void> {\n weightValues = await this.extractIterations(weightValues);\n tidy(() => {\n this.accBeta1.assign(pow(this.beta1, this.iterations_ + 1));\n\n this.accBeta2.assign(pow(this.beta2, this.iterations_ + 1));\n });\n const variableCount = weightValues.length / 2;\n const trainable = false;\n this.accumulatedFirstMoment =\n weightValues.slice(0, variableCount).map(v => ({\n originalName: v.name,\n variable: v.tensor.variable(\n trainable)\n }));\n this.accumulatedSecondMoment =\n weightValues.slice(variableCount, variableCount * 2).map(v => ({\n originalName: v.name,\n variable: v.tensor.variable(trainable)\n }));\n }\n\n getConfig(): ConfigDict {\n return {\n 'learningRate': this.learningRate,\n 'beta1': this.beta1,\n 'beta2': this.beta2,\n 'epsilon': this.epsilon,\n }; \n }\n\n /** @nocollapse */\n static fromConfig<T extends Serializable>(\n cls: SerializableConstructor<T>, config: ConfigDict): T {\n return new cls(\n config['learningRate'], config['beta1'], config['beta2'],\n config['epsilon']);\n }\n\n }\n\n registerClass(AdamOptimizer);\n /**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n *\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n =====\n\n *\n\n *\n\n {\n {ENGINE} from './engine';\n {dispose, tidy} from './globals';\n {abs} from './ops/abs';\n {add} from './ops/add';\n {div} from './ops/div';\n {maximum} from './ops/maximum';\n {mul} from './ops/mul';\n {scalar} from './ops/scalar';\n {sub} from './ops/sub';\n {zerosLike} from './ops/zeros_like';\n {ConfigDict, registerClass, Serializable, SerializableConstructor} from './serialization';\n {Variable} from './tensor';\n {NamedTensor, NamedVariableMap} from './tensor_types';\n {Optimizer, OptimizerVariable} from './optimizer';\n }\n\n class AdamaxOptimizer extends Optimizer {\n /** @nocollapse */\n static className = 'Adamax'; // Note: Name matters for Python compatibility.\n private accBeta1: Variable;\n private iteration: Variable;\n private accumulatedFirstMoment:

```

```

OptimizerVariable[] = [];
private accumulatedWeightedInfNorm: OptimizerVariable[] = [];
constructor(
 protected
 learningRate: number, protected beta1: number,
 protected beta2: number, protected epsilon: number = null,
 protected decay = 0.0) {
 super();
 tidy(() => {
 this.iteration = scalar(0).variable();
 this.accBeta1 = scalar(beta1).variable();
 });
 if (epsilon == null) {
 this.epsilon = ENGINE.backend.epsilon();
 }
 applyGradients(variableGradients: NamedVariableMap|NamedTensor[]) {
 const variableNames = Array.isArray(variableGradients) ?
 variableGradients.map(item => item.name) :
 Object.keys(variableGradients);
 tidy(() => {
 const oneMinusAccBeta1 = sub(1, this.accBeta1);
 const lr =
 div(-this.learningRate, add(mul(this.iteration, this.decay), 1));
 variableNames.forEach((name, i) => {
 const value = ENGINE.registeredVariables[name];
 const trainable = false;
 if (this.accumulatedFirstMoment[i] == null) {
 this.accumulatedFirstMoment[i] = {
 originalName: `${name}/m`,
 variable: zerosLike(value).variable(trainable)
 };
 }
 if (this.accumulatedWeightedInfNorm[i] == null) {
 this.accumulatedWeightedInfNorm[i] = {
 originalName: `${name}/v`,
 variable: zerosLike(value).variable(trainable)
 };
 }
 const gradient = Array.isArray(variableGradients) ?
 variableGradients[i].tensor :
 variableGradients[name];
 if (gradient == null) {
 return;
 }
 const firstMoment = this.accumulatedFirstMoment[i].variable;
 const weightedInfNorm = this.accumulatedWeightedInfNorm[i].variable;
 const newFirstMoment = add(mul(firstMoment, this.beta1), mul(gradient, 1 - this.beta1));
 const ut0 = mul(weightedInfNorm, this.beta2);
 const ut1 = abs(gradient);
 const newWeightedInfNorm = maximum(ut0, ut1);
 firstMoment.assign(newFirstMoment);
 weightedInfNorm.assign(newWeightedInfNorm);
 const newValue = add(mul(div(lr, oneMinusAccBeta1), div(newFirstMoment, add(newWeightedInfNorm, this.epsilon))), value);
 value.assign(newValue);
 });
 this.iteration.assign(add(this.iteration, 1));
 this.accBeta1.assign(mul(this.accBeta1, this.beta1));
 });
 this.incrementIterations();
 }
 dispose(): void {
 this.accBeta1.dispose();
 this.iteration.dispose();
 if (this.accumulatedFirstMoment != null) {
 dispose(this.accumulatedFirstMoment.map(v => v.variable));
 }
 if (this.accumulatedWeightedInfNorm != null) {
 dispose(this.accumulatedWeightedInfNorm.map(v => v.variable));
 }
 }
 async getWeights(): Promise<NamedTensor[]> {
 throw new Error('getWeights() is not implemented for Adamax yet.');
```





```

*\n * @param momentum\n * \n setMomentum(momentum:
number) {\n this.momentum = momentum;\n }\n\n async getWeights(): Promise<NamedTensor[]> {\n // Order
matters for Python compatibility.\n return [await this.saveIterations()].concat(this.accumulations.map(\n v =>
({name: v.originalName, tensor: v.variable}));\n }\n\n async setWeights(weightValues: NamedTensor[]):
Promise<void> {\n weightValues = await this.extractIterations(weightValues);\n const trainable = false;\n
this.accumulations = weightValues.map(\n v => ({originalName: v.name, variable:
v.tensor.variable(trainable)}));\n }\n\n getConfig(): ConfigDict {\n return {\n 'learningRate':
this.learningRate,\n 'momentum': this.momentum,\n 'useNesterov': this.useNesterov\n }; \n }\n\n /**
@nocollapse *\n static fromConfig<T extends Serializable>(\n cls: SerializableConstructor<T>, config:
ConfigDict): T {\n return new cls(\n config['learningRate'], config['momentum'], config['useNesterov']);\n
}\n}\n\nregisterClass(MomentumOptimizer);\n", "/**\n
* @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version
2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
===== \n
*\n\nimport {ENGINE} from '../engine';\nimport {dispose, tidy} from '../globals';\nimport {add} from
 '../ops/add';\nimport {div} from '../ops/div';\nimport {mul} from '../ops/mul';\nimport {sqrt} from
 '../ops/sqrt';\nimport {square} from
 '../ops/square';\nimport {sub} from '../ops/sub';\nimport {zerosLike} from '../ops/zeros_like';\nimport {ConfigDict,
registerClass, Serializable, SerializableConstructor} from '../serialization';\nimport {NamedTensor,
NamedTensorMap} from '../tensor_types';\nimport {Optimizer, OptimizerVariable} from '../optimizer';\n\n/**
@doclink Optimizer *\n\nexport class RMSPropOptimizer extends Optimizer {\n /** @nocollapse *\n static
className = 'RMSProp'; // Note: Name matters for Python compatibility.\n private centered: boolean;\n\n private
accumulatedMeanSquares: OptimizerVariable[] = [];\n private accumulatedMoments: OptimizerVariable[] = [];\n
private accumulatedMeanGrads: OptimizerVariable[] = [];\n\n constructor(\n protected learningRate: number,
protected decay = 0.9,\n protected momentum = 0.0, protected epsilon: number = null,\n centered = false) {\n
super();\n\n this.centered = centered;\n\n if (epsilon == null) {\n this.epsilon = ENGINE.backend.epsilon();\n
}\n\n if (learningRate == null) {\n throw new Error(`learningRate for RMSPropOptimizer must be
defined.`);\n }\n }\n\n applyGradients(variableGradients: NamedTensorMap|NamedTensor[]) {\n const
variableNames = Array.isArray(variableGradients) ?\n variableGradients.map(item => item.name) :\n
Object.keys(variableGradients);\n\n variableNames.forEach((name, i) => {\n const value =
ENGINE.registeredVariables[name];\n const trainable = false;\n if (this.accumulatedMeanSquares[i] == null)
{\n this.accumulatedMeanSquares[i] = {\n originalName: `${name}/rms`,\n variable: tidy(() =>
zerosLike(value).variable(trainable))\n }; \n }\n\n if (this.accumulatedMoments[i] == null) {\n
this.accumulatedMoments[i] = {\n originalName: `${name}/momentum`,\n variable: tidy(() =>
zerosLike(value).variable(trainable))\n }; \n }\n\n if (this.accumulatedMeanGrads[i] == null &&
this.centered) {\n this.accumulatedMeanGrads[i] = {\n originalName: `${name}/mg`,\n variable:
tidy(() => zerosLike(value).variable(trainable))\n }; \n }\n\n const gradient =
Array.isArray(variableGradients) ?\n variableGradients[i].tensor :\n variableGradients[name];\n\n if
(gradient == null) {\n return;\n }\n\n const accumulatedMeanSquare =
this.accumulatedMeanSquares[i].variable;\n const accumulatedMoments =
this.accumulatedMoments[i].variable;\n tidy(() => {\n const newAccumulatedMeanSquare =\n
add(mul(accumulatedMeanSquare, this.decay),\n mul(square(gradient), 1 - this.decay));\n\n if
(this.centered) {\n const accumulatedMeanGrad = this.accumulatedMeanGrads[i].variable;\n // Centered
gradient\n const newAccumulatedMeanGrad =\n

```

```

mul(gradient, 1 - this.decay));\n\n
 const gradContribution =\n div(mul(gradient, this.learningRate),\n sqrt(\n
sub(newAccumulatedMeanSquare,\n add(square(newAccumulatedMeanGrad), this.epsilon)))));\n
 const newAccumulatedMoments =\n add(mul(accumulatedMoments, this.momentum),
gradContribution);\n\n accumulatedMeanSquare.assign(newAccumulatedMeanSquare);\n
accumulatedMeanGrad.assign(newAccumulatedMeanGrad);\n
accumulatedMoments.assign(newAccumulatedMoments);\n\n const newValue = sub(value,
newAccumulatedMoments);\n value.assign(newValue);\n } else {\n // Plain gradient\n const
newAccumulatedMeanSquare =\n add(mul(accumulatedMeanSquare, this.decay),\n
mul(square(gradient), 1 - this.decay));\n\n const newAccumulatedMoments =\n add(mul(accumulatedMoments, this.momentum),\n div(mul(gradient,
this.learningRate),\n sqrt(add(newAccumulatedMeanSquare, this.epsilon))));\n\n accumulatedMeanSquare.assign(newAccumulatedMeanSquare);\n
accumulatedMoments.assign(newAccumulatedMoments);\n\n const newValue = sub(value,
newAccumulatedMoments);\n value.assign(newValue);\n }\n });\n });\n
this.incrementIterations();\n }\n\n dispose(): void {\n if (this.accumulatedMeanSquares != null) {\n
dispose(this.accumulatedMeanSquares.map(v => v.variable));\n }\n if (this.accumulatedMeanGrads != null &&
this.centered) {\n dispose(this.accumulatedMeanGrads.map(v => v.variable));\n }\n if
(this.accumulatedMoments != null) {\n dispose(this.accumulatedMoments.map(v => v.variable));\n }\n }\n\n
async getWeights(): Promise<NamedTensor[]> {\n // Order matters for Python compatibility.\n const variables:
OptimizerVariable[] =\n [...this.accumulatedMeanSquares, ...this.accumulatedMoments];\n
 if (this.centered) {\n variables.push(...this.accumulatedMeanGrads);\n }\n return [await
this.saveIterations()].concat(\n variables.map(v => ({name: v.originalName, tensor: v.variable}));\n)\n }\n\n
async setWeights(weightValues: NamedTensor[]): Promise<void> {\n weightValues = await
this.extractIterations(weightValues);\n const variableCount =\n this.centered ? weightValues.length / 3 :
weightValues.length / 2;\n const trainable = false;\n this.accumulatedMeanSquares =\n weightValues.slice(0, variableCount).map(v => ({\n
\n originalName: v.name,\n
\n variable: v.tensor.variable(\n
\n trainable)\n
\n }));\n this.accumulatedMoments =\n weightValues.slice(variableCount, variableCount * 2)\n
.map(v => ({\n
\n originalName: v.name,\n
\n variable: v.tensor.variable(trainable)\n
\n }));\n if
(this.centered) {\n this.accumulatedMeanGrads =\n weightValues.slice(variableCount * 2, variableCount *
3)\n .map(v => ({\n
\n originalName: v.name,\n
\n variable:
v.tensor.variable(trainable)\n
\n }));\n }\n }\n\n getConfig(): ConfigDict {\n return {\n
\n 'learningRate': this.learningRate,\n
\n 'decay': this.decay,\n
\n 'momentum': this.momentum,\n
\n 'epsilon':
this.epsilon,\n
\n 'centered': this.centered\n };\n }\n\n /** @nocollapse */\n static fromConfig<T extends
Serializable>(\n cls: SerializableConstructor<T>, config: ConfigDict): T {\n return new cls(\n
\n config['learningRate'], config['decay'], config['momentum'],\n
\n config['epsilon'], config['centered']);\n }\n\n }\n\n registerClass(RMSPropOptimizer);\n }\n\n "/**\n * @license\n * Copyright 2018 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not
use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n
 * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n */\n */\n\n import { AdadelatOptimizer } from './adadelat_optimizer';\n import { AdagradOptimizer } from
'./adagrad_optimizer';\n import { AdamOptimizer } from './adam_optimizer';\n import { AdamaxOptimizer } from

```

```

'/adamax_optimizer';\nimport {MomentumOptimizer} from './momentum_optimizer';\nimport
{RMSPropOptimizer} from './rmsprop_optimizer';\nimport
{SGDOptimizer} from './sgd_optimizer';\n\nexport class OptimizerConstructors {\n /**\n * Constructs a
`tf.SGDOptimizer` that uses stochastic gradient descent.\n * \n * ``js\n // Fit a quadratic function by learning
the coefficients a, b, c.\n * const xs = tf.tensor1d([0, 1, 2, 3]);\n * const ys = tf.tensor1d([1.1, 5.9, 16.8, 33.9]);\n
*\n * const a = tf.scalar(Math.random()).variable();\n * const b = tf.scalar(Math.random()).variable();\n * const c
= tf.scalar(Math.random()).variable();\n * \n * // y = a * x^2 + b * x + c.\n * const f = x =>
a.mul(x.square()).add(b.mul(x)).add(c);\n * const loss = (pred, label) => pred.sub(label).square().mean();\n * \n *
const learningRate = 0.01;\n * const optimizer = tf.train.sgd(learningRate);\n * \n * // Train the model.\n * for
(let i = 0; i < 10; i++) {\n * optimizer.minimize(() => loss(f(xs), ys));\n * }\n * \n * // Make predictions.\n *
console.log(\n * `a: ${a.dataSync()},\n * b: ${b.dataSync()}, c: ${c.dataSync()}`);\n * const preds = f(xs).dataSync();\n * preds.forEach((pred, i) => {\n
* console.log(`x: ${i}, pred: ${pred}`);\n * });\n * ``\n * \n * @param learningRate The learning rate to use
for the SGD algorithm.\n * \n * @doc {heading: 'Training', subheading: 'Optimizers', namespace: 'train'}\n * /\n
static sgd(learningRate: number): SGDOptimizer {\n return new SGDOptimizer(learningRate);\n }\n\n /**\n *
Constructs a `tf.MomentumOptimizer` that uses momentum gradient\n * descent.\n * \n * See\n *
[http://proceedings.mlr.press/v28/sutskever13.pdf](\n * http://proceedings.mlr.press/v28/sutskever13.pdf)\n * \n
* @param learningRate The learning rate to use for the Momentum gradient\n * descent algorithm.\n * @param
momentum The momentum to use for the momentum gradient descent\n * algorithm.\n * \n * @doc {heading:
'Training', subheading: 'Optimizers', namespace: 'train'}\n * /\n static momentum(learningRate:
number, momentum: number, useNesterov = false):\n MomentumOptimizer {\n return new
MomentumOptimizer(learningRate, momentum, useNesterov);\n }\n\n /**\n * Constructs a
`tf.RMSPropOptimizer` that uses RMSProp gradient\n * descent. This implementation uses plain momentum and
is not centered\n * version of RMSProp.\n * \n * See\n *
[http://www.cs.toronto.edu/~tijmen/csc321/slides/lecture_slides_lec6.pdf](\n *
http://www.cs.toronto.edu/~tijmen/csc321/slides/lecture_slides_lec6.pdf)\n * \n * @param learningRate The
learning rate to use for the RMSProp gradient\n * descent algorithm.\n * @param decay The discounting factor
for the history/coming gradient.\n * @param momentum The momentum to use for the RMSProp gradient
descent\n * algorithm.\n * @param epsilon Small value to avoid zero denominator.\n * @param centered If true,
gradients are normalized by the estimated\n * variance of the gradient.\n * \n * @doc {heading: 'Training',
subheading:
'Optimizers', namespace: 'train'}\n * /\n static rmsprop(\n learningRate: number, decay = .9, momentum = 0.0,
epsilon: number = null,\n centered = false): RMSPropOptimizer {\n return new RMSPropOptimizer(\n
learningRate, decay, momentum, epsilon, centered);\n }\n\n /**\n * Constructs a `tf.AdamOptimizer` that uses the
Adam algorithm.\n * See https://arxiv.org/abs/1412.6980\n * \n * @param
learningRate The learning rate to use for the Adam gradient\n * descent algorithm.\n * @param beta1 The
exponential decay rate for the 1st moment estimates.\n * @param beta2 The exponential decay rate for the 2nd
moment estimates.\n * @param epsilon A small constant for numerical stability.\n * \n * @doc {heading:
'Training', subheading: 'Optimizers', namespace: 'train'}\n * /\n static adam(\n learningRate = 0.001, beta1 = 0.9,
beta2 = 0.999,\n epsilon: number = null): AdamOptimizer {\n return new AdamOptimizer(learningRate,
beta1, beta2, epsilon);\n }\n\n /**\n * Constructs a `tf.AdadeltaOptimizer` that uses the Adadelta algorithm.\n *
See https://arxiv.org/abs/1212.5701\n * \n * @param learningRate The learning
rate to use for the Adadelta gradient\n * descent algorithm.\n * @param rho The learning rate decay over each
update.\n * @param epsilon A constant epsilon used to better condition the grad\n * update.\n * \n * @doc
{heading: 'Training', subheading: 'Optimizers', namespace: 'train'}\n * /\n static adadelta(learningRate = .001, rho =
.95, epsilon: number = null):\n AdadeltaOptimizer {\n return new AdadeltaOptimizer(learningRate, rho,
epsilon);\n }\n\n /**\n * Constructs a `tf.AdamaxOptimizer` that uses the Adamax algorithm.\n * See
https://arxiv.org/abs/1412.6980\n * \n * @param learningRate The learning rate

```

```

to use for the Adamax gradient descent algorithm.

@param beta1 The exponential decay rate for the 1st moment estimates.
@param beta2 The exponential decay rate for the 2nd moment estimates.
@param epsilon A small constant for numerical stability.
@doc {heading: 'Training', subheading: 'Optimizers',
namespace: 'train'}
static adamax(learningRate = 0.002, beta1 = 0.9, beta2 = 0.999, epsilon: number =
null, decay = 0.0): AdamaxOptimizer {
 return new AdamaxOptimizer(learningRate, beta1, beta2, epsilon,
 decay);
}

Constructs a `tf.AdagradOptimizer` that uses the Adagrad algorithm. See
http://www.jmlr.org/papers/volume12/duchi11a/duchi11a.pdf or
http://ruder.io/optimizing-gradient-descent/index.html#adagrad

@param learningRate The learning rate to use for the Adagrad gradient descent algorithm.
@param initialAccumulatorValue Starting value for the accumulators, must be positive.
@doc {heading: 'Training', subheading: 'Optimizers',
namespace: 'train'}
static adagrad(learningRate: number, initialAccumulatorValue = 0.1):
 AdagradOptimizer {
 return new AdagradOptimizer(learningRate, initialAccumulatorValue);
 }
}

====

So typings can propagate.
import {AdadeltaOptimizer} from './optimizers/adadelta_optimizer';
import {AdagradOptimizer} from './optimizers/adagrad_optimizer';
import {AdamOptimizer} from './optimizers/adam_optimizer';
import {AdamaxOptimizer} from './optimizers/adamax_optimizer';
import {MomentumOptimizer} from './optimizers/momentum_optimizer';
import {OptimizerConstructors} from './optimizers/optimizer_constructors';
import {RMSPropOptimizer} from './optimizers/rmsprop_optimizer';
import {SGDOptimizer} from './optimizers/sgd_optimizer';
// tslint:disable-next-line:no-unused-expression
[MomentumOptimizer, SGDOptimizer, AdadeltaOptimizer, AdagradOptimizer,
 RMSPropOptimizer, AdamaxOptimizer, AdamOptimizer];
export const train = {
 sgd: OptimizerConstructors.sgd,
 momentum: OptimizerConstructors.momentum,
 adadelta: OptimizerConstructors.adadelta,
 adagrad: OptimizerConstructors.adagrad,
 rmsprop: OptimizerConstructors.rmsprop,
 adamax: OptimizerConstructors.adamax,
 adam: OptimizerConstructors.adam
};

====

const delayCallback: Function = () => {
 if (typeof requestAnimationFrame !== 'undefined') {
 return requestAnimationFrame();
 } else if (typeof setImmediate !== 'undefined') {
 return setImmediate();
 }
 return (f: Function) => f(); // no delays
};

Returns a promise that resolve when a requestAnimationFrame has completed.
On Node.js this uses setImmediate instead of requestAnimationFrame.
This is simply a sugar method so that users can do the following:
`await tf.nextFrame();`
@doc {heading: 'Performance', subheading: 'Timing'}
function nextFrame():

```

```

Promise<void> {\n return new Promise<void>(resolve => delayCallback(() => resolve()));\n}\n\n\nexport
{nextFrame};\n", "/*\n * @license\n * Copyright 2017 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n *
Unless required
by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\"
BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the
License for the specific language governing permissions and\n * limitations under the License.\n *
=====\\n
*\n\nimport * as util from './util';\n\nexport function assertParamsConsistent(shapes: number[][], axis: number) {\n
const rank = shapes[0].length;\n shapes.forEach((shape, i) => {\n util.assert(\n shape.length === rank,\n
() =>\n `Error in concat${rank}D: rank of tensors[${i}] must be the same ` +\n `as the rank of the rest
(${rank})`);\n });\n util.assert(\n axis >= 0 && axis < rank,\n () => `Error in concat${rank}D: axis must be
between 0 and ${rank - 1}.`);\n const firstShape = shapes[0];\n shapes.forEach((shape, i) => {\n for
(let r = 0; r < rank; r++) {\n util.assert(\n (r === axis) || (shape[r] === firstShape[r]),\n () => `Error in
concat${rank}D: Shape of tensors[${i}] (${shape}) ` +\n `does not match the shape of the rest
(${firstShape}) ` +\n `along the non-concatenated axis ${i}.`);\n }\n });\n}\n\nexport function
computeOutShape(shapes: number[][], axis: number): number[] {\n const outputShape = shapes[0].slice();\n for
(let i = 1; i < shapes.length; i++) {\n outputShape[axis] += shapes[i][axis];\n }\n return outputShape;\n}\n", "/*\n *
@license\n * Copyright 2017 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version
2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
=====\\n
\n\n/\n * Inputs of size above this threshold will be parallelized by calling multiple\n * shader programs.\n
*\n\nimport {nearestDivisor} from './util';\n\nexport const PARALLELIZE_THRESHOLD = 30;\n\nexport interface
ReduceInfo {\n windowSize: number;\n batchSize: number;\n inSize: number;\n outSize: number;\n}\n\nexport
function computeOptimalWindowSize(inSize: number): number {\n if (inSize <= PARALLELIZE_THRESHOLD)\n {\n return inSize;\n }\n return nearestDivisor(inSize, Math.floor(Math.sqrt(inSize)));\n}\n", "/*\n * @license\n *
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\"License\");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====\\n
*\n\n// Returns the image center in pixels.\n\nexport function getImageCenter(\n center: number|[number, number],
imageHeight: number,\n imageWidth: number): [number, number] {\n const centerX =\n imageWidth *
(typeof center === 'number' ? center : center[0]);\n const centerY =\n imageHeight * (typeof center ===
'number' ? center : center[1]);\n return [centerX, centerY];\n}\n", "/*\n * @license\n * Copyright 2018 Google
LLC. All
Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
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```

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```
=====
*\n\n/**\n * Gets the new shape of the input Tensor after it's been reshaped\n * to:\n * [blockShape[0], ...,
blockShape[M-1], batch / prod(blockShape)],\n * inputShape[1], ..., inputShape[N-1]]\n *\n * See step 1:
https://www.tensorflow.org/api_docs/python/tf/batch_to_space_nd\n */\nexport function getReshaped(\n inputShape:
 number[], blockShape: number[], prod: number,\n batchToSpace = true): number[] {\n let reshaped: number[] =
 [];\n if (batchToSpace) {\n reshaped = reshaped.concat(blockShape.slice(0));\n reshaped.push(inputShape[0] /
 prod);\n reshaped = reshaped.concat(inputShape.slice(1));\n } else {\n reshaped =
 reshaped.concat(inputShape[0]);\n const spatialLength = blockShape.length;\n for (let i = 0; i < spatialLength;
 ++i) {\n reshaped =\n reshaped.concat([inputShape[i + 1] / blockShape[i], blockShape[i]]);\n }\n reshaped = reshaped.concat(inputShape.slice(spatialLength + 1));\n }\n return reshaped;\n}\n\n/**\n * Gets the
permutation that will transpose the dimensions of the\n * reshaped tensor to shape:\n *\n * [batch /
prod(block_shape),inputShape[1], blockShape[0], ..., \n * inputShape[M], blockShape[M-1],inputShape[M+1], ...,
inputShape[N-1]]\n *\n * see step 2: https://www.tensorflow.org/api_docs/python/tf/batch_to_space_nd\n */\nexport
function getPermuted(\n reshapedRank: number, blockShapeRank: number,\n batchToSpace = true): number[] {\n const permuted =
 [];\n if (batchToSpace) {\n permuted.push(blockShapeRank);\n for (let i = blockShapeRank + 1; i <
 reshapedRank; ++i) {\n if (i <= 2 * blockShapeRank) {\n permuted.push(i);\n permuted.push(i -
 (blockShapeRank + 1));\n } else {\n permuted.push(i);\n }\n }\n } else {\n const
 permutedBeforeBatch = [];\n const permutedAfterBatch = [];\n for (let i = 1; i < reshapedRank; ++i) {\n if (i
 >= blockShapeRank * 2 + 1 || i % 2 === 1) {\n permutedAfterBatch.push(i);\n } else {\n permutedBeforeBatch.push(i);\n }\n }\n permuted.push(...permutedBeforeBatch);\n permuted.push(0);\n permuted.push(...permutedAfterBatch);\n }\n return permuted;\n}\n\n/**\n * Gets the shape of the reshaped and
permuted input Tensor before any cropping\n * is applied. The new shape will be:\n *\n * [batch /
prod(blockShape),inputShape[1]
* blockShape[0], ..., \n * inputShape[M] * blockShape[M-1],inputShape[M+1], ..., inputShape[N-1]]\n *\n * See
step 3: https://www.tensorflow.org/api_docs/python/tf/batch_to_space_nd\n */\nexport function
getReshapedPermuted(\n inputShape: number[], blockShape: number[], prod: number,\n batchToSpace = true):
 number[] {\n const reshapedPermuted = [];\n if (batchToSpace) {\n reshapedPermuted.push(inputShape[0] /
 prod);\n } else {\n reshapedPermuted.push(inputShape[0] * prod);\n }\n for (let i = 1; i < inputShape.length;
 ++i) {\n if (i <= blockShape.length) {\n if (batchToSpace) {\n reshapedPermuted.push(blockShape[i - 1] *
 inputShape[i]);\n } else {\n reshapedPermuted.push(inputShape[i] / blockShape[i - 1]);\n }\n } else {\n reshapedPermuted.push(inputShape[i]);\n }\n }\n return reshapedPermuted;\n}\n\n/**\n * Converts the crops
argument into the beginning coordinates of a slice\n * operation.\n */\nexport function getSliceBeginCoords(\n crops: number[][], blockShape: number): number[] {\n const
 sliceBeginCoords = [0];\n for (let i = 0; i < blockShape; ++i) {\n sliceBeginCoords.push(crops[i][0]);\n }\n return sliceBeginCoords;\n}\n\n/**\n * Converts the crops argument into the size of a slice operation. When\n *
combined with getSliceBeginCoords this function allows the reshaped and\n * permuted Tensor to be cropped to its
final output shape of:\n *\n * inputShape[1] * blockShape[0] - crops[0,0] - crops[0,1], ..., \n * inputShape[M] *
blockShape[M-1] -crops[M-1,0] - \n * crops[M-1,1],inputShape[M+1], ..., inputShape[N-1]]\n *\n * See step 4:
https://www.tensorflow.org/api_docs/python/tf/batch_to_space_nd\n */\nexport function
getSliceSize(\n uncroppedShape: number[], crops: number[][], blockShape: number): number[] {\n const sliceSize =
 uncroppedShape.slice(0, 1);\n for (let i = 0; i < blockShape; ++i) {\n sliceSize.push(uncroppedShape[i + 1] -
 crops[i][0])

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- crops[i][1]);\n } \n\n return sliceSize;\n}\n"/**\n * @license\n * Copyright 2018 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
===== \n
*\n\nexport const SELU_SCALEALPHA = 1.7580993408473768599402175208123;\nexport const SELU_SCALE
= 1.0507009873554804934193349852946;\n"/**\n * @license\n * Copyright 2018 Google LLC. All Rights
Reserved.\n * Licensed under the
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Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
===== \n
*\n\nexport const ERF_P = 0.3275911;\nexport const ERF_A1 = 0.254829592;\nexport const ERF_A2 = -
0.284496736;\nexport const ERF_A3 = 1.421413741;\nexport const ERF_A4 = -1.453152027;\nexport const
ERF_A5 = 1.061405429;\n"/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed
under the Apache License, Version 2.0 (the "License");\n * you may
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http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
===== \n
*\n\nimport {env} from './environment';\nexport function warn(...msg: Array<{}>): void {\n if
(!env().getBool('IS_TEST')) {\n console.warn(...msg);\n }\n}\n\nexport function log(...msg: Array<{}>): void {\n
if (!env().getBool('IS_TEST')) {\n console.log(...msg);\n }\n}\n"/**\n * @license\n * Copyright 2018 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n *
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http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
===== \n
*\n\nimport {TypedArray} from './types';\n/**\n * Merges real and imaginary Float32Arrays into a single complex
Float32Array.\n * \n * The memory layout is interleaved as follows:\n * real: [r0, r1, r2]\n * imag: [i0, i1, i2]\n *
complex: [r0, i0, r1, i1, r2, i2]\n * \n * This is the inverse of splitRealAndImagArrays.\n * \n * @param real The real
values of the complex tensor values.\n * @param imag The imag values of the
complex tensor values.\n * @returns A complex tensor as a Float32Array with merged values.\n */\nexport function
mergeRealAndImagArrays(\n real: Float32Array, imag: Float32Array): Float32Array {\n if (real.length !==
imag.length) {\n throw new Error(\n `Cannot merge real and imag arrays of different lengths. real: ` +\n
`${real.length}, imag: ${imag.length}.`);\n }\n const result = new Float32Array(real.length * 2);\n for (let i = 0; i
< result.length; i += 2) {\n result[i] = real[i / 2];\n result[i + 1] = imag[i / 2];\n }\n return result;\n}\n\n/**\n *
Splits a complex Float32Array into real and imag parts.\n * \n * The memory layout is interleaved as follows:\n *

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complex: [r0, i0, r1, i1, r2, i2]\n * real: [r0, r1, r2]\n * imag: [i0, i1, i2]\n * This is the inverse of
mergeRealAndImagArrays.\n * @param complex The complex tensor values.\n * @returns An object with real
and imag Float32Array components of the complex\n * tensor.\n */\nexport
function splitRealAndImagArrays(complex: Float32Array):\n {real: Float32Array, imag: Float32Array} {\n
const real = new Float32Array(complex.length / 2);\n const imag = new Float32Array(complex.length / 2);\n for
(let i = 0; i < complex.length; i += 2) {\n real[i / 2] = complex[i];\n imag[i / 2] = complex[i + 1];\n }\n return
{real, imag};\n}\n\n/**\n * Extracts even indexed complex values in the given array.\n * @param complex The
complex tensor values\n */\nexport function complexWithEvenIndex(complex: Float32Array):\n {real:
Float32Array, imag: Float32Array} {\n const len = Math.ceil(complex.length / 4);\n const real = new
Float32Array(len);\n const imag = new Float32Array(len);\n for (let i = 0; i < complex.length; i += 4) {\n
real[Math.floor(i / 4)] = complex[i];\n imag[Math.floor(i / 4)] = complex[i + 1];\n }\n return {real,
imag};\n}\n\n/**\n * Extracts odd indexed complex values in the given array.\n * @param complex The complex
tensor values\n */\nexport
function complexWithOddIndex(complex: Float32Array):\n {real: Float32Array, imag: Float32Array} {\n const
len = Math.floor(complex.length / 4);\n const real = new Float32Array(len);\n const imag = new
Float32Array(len);\n for (let i = 2; i < complex.length; i += 4) {\n real[Math.floor(i / 4)] = complex[i];\n
imag[Math.floor(i / 4)] = complex[i + 1];\n }\n return {real, imag};\n}\n\n/**\n * Get the map representing a
complex value in the given array.\n * @param complex The complex tensor values.\n * @param index An index of
the target complex value.\n */\nexport function getComplexWithIndex(\n complex: Float32Array, index: number):\n
{real: number, imag: number} {\n const real = complex[index * 2];\n const imag = complex[index * 2 + 1];\n
return {real, imag};\n}\n\n/**\n * Insert a given complex value into the TypedArray.\n * @param data The array in
which the complex value is inserted.\n * @param c The complex value to be inserted.\n * @param index An index
of
the target complex value.\n */\nexport function assignToTypedArray(\n data: TypedArray, real: number, imag:
number, index: number) {\n data[index * 2] = real;\n data[index * 2 + 1] = imag;\n}\n\n/**\n * Make the list of
exponent terms used by FFT.\n */\nexport function exponents(\n n: number, inverse: boolean): {real:
Float32Array, imag: Float32Array} {\n const real = new Float32Array(n / 2);\n const imag = new Float32Array(n /
2);\n for (let i = 0; i < Math.ceil(n / 2); i++) {\n const x = (inverse ? 2 : -2) * Math.PI * (i / n);\n real[i] =
Math.cos(x);\n imag[i] = Math.sin(x);\n }\n return {real, imag};\n}\n\n/**\n * Make the exponent term used by
FFT.\n */\nexport function exponent(\n k: number, n: number, inverse: boolean): {real: number, imag: number}
{\n const x = (inverse ? 2 : -2) * Math.PI * (k / n);\n const real = Math.cos(x);\n const imag = Math.sin(x);\n
return {real, imag};\n}\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n
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compliance with the License.\n * You may obtain a copy of the License at\n */\n
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software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n */\n
=====
\n
*/\nimport {TensorInfo} from './kernel_registry';\nimport {Tensor} from './tensor';\nimport {assert} from
'./util';\n\n/**\n * Prepare the split size array. When the input is a number, the axis is evenly\n * divided among the
split size. When the input contains the negative value, the\n * rest of the axis is allocated toward that.\n */\nexport
function prepareSplitSize(\n x: Tensor|TensorInfo, numOrSizeSplits: number[]|number,\n axis = 0): number[]\n {\n let
splitSizes = [];\n if (typeof (numOrSizeSplits) === 'number') {\n assert(\n x.shape[axis] %
numOrSizeSplits === 0,\n () => 'Number of splits must evenly divide the axis.);\n splitSizes =\n new
Array(numOrSizeSplits).fill(x.shape[axis] / numOrSizeSplits);\n } else {\n const numOfNegs =
numOrSizeSplits.reduce((count, value) => {\n if (value === -1) {\n count += 1;\n }\n return count;\n
}, 0);\n assert(\n numOfNegs <= 1,\n () => 'There should be only one negative value in split array.);\n

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const negIndex = numOrSizeSplits.indexOf(-1);\n // Allow the number of split array to be -1, which indicates the
rest\n // of dimension is allocated to that split.\n if (negIndex !== -1) {\n const total =
numOrSizeSplits.reduce((a, b) => b > 0 ? a + b : a);\n numOrSizeSplits[negIndex]
= x.shape[axis] - total;\n } \n assert(\n x.shape[axis] === numOrSizeSplits.reduce((a, b) => a + b),\n ()
=> "The sum of sizes must match the size of the axis dimension.");\n splitSizes = numOrSizeSplits;\n } \n return
splitSizes;\n}\n", "/*\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *

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===== \n
*\n\nimport {TensorInfo}
from './kernel_registry';\nimport {nearestDivisor} from './util';\n\nimport {PARALLELIZE_THRESHOLD} from
'./reduce_util';\n\nexport interface SegOpInfo {\n windowSize: number;\n batchSize: number;\n inSize: number;\n
numSegments: number;\n}\n\nexport function segOpComputeOptimalWindowSize(\n inSize: number,
numSegments: number): number {\n let done = false;\n let res;\n\n if (inSize <= PARALLELIZE_THRESHOLD)
{\n res = inSize;\n done = true;\n } else {\n res = nearestDivisor(inSize, Math.floor(Math.sqrt(inSize)));\n
}\n\n while (!done) {\n if (res > numSegments || res === inSize) {\n done = true;\n } else {\n res =
nearestDivisor(inSize, res + 1);\n }\n }\n return res;\n}\n\nexport function computeOutShape(\n aShape:
number[], axis: number, numSegments: number): number[] {\n const outShape = [];\n const rank =
aShape.length;\n for (let dim = 0; dim < rank; dim++) {\n if (dim !== axis) {\n outShape.push(aShape[dim]);\n

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 } else {\n outShape.push(numSegments);\n }\n }\n return outShape;\n}\n\nexport interface
GatherOpShapeInfo {\n batchSize: number;\n sliceSize: number;\n outerSize: number;\n dimSize: number;\n
outputShape: number[];\n}\n\nexport function collectGatherOpShapeInfo(\n x: TensorInfo, indices: TensorInfo,
axis: number, batchDims: number): GatherOpShapeInfo {\n const indicesRank = indices.shape.length;\n const
xRank = x.shape.length;\n if (batchDims !== 0) {\n if (batchDims < -indicesRank || batchDims > indicesRank)
{\n throw new Error(`Expect batchDims in the range of [-${indicesRank}, ${indicesRank}], but got
${batchDims}`);\n }\n if (batchDims < 0) {\n batchDims += indicesRank;\n }\n if (batchDims >
xRank) {\n throw new Error(`batchDims (${batchDims}) must be less than rank(x) (${xRank}).`);\n }\n if
(axis < batchDims) {\n throw new Error(`batchDims (${batchDims}) must be less than or equal to axis
(${axis}).`);\n }\n for (let i = 0; i < batchDims; ++i) {\n if (x.shape[i] !== indices.shape[i]) {\n throw new
Error(\n `x.shape[${i}]: ${x.shape[i]} should be equal to indices.shape[${i}]:
${indices.shape[i]}`);\n }\n }\n const dimSize = x.shape[axis];\n const outputShape: number[] = [];\n let
batchSize = 1;\n let outerSize = 1;\n let sliceSize = 1;\n for (let i = 0; i < batchDims; ++i) {\n
outputShape.push(x.shape[i]);\n batchSize *= x.shape[i];\n }\n for (let i = batchDims; i < axis; ++i) {\n
outputShape.push(x.shape[i]);\n outerSize *= x.shape[i];\n }\n for (let i = batchDims; i < indicesRank; ++i) {\n
outputShape.push(indices.shape[i]);\n }\n for (let i = axis + 1; i < xRank; ++i) {\n
outputShape.push(x.shape[i]);\n sliceSize *= x.shape[i];\n }\n return {batchSize, sliceSize, outerSize, dimSize,
outputShape};\n}\n", "/*\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed

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distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n *

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=====
*\n\nimport {decodeString, encodeString} from './util';\n\n// Utilities needed by backend consumers of tf-
core.\nexport * from './ops/axis_util';\nexport * from './ops/broadcast_util';\nexport * from
 './ops/concat_util';\nexport * from './ops/conv_util';\nexport * from './ops/fused_util';\nexport * from
 './ops/fused_types';\nexport * from './ops/reduce_util';\n\nimport
 * as slice_util from './ops/slice_util';\nexport {slice_util};\n\nexport {BackendValues, TypedArray, upcastType,
 PixelData} from './types';\nexport {MemoryInfo, TimingInfo} from './engine';\nexport * from
 './ops/rotate_util';\nexport * from './ops/array_ops_util';\nexport * from './ops/gather_nd_util';\nexport * from
 './ops/scatter_nd_util';\nexport * from './ops/selu_util';\nexport * from './ops/fused_util';\nexport * from
 './ops/erf_util';\nexport * from './log';\nexport * from './backends/complex_util';\nexport * from
 './ops/split_util';\n\nimport * as segment_util from './ops/segment_util';\nexport {segment_util};\n\nexport function
 fromUint8ToStringArray(vals: Uint8Array[]) {\n try {\n // Decode the bytes into string.\n return vals.map(val
 => decodeString(val));\n } catch (err) {\n throw new Error(\n `Failed to decode encoded string bytes into utf-
8, error: ${err}`);\n }\n}\n\nexport function fromStringArrayToUint8(strings:
 string[]) {\n return strings.map(s => encodeString(s));\n}\n\n",/**\n * @license\n * Copyright 2020 Google LLC.
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 OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
 governing permissions and\n * limitations under the License.\n *
=====
*\n\nexport {nonMaxSuppressionV3Impl, nonMaxSuppressionV4Impl, nonMaxSuppressionV5Impl} from
 './non_max_suppression_impl';\nexport {whereImpl} from './where_impl';\n\n",/**\n * @license\n * Copyright 2020
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 All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use
 this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
 http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
 software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
 OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
 governing permissions and\n * limitations under the License.\n *
=====
*\n\n// base.ts is tfjs-core without auto registration of things like flags,\n// gradients, chained ops or the opHandler.
 See base_side_effects.ts for parts\n// tfjs core that are required side effects.\n\n/**\n * @fileoverview\n * @suppress
 {partialAlias} Optimization disabled due to passing the module\n * object into a function
 below:\n *\n * import * as ops from './ops/ops';\n * setOpHandler(ops);\n *\n\n// Serialization.\nimport * as io
 from './io/io';\nimport * as math from './math';\nimport * as browser from './ops/browser';\nimport * as gather_util
 from './ops/gather_nd_util';\nimport * as scatter_util from './ops/scatter_nd_util';\nimport * as slice_util from
 './ops/slice_util';\nimport * as serialization from './serialization';\nimport * as tensor_util from './tensor_util';\nimport
 * as test_util from './test_util';\nimport * as util from './util';\nimport {version} from './version';\n\nexport
 {InferenceModel, MetaGraph, MetaGraphInfo, ModelPredictConfig, ModelTensorInfo, SavedModelTensorInfo,
 SignatureDef, SignatureDefEntry, SignatureDefInfo} from './model_types';\n\n// Optimizers.\nexport
 {AdadeltaOptimizer} from './optimizers/adadelta_optimizer';\nexport {AdagradOptimizer} from
 './optimizers/adagrad_optimizer';\nexport {AdamOptimizer} from './optimizers/adam_optimizer';\nexport
 {AdamaxOptimizer}
 from './optimizers/adamax_optimizer';\nexport {MomentumOptimizer} from
 './optimizers/momentum_optimizer';\nexport {Optimizer} from './optimizers/optimizer';\nexport
 {RMSPropOptimizer} from './optimizers/rmsprop_optimizer';\nexport {SGDOptimizer} from

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./optimizers/sgd_optimizer';\nexport {Scalar, Tensor, Tensor1D, Tensor2D, Tensor3D, Tensor4D, Tensor5D,
TensorBuffer, Variable} from './tensor';\nexport {GradSaveFunc, NamedTensorMap, TensorContainer,
TensorContainerArray, TensorContainerObject} from './tensor_types';\nexport {BackendValues, DataType,
DataTypeMap, DataValues, NumericDataType, PixelData, Rank, RecursiveArray, ScalarLike, ShapeMap,
sumOutType, TensorLike, TypedArray, upcastType} from './types';\n\nexport * from './ops/ops';\nexport
{Reduction} from './ops/loss_ops_utils';\n\nexport * from './train';\nexport * from './globals';\nexport * from
'/kernel_registry';\nexport {customGrad, grad, grads, valueAndGrad, valueAndGrads, variableGrads} from
'/gradients';\n\nexport {TimingInfo,
MemoryInfo, ForwardFunc} from './engine';\nexport {Environment, env, ENV} from './environment';\nexport
{Platform} from './platforms/platform';\n\nexport {version as version_core};\n\n// Top-level method
exports.\nexport {nextFrame} from './browser_util';\n\n// Second level exports.\nimport * as backend_util from
'/backends/backend_util';\nimport * as device_util from './device_util';\nexport {\n browser,\n io,\n math,\n
serialization,\n test_util,\n util,\n backend_util,\n tensor_util,\n slice_util,\n gather_util,\n scatter_util,\n
device_util\n};\n\nimport * as kernel_impls from './backends/kernel_impls';\nexport {kernel_impls};\n\n// Backend
specific.\nexport {KernelBackend, BackendTimingInfo, DataMover, DataStorage} from './backends/backend';\n\n//
Export all kernel names / info.\nexport * from './kernel_names';\n", "/*\n * @license\n * Copyright 2017 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you
may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*\n\n// Required side effectful code.\nimport './base_side_effects';\n\n// All exports from this package should be in
base.\nexport * from './base';\n", "/*\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n *
Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in
compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n
*\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is
distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n *
=====
*\n\nconst contexts: {[key: string]: WebGLRenderingContext} = {};\n\nconst WEBGL_ATTRIBUTES:
WebGLContextAttributes = {\n alpha: false,\n antialias: false,\n premultipliedAlpha: false,\n
preserveDrawingBuffer: false,\n depth: false,\n stencil: false,\n failIfMajorPerformanceCaveat: true\n};\n\nexport
function clearWebGLContext(webGLVersion: number) {\n delete contexts[webGLVersion];\n}\n\nexport function
setWebGLContext(\n webGLVersion: number, gl: WebGLRenderingContext) {\n contexts[webGLVersion] =
gl;\n}\n\nexport function getWebGLContext(webGLVersion:
number): WebGLRenderingContext {\n if (!(webGLVersion in contexts)) {\n const newCtx =
getWebGLRenderingContext(webGLVersion);\n if (newCtx !== null) {\n contexts[webGLVersion] =
newCtx;\n } else {\n console.log('Could not get context for WebGL version', webGLVersion);\n return
null;\n }\n }\n const gl = contexts[webGLVersion];\n if (gl.isContextLost()) {\n delete
contexts[webGLVersion];\n return getWebGLContext(webGLVersion);\n }\n\n gl.disable(gl.DEPTH_TEST);\n
gl.disable(gl.STENCIL_TEST);\n gl.disable(gl.BLEND);\n gl.disable(gl.DITHER);\n
gl.disable(gl.POLYGON_OFFSET_FILL);\n gl.disable(gl.SAMPLE_COVERAGE);\n
gl.enable(gl.SCISSOR_TEST);\n gl.enable(gl.CULL_FACE);\n gl.cullFace(gl.BACK);\n\n return
contexts[webGLVersion];\n}\n\nfunction createCanvas(webGLVersion: number) {\n if (typeof OffscreenCanvas

```

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!== 'undefined' && webGLVersion === 2) {\n return new OffscreenCanvas(300, 150);\n } else if (typeof
document !==
'undefined') {\n return document.createElement('canvas');\n } else {\n throw new Error('Cannot create a canvas
in this context');\n }\n}\n\nfunction getWebGLRenderingContext(webGLVersion: number):
WebGLRenderingContext {\n if (webGLVersion !== 1 && webGLVersion !== 2) {\n throw new Error('Cannot
get WebGL rendering context, WebGL is disabled.);\n }\n const canvas = createCanvas(webGLVersion);\n canvas.addEventListener('webglcontextlost', (ev: Event) => {\n ev.preventDefault();\n delete
contexts[webGLVersion];\n }, false);\n if (webGLVersion === 1) {\n return (canvas.getContext('webgl',
WEBGL_ATTRIBUTES) ||\n canvas.getContext('experimental-webgl', WEBGL_ATTRIBUTES)) as\n WebGLRenderingContext;\n }\n return canvas.getContext('webgl2', WEBGL_ATTRIBUTES) as
WebGLRenderingContext;\n}\n"/**\n * @license\n * Copyright 2017 Google LLC. All Rights Reserved.\n *
Licensed under the Apache License, Version 2.0 (the "License");\n * you may not
use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {backend_util, DataId, DataType, env, TensorInfo, util} from '@tensorflow/tfjs-core';\n\nexport enum
PackingScheme {\n /**\n * All values in a single texel are densely packed without any constraints.\n *\n * This
is how the shader encodes a tensor with shape = [2, 3, 4]\n * (indices are [batch, row, col]).\n *\n * 000|001
010|011 020|021\n * -----\n * 002|003 012|013 022|023\n *\n * 100|101 110|111 120|121\n * -----\n * 102|103 112|113 122|123\n *\n * DENSE,\n *\n * Single texels contain only values from the same batch, and from adjacent\n * rows and
columns.\n *\n * This is how the shader encodes a tensor with shape = [2, 3, 5]\n * (indices are [batch, row,
col]).\n *\n * 000|001 002|003 004|xxx 020|021 022|023 024|xxx\n * -----\n * 010|011 012|013 014|xxx xxx|xxx xxx|xxx xxx|xxx\n *\n * 100|101 102|103 104|xxx
120|121 122|123 124|xxx\n * -----\n * 110|111 112|113 114|xxx
xxx|xxx xxx|xxx xxx|xxx\n *\n * SHARED_BATCH\n *}\n\nexport enum TextureUsage {\n RENDER,\n UPLOAD,\n PIXELS,\n DOWNLOAD\n}\n\nexport enum PhysicalTextureType {\n UNPACKED_FLOAT16,\n UNPACKED_FLOAT32,\n PACKED_4X1_UNSIGNED_BYTE,\n PACKED_2X2_FLOAT32,\n PACKED_2X2_FLOAT16\n}\n\nexport
interface TextureData {\n // Required.\n shape: number[];\n dtype: DataType;\n\n // Optional.\n values?:
backend_util.BackendValues;\n texture?: WebGLTexture;\n // For complex numbers, the real and imaginary parts
are stored as their own\n // individual tensorInfos, with a parent joining the two with the\n // complexTensors field.
When this is defined, texture will be null.\n complexTensorInfos?: {real: TensorInfo, imag: TensorInfo};\n /**
[rows, columns] shape of the texture. *\n texShape?: [number, number];\n usage?: TextureUsage;\n isPacked?:
boolean;\n\n refCount: number;\n\n // Available when the tensor has been sliced.\n slice?: {\n // Offset in the 'flat
index' space.\n flatOffset: number;\n // Used for counting how many sliced tensors point to the same texture.\n
origDataId: DataId;\n };\n}\n\nexport function getUnpackedMatrixTextureShapeWidthHeight(\n rows: number,
columns: number): [number, number] {\n return [columns,
rows];\n}\n\nexport function getUnpackedArraySizeFromMatrixSize(\n matrixSize: number, channelsPerTexture:
number): number {\n return matrixSize * channelsPerTexture;\n}\n\nexport function
getColorMatrixTextureShapeWidthHeight(\n rows: number, columns: number): [number, number] {\n return
[columns * 4, rows];\n}\n\n/**\n * Get shape for densely packed RGBA texture.\n */\nexport function
getDenseTexShape(shape: number[]): [number, number] {\n const size = util.sizeFromShape(shape);\n const
texelsNeeded = Math.ceil(size / 4);\n return util.sizeToSquarishShape(texelsNeeded);\n}\n\nexport function
getMatrixSizeFromUnpackedArraySize(\n unpackedSize: number, channelsPerTexture: number): number {\n if

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(unpackedSize % channelsPerTexture !== 0) {\n throw new Error(\n `unpackedSize (${unpackedSize}) must
be a multiple of ` +\n `${channelsPerTexture}`);\n }\n return unpackedSize / channelsPerTexture;\n}\n\nexport
function decodeMatrixFromUnpackedColorRGBAArray(\n
 unpackedArray: Float32Array, matrix: Float32Array, channels: number) {\n const requiredSize =
unpackedArray.length * channels / 4;\n if (matrix.length < requiredSize) {\n throw new Error(\n `matrix
length (${matrix.length}) must be >= ${requiredSize}`);\n }\n let dst = 0;\n for (let src = 0; src <
unpackedArray.length; src += 4) {\n for (let c = 0; c < channels; c++) {\n matrix[dst++] = unpackedArray[src +
c];\n }\n }\n}\n\nexport function getPackedMatrixTextureShapeWidthHeight(\n rows: number, columns:
number): [number, number] {\n return [\n Math.max(1, Math.ceil(columns / 2)), Math.max(1, Math.ceil(rows /
2))\n];\n}\n\nexport function getPackedRGBAArraySizeFromMatrixShape(\n rows: number, columns: number):
number {\n const [w, h] = getPackedMatrixTextureShapeWidthHeight(rows, columns);\n return w * h *
4;\n}\n\nexport interface TextureConfig {\n internalFormatFloat: number;\n textureFormatFloat: number;\n
internalFormatPackedHalfFloat:
number;\n internalFormatHalfFloat: number;\n internalFormatPackedFloat: number;\n\n // The format to use
during a gl.readPixels call.\n downloadTextureFormat: number;\n // How many channels need to be unpacked after
a gl.readPixels call.\n downloadUnpackNumChannels: number;\n\n defaultNumChannels: number;\n
textureTypeHalfFloat: number;\n textureTypeFloat: number;\n}\n\nexport function getTextureConfig(\n //
tslint:disable-next-line:no-any\n gl: WebGLRenderingContext, textureHalfFloatExtension?: any): TextureConfig
{\n // tslint:disable-next-line:no-any\n const glany = gl as any;\n\n let internalFormatFloat: number;\n let
internalFormatHalfFloat: number;\n let internalFormatPackedHalfFloat: number;\n let internalFormatPackedFloat:
number;\n let textureFormatFloat: number;\n\n let downloadTextureFormat: number;\n let
downloadUnpackNumChannels: number;\n\n let defaultNumChannels: number;\n let textureTypeHalfFloat:
number;\n let textureTypeFloat: number;\n\n if (env().getNumber('WEBGL_VERSION') === 2) {\n internalFormatFloat = glany.R32F;\n
internalFormatHalfFloat = glany.R16F;\n internalFormatPackedHalfFloat = glany.RGBA16F;\n
internalFormatPackedFloat = glany.RGBA32F;\n textureFormatFloat = glany.RED;\n
downloadUnpackNumChannels = 4;\n defaultNumChannels = 1;\n textureTypeHalfFloat =
glany.HALF_FLOAT;\n textureTypeFloat = glany.FLOAT;\n } else {\n internalFormatFloat = gl.RGBA;\n
internalFormatHalfFloat = gl.RGBA;\n internalFormatPackedHalfFloat = gl.RGBA;\n
internalFormatPackedFloat = glany.RGBA;\n textureFormatFloat = gl.RGBA;\n downloadUnpackNumChannels
= 4;\n defaultNumChannels = 4;\n textureTypeHalfFloat = textureHalfFloatExtension != null ?\n
textureHalfFloatExtension.HALF_FLOAT_OES : \n null;\n textureTypeFloat = gl.FLOAT;\n }\n\n downloadTextureFormat = gl.RGBA;\n\n return {\n internalFormatFloat,\n internalFormatHalfFloat,\n
internalFormatPackedHalfFloat,\n
internalFormatPackedFloat,\n textureFormatFloat,\n downloadTextureFormat,\n
downloadUnpackNumChannels,\n defaultNumChannels,\n textureTypeHalfFloat,\n textureTypeFloat\n
};\n}\n\n", "/*\n * @license\n * Copyright 2017 Google LLC. All Rights Reserved.\n * Licensed under the Apache
License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You
may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required
by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\"
BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the
License for the specific language governing permissions and\n * limitations under the License.\n */\n
=====\n\n*\n\nimport {env, TensorInfo, util} from '@tensorflow/tfjs-core';\nimport
{getWebGLContext} from './canvas_util';\nimport {getTextureConfig} from './tex_util';\n\nexport function
callAndCheck<T>(gl: WebGLRenderingContext, func: () => T): T {\n const returnValue = func();\n if
(env().getBool('DEBUG')) {\n checkWebGLError(gl);\n }\n return returnValue;\n}\n\nfunction
checkWebGLError(gl: WebGLRenderingContext) {\n const error = gl.getError();\n if (error !== gl.NO_ERROR)

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{\n throw new Error('WebGL Error: ' + getWebGLErrorMessage(gl, error));\n }\n}\n\n//
https://en.wikipedia.org/wiki/Half-precision_floating-point_format\nconst MIN_FLOAT16 = 5.96e-8;\nconst
MAX_FLOAT16 = 65504;\n\nexport function canBeRepresented(num: number): boolean {\n if
(env().getBool('WEBGL_RENDER_FLOAT32_ENABLED') || num === 0 ||\n (MIN_FLOAT16 <
Math.abs(num) && Math.abs(num) < MAX_FLOAT16)) {\n return true;\n }\n return false;\n }\n\nexport
function getWebGLErrorMessage(\n gl: WebGLRenderingContext, status: number): string {\n switch (status) {\n
 case gl.NO_ERROR:\n return 'NO_ERROR';\n case gl.INVALID_ENUM:\n return
'INVALID_ENUM';\n case gl.INVALID_VALUE:\n return 'INVALID_VALUE';\n case
gl.INVALID_OPERATION:\n return 'INVALID_OPERATION';\n case
gl.INVALID_FRAMEBUFFER_OPERATION:\n return 'INVALID_FRAMEBUFFER_OPERATION';\n case
gl.OUT_OF_MEMORY:\n return 'OUT_OF_MEMORY';\n case gl.CONTEXT_LOST_WEBGL:\n return
'CONTEXT_LOST_WEBGL';\n default:\n return `Unknown error code ${status}`;\n }\n }\n\nexport function
getExtensionOrThrow(\n gl: WebGLRenderingContext, extensionName: string): {} {\n return
throwIfNull<{}>(\n gl, () => gl.getExtension(extensionName),\n 'Extension \'' + extensionName + '\' not
supported on this browser.);\n }\n\nexport function createVertexShader(\n gl: WebGLRenderingContext,
vertexShaderSource: string): WebGLShader {\n const vertexShader: WebGLShader =
throwIfNull<WebGLShader>(\n gl, () => gl.createShader(gl.VERTEX_SHADER),\n
 'Unable to create vertex WebGLShader.);\n callAndCheck(gl, () => gl.shaderSource(vertexShader,
vertexShaderSource));\n callAndCheck(gl, () => gl.compileShader(vertexShader));\n if
(gl.getShaderParameter(vertexShader, gl.COMPILE_STATUS) === false) {\n
 console.log(gl.getShaderInfoLog(vertexShader));\n throw new Error('Failed to compile vertex shader.);\n }\n
return vertexShader;\n }\n\nexport function createFragmentShader(\n gl: WebGLRenderingContext,
fragmentShaderSource: string): WebGLShader {\n const fragmentShader: WebGLShader =
throwIfNull<WebGLShader>(\n gl, () => gl.createShader(gl.FRAGMENT_SHADER),\n
 'Unable to create
fragment WebGLShader.);\n callAndCheck(gl, () => gl.shaderSource(fragmentShader, fragmentShaderSource));\n
callAndCheck(gl, () => gl.compileShader(fragmentShader));\n if (gl.getShaderParameter(fragmentShader,
gl.COMPILE_STATUS) === false) {\n logShaderSourceAndInfoLog(\n fragmentShaderSource,
gl.getShaderInfoLog(fragmentShader));\n
 throw new Error('Failed to compile fragment shader.);\n }\n return fragmentShader;\n }\n\nconst
lineNumberRegex = /ERROR: [0-9]+:([0-9]+)/g;\nfunction logShaderSourceAndInfoLog(\n shaderSource: string,
shaderInfoLog: string) {\n const lineNumberRegexResult = lineNumberRegex.exec(shaderInfoLog);\n if
(lineNumberRegexResult == null) {\n console.log(`Couldn't parse line number in error: ${shaderInfoLog}`);\n
 console.log(shaderSource);\n return;\n }\n\n const lineNumber = +lineNumberRegexResult[1];\n\n const
shaderLines = shaderSource.split('\n');\n const pad = shaderLines.length.toString().length + 2;\n const
linesWithLineNumbers = shaderLines.map(\n (line, lineNumber) =>\n util.rightPad((lineNumber +
1).toString(), pad) + line);\n let maxLineLength = 0;\n for (let i = 0; i < linesWithLineNumbers.length; i++) {\n
 maxLineLength = Math.max(linesWithLineNumbers[i].length, maxLineLength);\n }\n\n const beforeErrorLines =
linesWithLineNumbers.slice(0,
lineNumber - 1);\n const errorLine = linesWithLineNumbers.slice(lineNumber - 1, lineNumber);\n const
afterErrorLines = linesWithLineNumbers.slice(lineNumber);\n\n console.log(beforeErrorLines.join('\n'));\n
console.log(shaderInfoLog.split('\n')[0]);\n console.log(\n `%c ${util.rightPad(errorLine[0],
maxLineLength)}`,\n 'border: 1px solid red; background-color: #e3d2d2; color: #a61717');\n
console.log(afterErrorLines.join('\n'));\n }\n\nexport function createProgram(gl: WebGLRenderingContext):
WebGLProgram {\n return throwIfNull<WebGLProgram>(\n gl, () => gl.createProgram(), 'Unable to create
WebGLProgram.);\n }\n\nexport function linkProgram(gl: WebGLRenderingContext, program: WebGLProgram)
{\n callAndCheck(gl, () => gl.linkProgram(program));\n if (gl.getProgramParameter(program, gl.LINK_STATUS)
=== false) {\n console.log(gl.getProgramInfoLog(program));\n throw new Error('Failed to link vertex and
fragment shaders.);\n }\n }\n\nexport

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function validateProgram(\n gl: WebGLRenderingContext, program: WebGLProgram) {\n callAndCheck(gl, ()
=> gl.validateProgram(program));\n if (gl.getProgramParameter(program, gl.VALIDATE_STATUS) === false) {\n
 console.log(gl.getProgramInfoLog(program));\n throw new Error('Shader program validation failed.');

```

```

0, gl.canvas.width, gl.canvas.height));\n}\n\nexport function bindColorTextureToFramebuffer(\n gl:
WebGLRenderingContext, texture: WebGLTexture,\n framebuffer: WebGLFramebuffer)
{\n callAndCheck(gl, () => gl.bindFramebuffer(gl.FRAMEBUFFER, framebuffer));\n callAndCheck(\n gl,\n () => gl.framebufferTexture2D(\n gl.FRAMEBUFFER, gl.COLOR_ATTACHMENT0, gl.TEXTURE_2D,
texture, 0));\n}\n\nexport function unbindColorTextureFromFramebuffer(\n gl: WebGLRenderingContext,
framebuffer: WebGLFramebuffer) {\n callAndCheck(gl, () => gl.bindFramebuffer(gl.FRAMEBUFFER,
framebuffer));\n callAndCheck(\n gl,\n () => gl.framebufferTexture2D(\n gl.FRAMEBUFFER,
gl.COLOR_ATTACHMENT0, gl.TEXTURE_2D, null, 0));\n}\n\nexport function validateFramebuffer(gl:
WebGLRenderingContext) {\n const status = gl.checkFramebufferStatus(gl.FRAMEBUFFER);\n if (status !==
gl.FRAMEBUFFER_COMPLETE) {\n throw new Error(\n 'Error binding framebuffer: ' +
getFramebufferErrorMessage(gl, status));\n }\n}\n\nexport function getFramebufferErrorMessage(\n gl:
WebGLRenderingContext, status: number): string {\n switch (status) {\n case
gl.FRAMEBUFFER_INCOMPLETE_ATTACHMENT:\n return 'FRAMEBUFFER_INCOMPLETE_ATTACHMENT';\n case
gl.FRAMEBUFFER_INCOMPLETE_MISSING_ATTACHMENT:\n return
'FRAMEBUFFER_INCOMPLETE_MISSING_ATTACHMENT';\n case
gl.FRAMEBUFFER_INCOMPLETE_DIMENSIONS:\n return
'FRAMEBUFFER_INCOMPLETE_DIMENSIONS';\n case gl.FRAMEBUFFER_UNSUPPORTED:\n return
'FRAMEBUFFER_UNSUPPORTED';\n default:\n return `unknown error ${status}`;\n }\n}\n\nfunction
throwIfNull<T>(\n gl: WebGLRenderingContext, returnTOrNull: () => T | null,\n failureMessage: string): T {\n const tOrNull: T | null = callAndCheck(gl, () => returnTOrNull());\n if (tOrNull === null) {\n throw new
Error(failureMessage);\n }\n return tOrNull;\n}\n\nfunction validateTextureUnit(gl: WebGLRenderingContext,
textureUnit: number) {\n const maxTextureUnit = gl.MAX_COMBINED_TEXTURE_IMAGE_UNITS - 1;\n const glTextureUnit = textureUnit + gl.TEXTURE0;\n if (glTextureUnit < gl.TEXTURE0 || glTextureUnit >
maxTextureUnit) {\n const
textureUnitRange = `[gl.TEXTURE0, gl.TEXTURE${maxTextureUnit}]`;\n throw new Error(`textureUnit must
be in ${textureUnitRange}`);\n }\n}\n\nexport function getBatchDim(shape: number[], dimsToSkip = 2): number
{\n return util.sizeFromShape(shape.slice(0, shape.length - dimsToSkip));\n}\n\nexport function
getRowsCols(shape: number[]): [number, number] {\n if (shape.length === 0) {\n throw Error('Cannot get rows
and columns of an empty shape array.);\n }\n return [\n shape.length > 1 ? shape[shape.length - 2] : 1,
shape[shape.length - 1]\n];\n}\n\nexport function getShapeAs3D(shape: number[]): [number, number, number] {\n let
shapeAs3D: [number, number, number] = [1, 1, 1];\n const isScalar = shape.length === 0 || (shape.length === 1
&& shape[0] === 1);\n if (!isScalar) {\n shapeAs3D = [\n getBatchDim(shape), ...getRowsCols(shape)\n] as
[number, number, number];\n }\n return shapeAs3D;\n}\n\nexport function getTextureShapeFromLogicalShape(\n logShape:
number[], isPacked = false): [number, number] {\n let maxTexSize =
env().getNumber('WEBGL_MAX_TEXTURE_SIZE');\n if (isPacked) {\n maxTexSize = maxTexSize * 2;\n\n // This logic ensures we accurately count the number of packed texels needed\n // to accommodate the tensor. We
can only pack values in the same texel if\n // they are from adjacent pairs of rows/cols within the same batch. So if
a\n // tensor has 3 rows, we pretend it has 4 rows in order to account for the\n // fact that the texels containing the
third row are half empty.\n logShape = logShape.map(\n (d, i) => i >= logShape.length - 2 ?\n util.nearestLargerEven(logShape[i]) :\n logShape[i]);\n\n // Packed texture height is at least 2 (the channel
height of a single\n // texel).\n if (logShape.length === 1) {\n logShape = [2, logShape[0]];\n }\n }\n\n // If
logical shape is 2, we don't squeeze, since we want to match physical.\n if (logShape.length !==
2) {\n const squeezeResult = util.squeezeShape(logShape);\n logShape = squeezeResult.newShape;\n }\n\n let
size = util.sizeFromShape(logShape);\n if (logShape.length <= 1 && size <= maxTexSize) {\n return [1, size];\n }
else if (\n logShape.length === 2 && logShape[0] <= maxTexSize &&\n logShape[1] <= maxTexSize {\n return
logShape as [number, number];\n } else if (\n logShape.length === 3 && logShape[0] * logShape[1] <=

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maxTexSize &&\n logShape[2] <= maxTexSize) {\n return [logShape[0] * logShape[1], logShape[2]];\n } else
if (\n logShape.length === 3 && logShape[0] <= maxTexSize &&\n logShape[1] * logShape[2] <=
maxTexSize) {\n return [logShape[0], logShape[1] * logShape[2]];\n } else if (\n logShape.length === 4 &&\n
 logShape[0] * logShape[1] * logShape[2] <= maxTexSize &&\n logShape[3] <= maxTexSize) {\n return
[logShape[0] * logShape[1] * logShape[2], logShape[3]];\n } else if (\n logShape.length === 4
&& logShape[0] <= maxTexSize &&\n logShape[1] * logShape[2] * logShape[3] <= maxTexSize) {\n return
[logShape[0], logShape[1] * logShape[2] * logShape[3]];\n } else {\n if (isPacked) {\n // For packed textures
size equals the number of channels required to\n // accommodate the texture data. However in order to squarify
such that\n // inner dimensions stay even, we rewrite size to equal the number of\n // texels. Then in the return
statement we rehydrate the squarified\n // dimensions to channel units.\n\n const batchDim =
getBatchDim(logShape);\n let rows = 2, cols = 2;\n if (logShape.length) {\n [rows, cols] =
getRowsCols(logShape);\n } \n size = batchDim * (rows / 2) * (cols / 2);\n return
util.sizeToSquarishShape(size).map(d => d * 2) as [number, number];\n }\n return
util.sizeToSquarishShape(size);\n }\n}\n\nfunction isEven(n: number): boolean {\n return n % 2 ===
0;\n}\n\n/**\n * This determines whether
reshaping a packed texture requires rearranging\n * the data within the texture, assuming 2x2 packing.\n */\n\nexport
function isReshapeFree(shape1: number[], shape2: number[]): boolean {\n shape1 = shape1.slice(-2);\n shape2 =
shape2.slice(-2);\n\n if (util.arraysEqual(shape1, shape2)) {\n return true;\n }\n\n if (!shape1.length ||
!shape2.length) { // One of the shapes is a scalar.\n return true;\n }\n\n if (shape1[0] === 0 || shape1[1] === 0 ||
shape2[0] === 0 ||\n shape2[1] === 0) {\n return true;\n }\n\n if (shape1.length !== shape2.length) { // One of
the shapes is a vector.\n const shape1Cols = shape1.slice(-1)[0];\n const shape2Cols = shape2.slice(-1)[0];\n if
(shape1Cols === shape2Cols) {\n return true;\n }\n\n if (isEven(shape1Cols) && isEven(shape2Cols) &&\n
 (shape1[0] === 1 || shape2[0] === 1)) {\n return true;\n }\n }\n return shape1[1] === shape2[1] &&
isEven(shape1[0]) && isEven(shape2[0]);\n}\n\n// We cache
webgl params because the environment gets reset between\n// unit tests and we don't want to constantly query the
WebGLContext for\n// MAX_TEXTURE_SIZE.\n\nlet MAX_TEXTURE_SIZE: number;\n\nlet
MAX_TEXTURES_IN_SHADER: number;\n\n\nexport function getWebGLMaxTextureSize(webGLVersion:
number): number {\n if (MAX_TEXTURE_SIZE === null) {\n const gl = getWebGLContext(webGLVersion);\n MAX_TEXTURE_SIZE = gl.getParameter(gl.MAX_TEXTURE_SIZE);\n }\n return
MAX_TEXTURE_SIZE;\n}\n\n\nexport function resetMaxTextureSize() {\n MAX_TEXTURE_SIZE =
null;\n}\n\n\nexport function resetMaxTexturesInShader() {\n MAX_TEXTURES_IN_SHADER = null;\n}\n\n\nexport
function getMaxTexturesInShader(webGLVersion: number): number {\n if (MAX_TEXTURES_IN_SHADER ===
null) {\n const gl = getWebGLContext(webGLVersion);\n MAX_TEXTURES_IN_SHADER =
gl.getParameter(gl.MAX_TEXTURE_IMAGE_UNITS);\n }\n // We cap at 16 to avoid spurious runtime \"memory
exhausted\" error.\n return Math.min(16, MAX_TEXTURES_IN_SHADER);\n}\n\n\nexport
function getWebGLDisjointQueryTimerVersion(webGLVersion: number):\n number {\n if (webGLVersion ===
0) {\n return 0;\n }\n\n let queryTimerVersion: number;\n const gl = getWebGLContext(webGLVersion);\n\n if
(hasExtension(gl, 'EXT_disjoint_timer_query_webgl2') &&\n webGLVersion === 2) {\n queryTimerVersion =
2;\n } else if (hasExtension(gl, 'EXT_disjoint_timer_query')) {\n queryTimerVersion = 1;\n } else {\n
queryTimerVersion = 0;\n }\n return queryTimerVersion;\n}\n\n\nexport function hasExtension(gl:
WebGLRenderingContext, extensionName: string) {\n const ext = gl.getExtension(extensionName);\n return ext !=
null;\n}\n\n\nexport function isWebGLVersionEnabled(webGLVersion: 1|2) {\n try {\n const gl =
getWebGLContext(webGLVersion);\n if (gl != null) {\n return true;\n }\n } catch (e) {\n console.log('Error
when getting WebGL context: ', e);\n return false;\n }\n return false;\n}\n\n\nexport function
isCapableOfRenderingToFloatTexture(webGLVersion:
number):\n boolean {\n if (webGLVersion === 0) {\n return false;\n }\n\n const gl =
getWebGLContext(webGLVersion);\n\n if (webGLVersion === 1) {\n if (!hasExtension(gl, 'OES_texture_float'))
{\n return false;\n }\n } else {\n if (!hasExtension(gl, 'EXT_color_buffer_float')) {\n return false;\n }\n
}

```

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}\n\n const isFramebufferComplete = createFloatTextureAndBindToFramebuffer(gl);\n return
isFramebufferComplete;\n}\n\n/**\n * Check if we can download values from a float/half-float texture.\n *\n * Note that for performance reasons we use binding a texture to a framebuffer\n * as a proxy for ability to download float values later using readPixels. The\n * texture params of this texture will not match those in readPixels exactly\n * but if we are unable to bind some kind of float texture to the framebuffer\n * then we definitely will not be able to read float values from it.\n */\nexport function isDownloadFloatTextureEnabled(webGLVersion:
number): boolean {\n if (webGLVersion === 0) {\n return false;\n }\n\n const gl =
getWebGLContext(webGLVersion);\n\n if (webGLVersion === 1) {\n if (!hasExtension(gl, 'OES_texture_float'))
{\n return false;\n }\n if (!hasExtension(gl, 'WEBGL_color_buffer_float')) {\n return false;\n }\n } else
{\n if (hasExtension(gl, 'EXT_color_buffer_float')) {\n return createFloatTextureAndBindToFramebuffer(gl);\n
}\n\n const COLOR_BUFFER_HALF_FLOAT = 'EXT_color_buffer_half_float';\n if (hasExtension(gl,
COLOR_BUFFER_HALF_FLOAT)) {\n const textureHalfFloatExtension =\n
gl.getExtension(COLOR_BUFFER_HALF_FLOAT);\n return
createHalfFloatTextureAndBindToFramebuffer(\n gl, textureHalfFloatExtension);\n }\n\n return false;\n
}\n\n const isFramebufferComplete = createFloatTextureAndBindToFramebuffer(gl);\n return
isFramebufferComplete;\n}\n\nfunction createFloatTextureAndBindToFramebuffer(gl:
WebGLRenderingContext):\n
boolean {\n const texConfig = getTextureConfig(gl);\n\n const texture = gl.createTexture();\n
gl.bindTexture(gl.TEXTURE_2D, texture);\n\n const width = 1;\n const height = 1;\n gl.texImage2D(\n
gl.TEXTURE_2D, 0, texConfig.internalFormatFloat, width, height, 0,\n texConfig.textureFormatFloat,
texConfig.textureTypeFloat, null);\n\n const framebuffer = gl.createFramebuffer();\n
gl.bindFramebuffer(gl.FRAMEBUFFER, framebuffer);\n gl.framebufferTexture2D(\n gl.FRAMEBUFFER,
gl.COLOR_ATTACHMENT0, gl.TEXTURE_2D, texture, 0);\n\n const isFramebufferComplete =\n
gl.checkFramebufferStatus(gl.FRAMEBUFFER) === gl.FRAMEBUFFER_COMPLETE;\n\n
gl.bindTexture(gl.TEXTURE_2D, null);\n gl.bindFramebuffer(gl.FRAMEBUFFER, null);\n
gl.deleteTexture(texture);\n gl.deleteFramebuffer(framebuffer);\n\n return isFramebufferComplete;\n}\n\nfunction
createHalfFloatTextureAndBindToFramebuffer(\n // tslint:disable-next-line:no-any\n gl:
WebGLRenderingContext, textureHalfFloatExtension:
any): boolean {\n const texConfig = getTextureConfig(gl, textureHalfFloatExtension);\n const texture =
gl.createTexture();\n gl.bindTexture(gl.TEXTURE_2D, texture);\n\n const width = 1;\n const height = 1;\n
gl.texImage2D(\n gl.TEXTURE_2D, 0, texConfig.internalFormatHalfFloat, width, height, 0,\n
texConfig.textureFormatFloat, texConfig.textureTypeHalfFloat, null);\n\n const framebuffer =
gl.createFramebuffer();\n gl.bindFramebuffer(gl.FRAMEBUFFER, framebuffer);\n gl.framebufferTexture2D(\n
gl.FRAMEBUFFER, gl.COLOR_ATTACHMENT0, gl.TEXTURE_2D, texture, 0);\n\n const
isFramebufferComplete =\n gl.checkFramebufferStatus(gl.FRAMEBUFFER) ===
gl.FRAMEBUFFER_COMPLETE;\n\n gl.bindTexture(gl.TEXTURE_2D, null);\n
gl.bindFramebuffer(gl.FRAMEBUFFER, null);\n gl.deleteTexture(texture);\n
gl.deleteFramebuffer(framebuffer);\n\n return isFramebufferComplete;\n}\n\nexport function
isWebGLFenceEnabled(webGLVersion: number) {\n if (webGLVersion !== 2) {\n return
false;\n }\n\n const gl = getWebGLContext(webGLVersion);\n\n // tslint:disable-next-line:no-any\n const
isEnabled = (gl as any).fenceSync !== null;\n return isEnabled;\n}\n\nexport function assertNotComplex(\n tensor:
TensorInfo|TensorInfo[], opName: string): void {\n if (!Array.isArray(tensor)) {\n tensor = [tensor];\n }\n
tensor.forEach(t => {\n if (t !== null) {\n util.assert(\n t.dtype !== 'complex64',\n () => `_${opName}_
does not support complex64 tensors ` +\n 'in the WebGL backend.);\n }\n });\n }\n\n"/**\n * @license\n *
Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
"License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an

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\"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n
* See the License for the specific language governing permissions and\n * limitations under the License.\n *
=====
\n
*\n\nimport {device_util, env} from '@tensorflow/tfjs-core';\n\nimport {getMaxTexturesInShader,
getWebGLDisjointQueryTimerVersion, getWebGLMaxTextureSize, isCapableOfRenderingToFloatTexture,
isDownloadFloatTextureEnabled, isWebGLFenceEnabled, isWebGLVersionEnabled} from './webgl_util';\n\nconst
ENV = env();\n\n/**\n * This file contains WebGL-specific flag registrations.\n */\n\n/**\n * True if WebGL is
supported.\n */\nENV.registerFlag('HAS_WEBGL', () => ENV.getNumber('WEBGL_VERSION') > 0);\n\n0:
No WebGL, 1: WebGL 1.0, 2: WebGL 2.0.\n\nENV.registerFlag('WEBGL_VERSION', () => {\n if
(isWebGLVersionEnabled(2)) {\n return 2;\n } else if (isWebGLVersionEnabled(1)) {\n return 1;\n }\n return
0;\n});\n\n/**\n * Whether to check for numerical representation problems.\n */\n\nENV.registerFlag('WEBGL_CHECK_NUMERICAL_PROBLEMS', () => false);\n\nENV.registerFlag(\n
'WEBGL_BUFFER_SUPPORTED', () => ENV.get('WEBGL_VERSION') === 2);\n\n/**\n * Whether the WebGL
backend will sometimes forward ops to the CPU.\n */\nENV.registerFlag('WEBGL_CPU_FORWARD', () =>
true);\n\n/**\n * Whether the WebGL backend will always use f16 textures for rendering.\n */\n\nENV.registerFlag('WEBGL_FORCE_F16_TEXTURES', () => false);\n\n/**\n * Whether to turn all packing related
flags on.\n */\nENV.registerFlag('WEBGL_PACK', () => ENV.getBool('HAS_WEBGL'));\n\n/**\n * Whether we will
pack the batchnormalization op.\n */\nENV.registerFlag('WEBGL_PACK_NORMALIZATION', () =>
ENV.getBool('WEBGL_PACK'));\n\n/**\n * Whether we will pack the clip op.\n */\n\nENV.registerFlag('WEBGL_PACK_CLIP', () => ENV.getBool('WEBGL_PACK'));\n\n/**\n * Whether we will
pack the depthwise conv op.\n */\n\n// TODO:
https://github.com/tensorflow/tfjs/issues/1679\n\nENV.registerFlag('WEBGL_PACK_DEPTHWISECONV',
() => false);\n\n/**\n * Whether we will pack binary ops.\n */\n\nENV.registerFlag(\n
'WEBGL_PACK_BINARY_OPERATIONS', () => ENV.getBool('WEBGL_PACK'));\n\n/**\n * Whether we will pack
unary ops.\n */\n\nENV.registerFlag(\n 'WEBGL_PACK_UNARY_OPERATIONS', () =>
ENV.getBool('WEBGL_PACK'));\n\n/**\n * Whether we will pack array ops.\n */\n\nENV.registerFlag(\n
'WEBGL_PACK_ARRAY_OPERATIONS', () => ENV.getBool('WEBGL_PACK'));\n\n/**\n * Whether we will pack
image ops.\n */\n\nENV.registerFlag(\n 'WEBGL_PACK_IMAGE_OPERATIONS', () =>
ENV.getBool('WEBGL_PACK'));\n\n/**\n * Whether we will pack reduce ops.\n */\n\nENV.registerFlag('WEBGL_PACK_REDUCE', () => ENV.getBool('WEBGL_PACK'));\n\n/**\n * Whether packed
WebGL kernels lazily unpack their outputs.\n */\n\nENV.registerFlag('WEBGL_LAZILY_UNPACK', () =>
ENV.getBool('WEBGL_PACK'));\n\n/**\n * Whether we will use the im2col algorithm to speed up convolutions.\n */\n\nENV.registerFlag('WEBGL_CONV_IM2COL', () => ENV.getBool('WEBGL_PACK'));\n\n/**\n * The maximum
texture
dimension.\n */\n\nENV.registerFlag(\n 'WEBGL_MAX_TEXTURE_SIZE',\n () =>
getWebGLMaxTextureSize(ENV.getNumber('WEBGL_VERSION')));\n\n/**\n * The maximum texture dimension.\n */\n\nENV.registerFlag(\n 'WEBGL_MAX_TEXTURES_IN_SHADER',\n () =>
getMaxTexturesInShader(ENV.getNumber('WEBGL_VERSION')));\n\n/**\n * The disjoint_query_timer extension
version.\n */\n0: disabled, 1: EXT_disjoint_timer_query, 2:\n\n/**\n * EXT_disjoint_timer_query_webgl2.\n */\n\nIn Firefox
with WebGL 2.0,\n\nEXT_disjoint_timer_query_webgl2 is not available, so we must use the\n\nWebGL 1.0
extension.\n\nENV.registerFlag('WEBGL_DISJOINT_QUERY_TIMER_EXTENSION_VERSION', () => {\n
const webGLVersion = ENV.getNumber('WEBGL_VERSION');\n\n if (webGLVersion === 0) {\n return 0;\n
}\n\n return getWebGLDisjointQueryTimerVersion(webGLVersion);\n});\n\n/**\n * Whether the timer object from
the disjoint_query_timer extension gives\n * timing information that is reliable.\n */\n\nENV.registerFlag(\n
'WEBGL_DISJOINT_QUERY_TIMER_EXTENSION_RELIABLE',\n
() => ENV.getNumber('WEBGL_DISJOINT_QUERY_TIMER_EXTENSION_VERSION') > 0 &&\n
!device_util.isMobile());\n\n/**\n * Whether the device is physically capable of rendering to float32 textures.\n */\n\nENV.registerFlag(\n 'WEBGL_RENDER_FLOAT32_CAPABLE',\n () =>

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isCapableOfRenderingToFloatTexture(ENV.getNumber('WEBGL_VERSION')));\n\n/**\n * Whether rendering to
float32 textures is enabled. If disabled, renders to\n * float16 textures.\n
*\nENV.registerFlag('WEBGL_RENDER_FLOAT32_ENABLED', () => {\n return
ENV.getBool('WEBGL_FORCE_F16_TEXTURES') ?\n false :\n
ENV.getBool('WEBGL_RENDER_FLOAT32_CAPABLE');\n});\n\n/**\n * Whether downloading float textures is
enabled (16 or 32 bit). If disabled,\n * uses IEEE 754 encoding of the float32 values to 4 uint8 when downloading.\n
*\nENV.registerFlag(\n 'WEBGL_DOWNLOAD_FLOAT_ENABLED',\n () =>
isDownloadFloatTextureEnabled(ENV.getNumber('WEBGL_VERSION')));\n\n/** Whether the fence API is
available.
*\nENV.registerFlag(\n 'WEBGL_FENCE_API_ENABLED',\n () =>
isWebGLFenceEnabled(ENV.getNumber('WEBGL_VERSION')));\n\n/**\n * Tensors with size <= than this will be
uploaded as uniforms, not textures.\n *\nENV.registerFlag('WEBGL_SIZE_UPLOAD_UNIFORM', () => {\n //
Use uniform uploads only when 32bit floats are supported. In\n // 16bit\n // environments there are problems with
comparing a 16bit texture value\n // with a 32bit uniform value.\n const useUniforms =
ENV.getBool('WEBGL_RENDER_FLOAT32_ENABLED');\n return useUniforms ? 4 : 0;\n});\n\n/**\n * If the
total number of bytes allocated on the GPU is greater than this\n * number, we will aggressively delete textures
upon disposal with\n * gl.deleteMatrixTexture, rather than making them available for reuse.\n *\n * Default value -1
indicates that we will never aggressively delete textures.\n *\nENV.registerFlag(\n
'WEBGL_DELETE_TEXTURE_THRESHOLD',\n () => {\n return -1;\n },\n threshold => {\n if
(threshold
< 0 && threshold !== -1) {\n throw new Error(\n `WEBGL_DELETE_TEXTURE_THRESHOLD must
be -1 (indicating never ` +\n `delete) or at least 0, but got ${threshold}.`);\n };\n });\n },"/**\n *
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2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====
*\nimport {env} from '@tensorflow/tfjs-core';\n\nexport
type GLSL = {\n version: string,\n attribute: string,\n varyingVs: string,\n varyingFs: string,\n texture2D:
string,\n output: string,\n defineOutput: string,\n defineSpecialNaN: string,\n defineSpecialInf: string,\n
defineRound: string\n};\n\nexport function getGlslDifferences(): GLSL {\n let version: string;\n let attribute:
string;\n let varyingVs: string;\n let varyingFs: string;\n let texture2D: string;\n let output: string;\n let
defineOutput: string;\n let defineSpecialNaN: string;\n let defineSpecialInf: string;\n let defineRound: string;\n\n
if (env().getNumber('WEBGL_VERSION') === 2) {\n version = '#version 300 es';\n attribute = 'in';\n
varyingVs = 'out';\n varyingFs = 'in';\n texture2D = 'texture';\n output = 'outputColor';\n defineOutput = 'out
vec4 outputColor';\n\n // Use custom isnan definition to work across differences between\n // implementations
on various platforms. While this should happen in ANGLE\n // we still
see differences between android and windows (on chrome) when\n // using isnan directly.\n defineSpecialNaN
= `\n bool isnan_custom(float val) {\n return (val > 0.0 || val < 0.0) ? false : val !== 0.0;\n }\n\n bvec4
isnan_custom(vec4 val) {\n return bvec4(isnan_custom(val.x),\n isnan_custom(val.y),
isnan_custom(val.z), isnan_custom(val.w));\n }\n\n #define isnan(value) isnan_custom(value)\n `;\n // In
webgl 2 we do not need to specify a custom isinf so there is no\n // need for a special INFINITY constant.\n
defineSpecialInf = `;\n defineRound = `\n #define round(value) newRound(value)\n int newRound(float
value) {\n return int(floor(value + 0.5));\n }\n\n ivec4 newRound(vec4 value) {\n return
ivec4(floor(value + vec4(0.5)));\n }\n\n `;\n } else {\n version = ";\n attribute = 'attribute';\n varyingVs =
'varying';\n varyingFs = 'varying';\n texture2D = 'texture2D';\n

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 output = 'gl_FragColor';\n defineOutput = '';\n // WebGL1 has no built in isnan so we define one here.\n defineSpecialNaN = `\n #define isnan(value) isnan_custom(value)\n bool isnan_custom(float val) {\n return (val > 0. || val < 1. || val == 0.) ? false : true;\n }\n bvec4 isnan_custom(vec4 val) {\n return\n bvec4(isnan(val.x), isnan(val.y), isnan(val.z), isnan(val.w));\n }\n `;\n defineSpecialInf = `\n uniform float\n INFINITY;\n\n bool isinf(float val) {\n return abs(val) == INFINITY;\n }\n bvec4 isinf(vec4 val) {\n return equal(abs(val), vec4(INFINITY));\n }\n `;\n defineRound = `\n int round(float value) {\n return int(floor(value + 0.5));\n }\n\n ivec4 round(vec4 value) {\n return ivec4(floor(value +\n vec4(0.5)));\n }\n `;\n }\n\n return {\n version,\n attribute,\n varyingVs,\n varyingFs,\n texture2D,\n output,\n defineOutput,\n\n defineSpecialNaN,\n defineSpecialInf,\n defineRound\n };\n}\n", "/*\n * @license\n * Copyright 2018\n * Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you\n * may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * \n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\n * OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n * governing permissions and\n * limitations under the License.\n *
=====
/\n\nimport {util} from '@tensorflow/tfjs-core';\n\n/\n * Produces GLSL code that derives logical coordinates\n * from a flat\n * index. The code performs integer division with each stride and decrements\n * the index until the index equals the final dimension coordinate.\n */\n\nexport function\ngetLogicalCoordinatesFromFlatIndex(\n coords: string[], shape: number[], index = 'index'): string {\n const\n strides = util.computeStrides(shape);\n return strides\n .map((stride, i) => {\n const line1 = `int ${coords[i]}\n = ${index} / ${stride}`;\n const line2 = i === strides.length - 1 ?\n `int ${coords[i + 1]} = ${index} -\n ${coords[i]} * ${stride}` :\n `index -= ${coords[i]} * ${stride}`;\n return `${line1}; ${line2}`;\n })\n .join(");\n\n\nfunction buildVec(x: string[]): string {\n if (x.length === 1) {\n return `${x[0]}`;\n }\n return\n `vec${x.length}(${x.join(',')})`;\n}\n\n/*\n * Produces GLSL code that computes the dot product of the input x and\n * y\n * vectors. Handles splitting inputs into increments of vec4s when necessary.\n */\n\nexport function dotify(x:\nstring[], y: string[]): string {\n if (x.length !== y.length)\n {\n throw new Error(`\n Vectors to be dotted must be of the same length -\n ` +\n `got ${x.length} and\n ${y.length}`);\n }\n\n const slices: string[] = [];\n const nearestVec4 = Math.floor(x.length / 4);\n const\n nearestVec4Remainder = x.length % 4;\n\n for (let i = 0; i < nearestVec4; i++) {\n const xSlice = x.slice(i * 4, i *\n 4 + 4);\n const ySlice = y.slice(i * 4, i * 4 + 4);\n slices.push(`${buildVec(xSlice)}, ${buildVec(ySlice)}`);\n }\n\n if (nearestVec4Remainder !== 0) {\n let xSlice = x.slice(nearestVec4 * 4);\n let ySlice =\n y.slice(nearestVec4 * 4);\n if (xSlice.length === 1) {\n xSlice = xSlice.map(d => `float(${d})`);\n ySlice =\n ySlice.map(d => `float(${d})`);\n }\n slices.push(`${buildVec(xSlice)}, ${buildVec(ySlice)}`);\n }\n\n return\n slices.map((d, i) => `dot(${d})`).join('+');\n}\n\n/*\n * Produces GLSL that computes the flat index from 3D\n * coordinates.\n */\n\nexport function getFlatIndexFrom3D(shape: [number, number,\nnumber]): string {\n const strides = util.computeStrides(shape).map(d => d.toString());\n\n return `\n int\n getFlatIndex(ivec3 coords) {\n return coords.x * ${strides[0]} + coords.y * ${strides[1]} + coords.z;\n }\n `;\n}\n\nexport const ENCODE_FLOAT_SNIPPET = `\n const float FLOAT_MAX = 1.70141184e38;\n const\n float FLOAT_MIN = 1.17549435e-38;\n\n lowp vec4 encode_float(highp float v) {\n if (isnan(v)) {\n return\n vec4(255, 255, 255, 255);\n }\n\n highp float av = abs(v);\n\n if (av < FLOAT_MIN) {\n return vec4(0.0,\n 0.0, 0.0, 0.0);\n }\n else if (v > FLOAT_MAX) {\n return vec4(0.0, 0.0, 128.0, 127.0) / 255.0;\n }\n else if (v < -\n FLOAT_MAX) {\n return vec4(0.0, 0.0, 128.0, 255.0) / 255.0;\n }\n\n highp vec4 c = vec4(0.0, 0.0, 0.0);\n\n highp float e = floor(log2(av));\n highp float m = exp2(fract(log2(av))) - 1.0;\n\n c[2] = floor(128.0 * m);\n m =\n = c[2] / 128.0;\n c[1] = floor(32768.0 * m);\n m -= c[1] / 32768.0;\n c[0] =\n floor(8388608.0 * m);\n\n highp float ebias = e + 127.0;\n c[3] = floor(ebias / 2.0);\n ebias -= c[3] * 2.0;\n c[2] += floor(ebias) * 128.0;\n\n c[3] += 128.0 * step(0.0, -v);\n\n return c / 255.0;\n }\n `;\n\n/*

```



and\n \* limitations under the License.\n \*

```
=====\n
*\n\nimport {getGlsIDifferences} from './gls_version';\nimport {GPGPUProgram} from './gpgpu_math';\nimport
{ENCODE_FLOAT_SNIPPET} from './shader_compiler_util';\nimport {TextureUsage} from './tex_util';\n\nexport
class EncodeFloatProgram implements GPGPUProgram {\n variableNames = ['A'];\n userCode: string;\n
outputShape: number[];\n outTexUsage = TextureUsage.DOWNLOAD;\n\n constructor(outputShape: number[])
{\n const glsl = getGlsIDifferences();\n this.outputShape = outputShape;\n this.userCode = `\n
${ENCODE_FLOAT_SNIPPET}\n\n void main() {\n float x = getAAtOutCoords();\n ${glsl.output} =
encode_float(x);\n }\n `;\n }\n}\n\n"/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n
 * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in
compliance
```

with the License.\n \* You may obtain a copy of the License at\n \* <http://www.apache.org/licenses/LICENSE-2.0>\n \* Unless required by applicable law or agreed to in writing, software\n \* distributed under the License is distributed on an "AS IS" BASIS,\n \* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*

```
=====\n
*\n\nimport {getGlsIDifferences} from './gls_version';\nimport {GPGPUProgram} from './gpgpu_math';\nimport
{ENCODE_FLOAT_SNIPPET} from './shader_compiler_util';\nimport {TextureUsage} from './tex_util';\n\nexport
class EncodeFloatPackedProgram implements GPGPUProgram {\n variableNames = ['A'];\n userCode: string;\n
outputShape: number[];\n packedInputs = true;\n packedOutput = false;\n outTexUsage =
TextureUsage.DOWNLOAD;\n\n constructor(outputShape:
[number, number, number]) {\n const glsl = getGlsIDifferences();\n this.outputShape = outputShape;\n
this.userCode = `\n ${ENCODE_FLOAT_SNIPPET}\n\n void main() {\n ivec3 coords =
getOutputCoords();\n float x = getChannel(getAAtOutCoords(), vec2(coords.y, coords.z));\n ${glsl.output}
= encode_float(x);\n }\n `;\n }\n}\n\n"/**\n * @license\n * Copyright 2018 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n
```

```
*
=====\n
*\n\nimport {getGlsIDifferences} from './gls_version';\nimport {GPGPUProgram} from './gpgpu_math';\nimport *
as shader_util from './shader_compiler_util';\n\nexport class EncodeMatrixProgram implements GPGPUProgram {\n
variableNames = ['A'];\n userCode: string;\n outputShape: number[];\n\n constructor(\n outputShape: [number,
number, number], texShape: [number, number],\n inputIsUnsignedByte = false) {\n const glsl =
getGlsIDifferences();\n const [height, width] = texShape;\n this.outputShape = outputShape;\n\n let output =
`result`;\n if (inputIsUnsignedByte) {\n output = `floor(result * 255. + 0.5)`;\n }\n\n this.userCode = `\n
${shader_util.getFlatIndexFrom3D(outputShape)}\n\n void main() {\n ivec3 coords =
getOutputCoords();\n\n int flatIndex = getFlatIndex(coords);\n int offset = imod(flatIndex, 4);\n\n flatIndex
= idiv(flatIndex, 4, 1);\n\n int r = flatIndex / ${width};\n int c = imod(flatIndex, ${width});\n vec2 uv
= (vec2(c, r) + halfCR) / vec2(${width}.0, ${height}.0);\n vec4 values = ${glsl.texture2D}(A, uv);\n\n float result;\n\n if(offset == 0) {\n result = values[0];\n } else if(offset == 1) {\n result =
values[1];\n } else if(offset == 2) {\n result = values[2];\n } else {\n result = values[3];\n }\n\n ${glsl.output} = vec4(${output}, 0., 0., 0.);\n }\n `;\n }\n}\n\n"/**\n * @license\n * Copyright 2018
Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you
```

may not use this file except in compliance with the License.\n \* You may obtain a copy of the License at\n \*\n \* <http://www.apache.org/licenses/LICENSE-2.0>\n \*\n \* Unless required by applicable law or agreed to in writing,  
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KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*

```
=====
*\n\nimport {getGlsIDifferences} from './gls_version';\nimport {GPGPUProgram} from './gpgpu_math';\nimport *
as shader_util from './shader_compiler_util';\n\n\nThis is how the shader encodes a tensor with shape = [2, 3,
5]\n(indices are [batch, row, col]).\n\n000|001 002|003 004|xxx 020|021 022|023 024|xxx\n-----\n---\n\n010|011 012|013 014|xxx xxx|xxx xxx|xxx\n\n100|101 102|103 104|xxx
120|121 122|123 124|xxx\n-----\n\n110|111 112|113 114|xxx xxx|xxx
xxx|xxx xxx|xxx\n\nSingle texels contain only values from the same batch, and from
adjacent rows\nand columns.\n\n\nexport class EncodeMatrixPackedProgram implements GPGPUProgram {\n variableNames = ['A'];\n userCode: string;\n outputShape: number[];\n packedInputs = false;\n packedOutput =
true;\n\n constructor(\n outputShape: [number, number, number], texShape: [number, number],\n inputIsUnsignedByte = false) {\n const glsl = getGlsIDifferences();\n const [height, width] = texShape;\n this.outputShape = outputShape;\n\n let mainLoop = `;\n let output = 'result';\n if (inputIsUnsignedByte) {\n output = 'floor(result * 255. + 0.5)';\n }\n\n for (let row = 0; row <= 1; row++) {\n for (let col = 0; col <= 1;
col++) {\n const channel = row * 2 + col;\n\n mainLoop += `\n localCoords = coords;\n if(localCoords[2] + ${col} < ${outputShape[2]}) {\n localCoords[2] += ${col};\n if(localCoords[1] +
${row} < ${outputShape[1]}) {\n localCoords[1] += ${row};\n\n flatIndex = getFlatIndex(localCoords);\n offset = imod(flatIndex, 4);\n\n flatIndex =
idiv(flatIndex, 4, 1.); \n r = flatIndex / ${width};\n c = imod(flatIndex, ${width});\n uv =
(vec2(c, r) + halfCR) / vec2(${width}.0, ${height}.0);\n values = ${glsl.texture2D}(A, uv);\n\n if(offset == 0) {\n result[${channel}] = values[0];\n } else if(offset == 1) {\n result[${channel}] = values[1];\n } else if(offset == 2) {\n result[${channel}] = values[2];\n } else {\n result[${channel}] = values[3];\n }\n }\n }\n }\n }\n\n this.userCode = `\n ${shader_util.getFlatIndexFrom3D(outputShape)}\n\n void main() {\n ivec3 coords =
getOutputCoords();\n vec4 result = vec4(0.); \n int flatIndex, r, c, offset;\n ivec3 localCoords;\n vec2 uv;\n vec4 values;\n\n ${mainLoop}\n\n ${glsl.output} = ${output};\n }\n `;\n}\n\n"/**\n * @license\n * Copyright 2017 Google LLC. All Rights Reserved.\n * Licensed under
the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n */\n=====
```

```
*\n\nimport {PixelData, TypedArray} from '@tensorflow/tfjs-core';\nimport {getGlsIDifferences} from
 './gls_version';\nimport
 * as tex_util from './tex_util';\nimport {TextureConfig} from './tex_util';\nimport * as webgl_util from
 './webgl_util';\n\n\nexport function createVertexShader(gl: WebGLRenderingContext): WebGLShader {\n const glsl =
getGlsIDifferences();\n const vertexShaderSource = `${glsl.version}\n precision highp float;\n ${glsl.attribute} vec3 clipSpacePos;\n ${glsl.attribute} vec2 uv;\n ${glsl.varyingVs} vec2 resultUV;\n\n void
main() {\n gl_Position = vec4(clipSpacePos, 1);\n resultUV = uv;\n };\n return
webgl_util.createVertexShader(gl, vertexShaderSource);\n}\n\n\nexport function createVertexBuffer(gl:
WebGLRenderingContext): WebGLBuffer {\n // [x y z u v] * [upper-left, lower-left, upper-right, lower-right]\n}
```



```

const vertexArray = new Float32Array(\n [-1, 1, 0, 0, 1, -1, -1, 0, 0, 0, 1, 1, 0, 1, 1, -1, 0, 1, 0]);\n return
webgl_util.createStaticVertexBuffer(gl, vertexArray);\n}\n\n\nexport function createIndexBuffer(gl:
WebGLRenderingContext): WebGLBuffer
{\n // OpenGL (and WebGL) have \"CCW == front\" winding\n const triangleVertexIndices = new
Uint16Array([0, 1, 2, 2, 1, 3]);\n return webgl_util.createStaticIndexBuffer(gl,
triangleVertexIndices);\n}\n\n\nfunction createAndConfigureTexture(\n gl: WebGLRenderingContext, width:
number, height: number,\n internalFormat: number, textureFormat: number,\n textureType: number):
WebGLTexture {\n webgl_util.validateTextureSize(width, height);\n const texture =
webgl_util.createTexture(gl);\n\n const tex2d = gl.TEXTURE_2D;\n webgl_util.callAndCheck(gl, () =>
gl.bindTexture(tex2d, texture));\n webgl_util.callAndCheck(\n gl, () => gl.texParameteri(tex2d,
gl.TEXTURE_WRAP_S, gl.CLAMP_TO_EDGE));\n webgl_util.callAndCheck(\n gl, () =>
gl.texParameteri(tex2d, gl.TEXTURE_WRAP_T, gl.CLAMP_TO_EDGE));\n webgl_util.callAndCheck(\n gl, ()
=> gl.texParameteri(tex2d, gl.TEXTURE_MIN_FILTER, gl.NEAREST));\n webgl_util.callAndCheck(\n gl, ()
=> gl.texParameteri(tex2d, gl.TEXTURE_MAG_FILTER,
gl.NEAREST));\n webgl_util.callAndCheck(\n gl,\n () => gl.texImage2D(\n tex2d, 0, internalFormat,
width, height, 0, textureFormat,\n textureType, null));\n webgl_util.callAndCheck(gl, () =>
gl.bindTexture(gl.TEXTURE_2D, null));\n return texture;\n}\n\n\nexport function
getInternalFormatForFloat32MatrixTexture(\n textureConfig: TextureConfig) {\n return
textureConfig.internalFormatFloat;\n}\n\n\nexport function createFloat32MatrixTexture(\n gl:
WebGLRenderingContext, rows: number, columns: number,\n textureConfig: TextureConfig): WebGLTexture {\n
const [width, height] =\n tex_util.getUnpackedMatrixTextureShapeWidthHeight(rows, columns);\n return
createAndConfigureTexture(\n gl, width, height,\n getInternalFormatForFloat32MatrixTexture(textureConfig),\n textureConfig.textureFormatFloat,
gl.FLOAT);\n}\n\n\nexport function getInternalFormatForFloat16MatrixTexture(\n textureConfig: TextureConfig)
{\n return textureConfig.internalFormatHalfFloat;\n}\n\n\nexport
function createFloat16MatrixTexture(\n gl: WebGLRenderingContext, rows: number, columns: number,\n textureConfig: TextureConfig): WebGLTexture {\n const [width, height] =\n tex_util.getUnpackedMatrixTextureShapeWidthHeight(rows, columns);\n return createAndConfigureTexture(\n
gl, width, height,\n getInternalFormatForFloat16MatrixTexture(textureConfig),\n textureConfig.textureFormatFloat, textureConfig.textureTypeHalfFloat);\n}\n\n\nexport function
getInternalFormatForUnsignedBytesMatrixTexture(\n textureConfig: TextureConfig) {\n return
textureConfig.downloadTextureFormat;\n}\n\n\nexport function createUnsignedBytesMatrixTexture(\n gl:
WebGLRenderingContext, rows: number, columns: number,\n textureConfig: TextureConfig): WebGLTexture {\n
const [width, height] =\n tex_util.getUnpackedMatrixTextureShapeWidthHeight(rows, columns);\n return
createAndConfigureTexture(\n gl, width, height,\n getInternalFormatForUnsignedBytesMatrixTexture(textureConfig),
gl.RGBA,\n gl.UNSIGNED_BYTE);\n}\n\n\nexport function getInternalFormatForPackedMatrixTexture(\n textureConfig: TextureConfig) {\n return textureConfig.internalFormatPackedFloat;\n}\n\n\nexport function
createPackedMatrixTexture(\n gl: WebGLRenderingContext, rows: number, columns: number,\n textureConfig:
TextureConfig): WebGLTexture {\n const [width, height] =\n tex_util.getPackedMatrixTextureShapeWidthHeight(rows, columns);\n return createAndConfigureTexture(\n gl,
width, height, getInternalFormatForPackedMatrixTexture(textureConfig),\n gl.RGBA, gl.FLOAT);\n}\n\n\nexport
function getInternalFormatForFloat16PackedMatrixTexture(\n textureConfig: TextureConfig) {\n return
textureConfig.internalFormatPackedHalfFloat;\n}\n\n\nexport function createFloat16PackedMatrixTexture(\n gl:
WebGLRenderingContext, rows: number, columns: number,\n textureConfig: TextureConfig): WebGLTexture {\n
const [width,
height] =\n tex_util.getPackedMatrixTextureShapeWidthHeight(rows, columns);\n return
createAndConfigureTexture(\n gl, width, height,\n

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getInternalFormatForFloat16PackedMatrixTexture(textureConfig), gl.RGBA,\n
textureConfig.textureTypeHalfFloat);\n}\n\nexport function bindVertexProgramAttributeStreams(\n gl:\n WebGLRenderingContext, program: WebGLProgram,\n vertexBuffer: WebGLBuffer): boolean {\n const\n posOffset = 0; // x is the first buffer element\n const uvOffset = 3 * 4; // uv comes after [x y z]\n const stride = (3 * 4) + (2 * 4); // xyz + uv, each entry is 4-byte float.\n webgl_util.callAndCheck(\n gl, () =>\n gl.bindBuffer(gl.ARRAY_BUFFER, vertexBuffer));\n const success =\n webgl_util.bindVertexBufferToProgramAttribute(\n gl, program, 'clipSpacePos', vertexBuffer, 3, stride,\n posOffset);\n return success &&\n webgl_util.bindVertexBufferToProgramAttribute(\n gl, program, 'uv',\n vertexBuffer, 2, stride, uvOffset);\n}\n\nexport\nfunction uploadDenseMatrixToTexture(\n gl: WebGLRenderingContext, texture: WebGLTexture, width:\n number,\n height: number, data: TypedArray, textureConfig: TextureConfig) {\n webgl_util.callAndCheck(gl, ()\n => gl.bindTexture(gl.TEXTURE_2D, texture));\n let dataForUpload: TypedArray, texelDataType: number,\n internalFormat: number;\n if (data instanceof Uint8Array) {\n dataForUpload = new Uint8Array(width * height *\n 4);\n texelDataType = gl.UNSIGNED_BYTE;\n internalFormat = gl.RGBA;\n } else {\n dataForUpload =\n new Float32Array(width * height * 4);\n texelDataType = gl.FLOAT;\n internalFormat =\n textureConfig.internalFormatPackedFloat;\n }\n dataForUpload.set(data);\n webgl_util.callAndCheck(\n gl,\n () => gl.texImage2D(\n gl.TEXTURE_2D, 0, internalFormat, width, height, 0, gl.RGBA,\n texelDataType, dataForUpload));\n webgl_util.callAndCheck(gl, () => gl.bindTexture(gl.TEXTURE_2D,\n null));\n}\n\nexport function\nuploadPixelDataToTexture(\n gl: WebGLRenderingContext, texture: WebGLTexture,\n pixels:\n PixelData|ImageData|HTMLImageElement|HTMLCanvasElement|\n HTMLVideoElement) {\n webgl_util.callAndCheck(gl, () => gl.bindTexture(gl.TEXTURE_2D, texture));\n if ((pixels as PixelData).data\n instanceof Uint8Array) {\n webgl_util.callAndCheck(\n gl,\n () => gl.texImage2D(\n gl.TEXTURE_2D, 0, gl.RGBA, pixels.width, pixels.height, 0, gl.RGBA,\n gl.UNSIGNED_BYTE, (pixels as\n PixelData).data));\n } else {\n webgl_util.callAndCheck(\n gl,\n () => gl.texImage2D(\n gl.TEXTURE_2D, 0, gl.RGBA, gl.RGBA, gl.UNSIGNED_BYTE,\n pixels as ImageData |\n HTMLImageElement | HTMLCanvasElement | HTMLVideoElement));\n }\n webgl_util.callAndCheck(gl, () => gl.bindTexture(gl.TEXTURE_2D, null));\n}\n\nexport function\ncreateBufferFromOutputTexture(\n gl2: WebGL2RenderingContext, rows: number, columns: number,\n textureConfig: TextureConfig): WebGLBuffer {\n // Create and bind the buffer.\n const buffer =\n gl2.createBuffer();\n webgl_util.callAndCheck(\n gl2, () => gl2.bindBuffer(gl2.PIXEL_PACK_BUFFER,\n buffer));\n // Initialize the buffer to the size of the texture in bytes.\n const bytesPerFloat = 4;\n const\n valuesPerTexel = 4;\n const bufferSizeBytes = bytesPerFloat * valuesPerTexel * rows * columns;\n webgl_util.callAndCheck(\n gl2,\n () => gl2.bufferData(\n gl2.PIXEL_PACK_BUFFER,\n bufferSizeBytes, gl2.STREAM_READ));\n // Enqueue a command on the GPU command queue to copy of\n texture into the\n // buffer.\n webgl_util.callAndCheck(\n gl2, () => gl2.readPixels(0, 0, columns, rows,\n gl2.RGBA, gl2.FLOAT, 0));\n webgl_util.callAndCheck(\n gl2, () =>\n gl2.bindBuffer(gl2.PIXEL_PACK_BUFFER, null));\n return buffer;\n}\n\nexport function\ndownloadFloat32MatrixFromBuffer(\n gl: WebGLRenderingContext, buffer: WebGLBuffer,\n size: number):\n Float32Array\n{\n const gl2 = gl as WebGL2RenderingContext;\n const downloadTarget = new Float32Array(size);\n gl2.bindBuffer(gl2.PIXEL_PACK_BUFFER, buffer);\n gl2.getBufferSubData(gl2.PIXEL_PACK_BUFFER, 0,\n downloadTarget);\n gl2.bindBuffer(gl2.PIXEL_PACK_BUFFER, null);\n return downloadTarget;\n}\n\nexport\nfunction downloadByteEncodedFloatMatrixFromOutputTexture(\n gl: WebGLRenderingContext, rows: number,\n columns: number,\n textureConfig: TextureConfig) {\n const [w, h] =\n tex_util.getUnpackedMatrixTextureShapeWidthHeight(rows, columns);\n const numChannels = 4;\n const\n downloadTarget = new Uint8Array(\n tex_util.getUnpackedArraySizeFromMatrixSize(rows * columns,\n numChannels));\n webgl_util.callAndCheck(\n gl,\n () => gl.readPixels(\n 0, 0, w, h,

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textureConfig.downloadTextureFormat, gl.UNSIGNED_BYTE,\n downloadTarget));\n\n // By wrapping the
buffer in a Float32Array, we use native browser IEEE 754\n // decoding of the 4 bytes
that back each 32 bit float.\n return new Float32Array(downloadTarget.buffer);\n}\n\n\nexport function
downloadPackedMatrixFromBuffer(\n gl: WebGLRenderingContext, buffer: WebGLBuffer, batch: number, rows:
number,\n cols: number, physicalRows: number, physicalCols: number,\n textureConfig: TextureConfig):
Float32Array {\n const gl2 = gl as WebGL2RenderingContext;\n\n const downloadTarget =\n new
Float32Array(tex_util.getPackedRGBAArraySizeFromMatrixShape(\n physicalRows, physicalCols));\n\n
gl2.bindBuffer(gl2.PIXEL_PACK_BUFFER, buffer);\n gl2.getBufferSubData(gl2.PIXEL_PACK_BUFFER, 0,
downloadTarget);\n gl2.bindBuffer(gl2.PIXEL_PACK_BUFFER, null);\n\n return downloadTarget;\n}\n\n\nexport
function downloadMatrixFromPackedOutputTexture(\n gl: WebGLRenderingContext, physicalRows: number,\n
physicalCols: number): Float32Array {\n const packedRGBA = new Float32Array(physicalRows * physicalCols *
4);\n webgl_util.callAndCheck(\n gl,\n () => gl.readPixels(\n
0, 0, physicalCols, physicalRows, gl.RGBA, gl.FLOAT, packedRGBA));\n\n return
packedRGBA;\n}\n\n", "/*\n * @license\n * Copyright 2017 Google LLC. All Rights Reserved.\n * Licensed under
the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n */
=====
*\n\nimport {env, PixelData, TypedArray, util} from '@tensorflow/tfjs-core';\nimport {getWebGLContext,
setWebGLContext} from './canvas_util';\nimport * as
gpgpu_util from './gpgpu_util';\nimport * as tex_util from './tex_util';\nimport {TextureConfig} from
'./tex_util';\nimport {WebGL1DisjointQueryTimerExtension, WebGL2DisjointQueryTimerExtension} from
'./webgl_types';\nimport * as webgl_util from './webgl_util';\n\nexport interface FenceContext {\n query:
WebGLQuery|WebGLSync;\n isFencePassed(): boolean;\n}\n\nexport class GPGPUContext {\n gl:
WebGLRenderingContext;\n textureFloatExtension: {};\n textureHalfFloatExtension: {};\n
colorBufferFloatExtension: {};\n colorBufferHalfFloatExtension: {};\n disjointQueryTimerExtension:
WebGL2DisjointQueryTimerExtension|\n WebGL1DisjointQueryTimerExtension;\n vertexBuffer:
WebGLBuffer;\n indexBuffer: WebGLBuffer;\n framebuffer: WebGLFramebuffer;\n outputTexture:
WebGLTexture|null = null;\n program: WebGLProgram|null = null;\n private disposed = false;\n private disjoint:
boolean;\n textureConfig: TextureConfig;\n\n constructor(gl?: WebGLRenderingContext) {\n const glVersion
= env().getNumber('WEBGL_VERSION');\n if (gl != null) {\n this.gl = gl;\n setWebGLContext(glVersion,
gl);\n } else {\n this.gl = getWebGLContext(glVersion);\n }\n // WebGL 2.0 enables texture floats without
an extension.\n let COLOR_BUFFER_FLOAT = 'WEBGL_color_buffer_float';\n const
COLOR_BUFFER_HALF_FLOAT = 'EXT_color_buffer_half_float';\n if
(env().getNumber('WEBGL_VERSION') === 1) {\n const TEXTURE_FLOAT = 'OES_texture_float';\n
const TEXTURE_HALF_FLOAT = 'OES_texture_half_float';\n this.textureFloatExtension =\n
webgl_util.getExtensionOrThrow(this.gl, TEXTURE_FLOAT);\n if (webgl_util.hasExtension(this.gl,
TEXTURE_HALF_FLOAT)) {\n this.textureHalfFloatExtension =\n
webgl_util.getExtensionOrThrow(this.gl, TEXTURE_HALF_FLOAT);\n } else if
(env().get('WEBGL_FORCE_F16_TEXTURES')) {\n throw new Error(\n 'GL context does not support
half float textures, yet the ' +\n 'environment
flag WEBGL_FORCE_F16_TEXTURES is set to true.);\n }\n this.colorBufferFloatExtension =
this.gl.getExtension(COLOR_BUFFER_FLOAT);\n if (webgl_util.hasExtension(this.gl,
COLOR_BUFFER_HALF_FLOAT)) {\n this.colorBufferHalfFloatExtension =\n
webgl_util.getExtensionOrThrow(this.gl, COLOR_BUFFER_HALF_FLOAT);\n } else if

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(env().get('WEBGL_FORCE_F16_TEXTURES')) {\n throw new Error(\n 'GL context does not support
color renderable half floats, yet ' +\n 'the environment flag WEBGL_FORCE_F16_TEXTURES is set to
true.);\n }\n } else {\n COLOR_BUFFER_FLOAT = 'EXT_color_buffer_float';\n if
(webgl_util.hasExtension(this.gl, COLOR_BUFFER_FLOAT)) {\n this.colorBufferFloatExtension =\nthis.gl.getExtension(COLOR_BUFFER_FLOAT);\n } else if (webgl_util.hasExtension(this.gl,
COLOR_BUFFER_HALF_FLOAT)) {\n this.colorBufferHalfFloatExtension =\nthis.gl.getExtension(COLOR_BUFFER_HALF_FLOAT);\n } else {\n throw new Error('GL context does not support color renderable floats');\n }\n }\n\n this.vertexBuffer = gpgpu_util.createVertexBuffer(this.gl);\n this.indexBuffer =
gpgpu_util.createIndexBuffer(this.gl);\n this.framebuffer = webgl_util.createFramebuffer(this.gl);\n\n this.textureConfig =\n tex_util.getTextureConfig(this.gl, this.textureHalfFloatExtension);\n }\n\n private get
debug(): boolean {\n return env().getBool('DEBUG');\n }\n\n public dispose() {\n if (this.disposed) {\n
return;\n }\n if (this.program != null) {\n console.warn(\n 'Disposing a GPGPUContext that still has a
bound WebGLProgram.' +\n ' This is probably a resource leak, delete the program with ' +\n
'GPGPUContext.deleteProgram before disposing.);\n }\n if (this.outputTexture != null) {\n console.warn(\n
'Disposing a GPGPUContext that still has a bound output matrix ' +\n
'texture. This is probably a resource leak, delete the output ' +\n
'matrix texture with
GPGPUContext.deleteMatrixTexture before ' +\n
'disposing.);\n }\n const gl = this.gl;\n webgl_util.callAndCheck(gl, () => gl.finish());\n webgl_util.callAndCheck(gl, () =>
gl.bindFramebuffer(gl.FRAMEBUFFER, null));\n webgl_util.callAndCheck(gl, () =>
gl.deleteFramebuffer(this.framebuffer));\n webgl_util.callAndCheck(gl, () =>
gl.bindBuffer(gl.ARRAY_BUFFER, null));\n webgl_util.callAndCheck(\n gl, () =>
gl.bindBuffer(gl.ELEMENT_ARRAY_BUFFER, null));\n webgl_util.callAndCheck(gl, () =>
gl.deleteBuffer(this.indexBuffer));\n this.disposed = true;\n }\n\n public createFloat32MatrixTexture(rows:
number, columns: number):\n WebGLTexture {\n this.throwIfDisposed();\n return
gpgpu_util.createFloat32MatrixTexture(\n this.gl, rows, columns, this.textureConfig);\n }\n\n public
createFloat16MatrixTexture(rows: number, columns: number):\n WebGLTexture {\n this.throwIfDisposed();\n return
gpgpu_util.createFloat16MatrixTexture(\n this.gl, rows, columns, this.textureConfig);\n }\n\n public createUnsignedBytesMatrixTexture(rows: number, columns:
number):\n WebGLTexture {\n this.throwIfDisposed();\n return
gpgpu_util.createUnsignedBytesMatrixTexture(\n this.gl, rows, columns, this.textureConfig);\n }\n\n public
uploadPixelDataToTexture(\n texture: WebGLTexture,\n pixels:
PixelData|ImageData|HTMLImageElement|HTMLCanvasElement) {\n this.throwIfDisposed();\n gpgpu_util.uploadPixelDataToTexture(this.gl, texture, pixels);\n }\n\n public uploadDenseMatrixToTexture(\n
texture: WebGLTexture, width: number, height: number, data: TypedArray) {\n this.throwIfDisposed();\n gpgpu_util.uploadDenseMatrixToTexture(\n this.gl, texture, width, height, data, this.textureConfig);\n }\n\n public createFloat16PackedMatrixTexture(rows: number, columns: number):\n WebGLTexture {\n this.throwIfDisposed();\n return
gpgpu_util.createFloat16PackedMatrixTexture(\n this.gl, rows, columns, this.textureConfig);\n }\n\n public createPackedMatrixTexture(rows: number, columns:
number):\n WebGLTexture {\n this.throwIfDisposed();\n return
gpgpu_util.createPackedMatrixTexture(\n this.gl, rows, columns, this.textureConfig);\n }\n\n public deleteMatrixTexture(texture: WebGLTexture) {\n this.throwIfDisposed();\n if (this.outputTexture === texture) {\n
webgl_util.unbindColorTextureFromFramebuffer(this.gl, this.framebuffer);\n this.outputTexture = null;\n }\n webgl_util.callAndCheck(this.gl, () => this.gl.deleteTexture(texture));\n }\n\n public
downloadByteEncodedFloatMatrixFromOutputTexture(\n texture: WebGLTexture, rows: number, columns:
number): Float32Array {\n return this.downloadMatrixDriver(\n texture,\n () =>
gpgpu_util.downloadByteEncodedFloatMatrixFromOutputTexture(\n

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 this.gl, rows, columns, this.textureConfig));\n } \n\n public downloadPackedMatrixFromBuffer(\n buffer:
WebGLBuffer, batch: number, rows: number, columns: number,\n physicalRows: number, physicalCols:
number): Float32Array {\n return gpgpu_util.downloadPackedMatrixFromBuffer(\n this.gl, buffer, batch,
rows, columns, physicalRows, physicalCols,\n this.textureConfig);\n } \n\n public
downloadFloat32MatrixFromBuffer(buffer: WebGLBuffer, size: number):\n Float32Array {\n return
gpgpu_util.downloadFloat32MatrixFromBuffer(this.gl, buffer, size);\n } \n\n public createBufferFromTexture(\n
texture: WebGLTexture, rows: number, columns: number): WebGLBuffer {\n
this.bindTextureToFrameBuffer(texture);\n const result = gpgpu_util.createBufferFromOutputTexture(\n
this.gl as WebGL2RenderingContext, rows, columns, this.textureConfig);\n
this.unbindTextureToFrameBuffer();\n return result;\n } \n\n public createAndWaitForFence():
Promise<void> {\n const fenceContext = this.createFence(this.gl);\n return this.pollFence(fenceContext);\n
} \n\n private createFence(gl: WebGLRenderingContext): FenceContext {\n let query:
WebGLQuery|WebGLSync;\n let isFencePassed: () => boolean;\n\n if
(env().getBool('WEBGL_FENCE_API_ENABLED')) {\n const gl2 = gl as WebGL2RenderingContext;\n\n const sync = gl2.fenceSync(gl2.SYNC_GPU_COMMANDS_COMPLETE, 0);\n gl.flush();\n\n isFencePassed = () => {\n const status = gl2.clientWaitSync(sync, 0, 0);\n return status ===
gl2.ALREADY_SIGNALED ||\n status === gl2.CONDITION_SATISFIED;\n };\n\n query = sync;\n } else if (\n env().getNumber('WEBGL_DISJOINT_QUERY_TIMER_EXTENSION_VERSION') > 0) {\n
query = this.beginQuery();\n this.endQuery();\n isFencePassed = () => this.isQueryAvailable(\n query,\n env().getNumber('WEBGL_DISJOINT_QUERY_TIMER_EXTENSION_VERSION'));\n } else {\n
// If we have no way to fence, return true immediately. This will fire in\n // WebGL 1.0 when there is no
disjoint query timer. In this case, because\n // the fence passes immediately, we'll immediately ask for a
download of\n // the texture, which will cause the UI thread to hang.\n isFencePassed = () => true;\n } \n\n
return {query, isFencePassed};\n } \n\n public downloadMatrixFromPackedTexture(\n texture: WebGLTexture,
physicalRows: number,\n physicalCols: number): Float32Array {\n return this.downloadMatrixDriver(\n
texture,\n () => gpgpu_util.downloadMatrixFromPackedOutputTexture(\n this.gl, physicalRows,
physicalCols));\n } \n\n private vertexAttrsAreBound = false;\n\n public createProgram(fragmentShaderSource:
string): WebGLProgram {\n this.throwIfDisposed();\n const gl = this.gl;\n const fragmentShader:
WebGLShader =\n webgl_util.createFragmentShader(gl, fragmentShaderSource);\n const vertexShader:
WebGLShader = gpgpu_util.createVertexShader(gl);\n const program: WebGLProgram =
webgl_util.createProgram(gl);\n webgl_util.callAndCheck(gl, () => gl.attachShader(program, vertexShader));\n
webgl_util.callAndCheck(gl, () => gl.attachShader(program, fragmentShader));\n webgl_util.linkProgram(gl,
program);\n if (this.debug) {\n webgl_util.validateProgram(gl, program);\n } \n if
(!this.vertexAttrsAreBound) {\n this.setProgram(program);\n this.vertexAttrsAreBound =
gpgpu_util.bindVertexProgramAttributeStreams(\n gl, this.program, this.vertexBuffer);\n } \n return
program;\n } \n\n public deleteProgram(program: WebGLProgram) {\n this.throwIfDisposed();\n if (program
=== this.program) {\n this.program = null;\n } \n if (program != null) {\n webgl_util.callAndCheck(this.gl,
() => this.gl.deleteProgram(program));\n } \n } \n\n public setProgram(program: WebGLProgram|null) {\n
this.throwIfDisposed();\n this.program
= program;\n if (((this.program != null) && this.debug) {\n webgl_util.validateProgram(this.gl,
this.program);\n } \n webgl_util.callAndCheck(this.gl, () => this.gl.useProgram(program));\n } \n\n public
getUniformLocation(\n program: WebGLProgram, uniformName: string,\n shouldThrow = true):
WebGLUniformLocation {\n this.throwIfDisposed();\n if (shouldThrow) {\n return
webgl_util.getProgramUniformLocationOrThrow(\n this.gl, program, uniformName);\n } else {\n return
webgl_util.getProgramUniformLocation(\n this.gl, program, uniformName);\n } \n } \n\n public
getAttributeLocation(program: WebGLProgram, attribute: string):\n number {\n this.throwIfDisposed();\n
return webgl_util.callAndCheck(\n this.gl, () => this.gl.getAttribLocation(program, attribute));\n } \n\n public
getUniformLocationNoThrow(program: WebGLProgram, uniformName: string):\n WebGLUniformLocation {\n

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this.throwIfDisposed();\n
return this.gl.getUniformLocation(program, uniformName);\n }\n\n public setInputMatrixTexture(\n
inputMatrixTexture: WebGLTexture, uniformLocation: WebGLUniformLocation,\n textureUnit: number) {\n
this.throwIfDisposed();\n this.throwIfNoProgram();\n webgl_util.bindTextureToProgramUniformSampler(\n
this.gl, inputMatrixTexture, uniformLocation, textureUnit);\n }\n\n public setOutputMatrixTexture(\n
outputMatrixTexture: WebGLTexture, rows: number, columns: number) {\n
this.setOutputMatrixTextureDriver(outputMatrixTexture, columns, rows);\n }\n\n public
setOutputPackedMatrixTexture(\n outputPackedMatrixTexture: WebGLTexture, rows: number, columns:
number) {\n this.throwIfDisposed();\n const [width, height] =\n
tex_util.getPackedMatrixTextureShapeWidthHeight(rows, columns);\n
this.setOutputMatrixTextureDriver(outputPackedMatrixTexture, width, height);\n }\n\n public
setOutputMatrixWriteRegion(\n startRow: number, numRows:
number, startColumn: number,\n numColumns: number) {\n this.setOutputMatrixWriteRegionDriver(\n
startColumn, startRow, numColumns, numRows);\n }\n\n public setOutputPackedMatrixWriteRegion(\n
startRow: number, numRows: number, startColumn: number,\n numColumns: number) {\n throw new
Error('setOutputPackedMatrixWriteRegion not implemented.);\n }\n\n public debugValidate() {\n if
(this.program != null) {\n webgl_util.validateProgram(this.gl, this.program);\n }\n
webgl_util.validateFramebuffer(this.gl);\n }\n\n public executeProgram() {\n this.throwIfDisposed();\n
this.throwIfNoProgram();\n const gl = this.gl;\n if (this.debug) {\n this.debugValidate();\n }\n
webgl_util.callAndCheck(\n gl, () => gl.drawElements(gl.TRIANGLES, 6, gl.UNSIGNED_SHORT, 0));\n
}\n\n public blockUntilAllProgramsCompleted() {\n this.throwIfDisposed();\n webgl_util.callAndCheck(this.gl,
() => this.gl.finish());\n }\n\n private
getQueryTimerExtension(): WebGL1DisjointQueryTimerExtension | WebGL2DisjointQueryTimerExtension
{\n if (this.disjointQueryTimerExtension == null) {\n this.disjointQueryTimerExtension =\n
webgl_util.getExtensionOrThrow(\n this.gl,\n env().getNumber(\n
'WEBGL_DISJOINT_QUERY_TIMER_EXTENSION_VERSION') === 2 ?\n
'EXT_disjoint_timer_query_webgl2' :\n 'EXT_disjoint_timer_query') as\n
WebGL1DisjointQueryTimerExtension | WebGL2DisjointQueryTimerExtension;\n }\n return
this.disjointQueryTimerExtension;\n }\n\n private getQueryTimerExtensionWebGL2():
WebGL2DisjointQueryTimerExtension {\n return this.getQueryTimerExtension();\n }\n\n private
getQueryTimerExtensionWebGL1(): WebGL1DisjointQueryTimerExtension {\n return
this.getQueryTimerExtension() as WebGL1DisjointQueryTimerExtension;\n }\n\n beginQuery(): WebGLQuery
{\n if (env().getNumber('WEBGL_DISJOINT_QUERY_TIMER_EXTENSION_VERSION')
=== 2) {\n const gl2 = this.gl as WebGL2RenderingContext;\n const ext =
this.getQueryTimerExtensionWebGL2();\n\n const query = gl2.createQuery();\n
gl2.beginQuery(ext.TIME_ELAPSED_EXT, query);\n return query;\n }\n const ext =
this.getQueryTimerExtensionWebGL1();\n const query = ext.createQueryEXT() as WebGLQuery;\n
ext.beginQueryEXT(ext.TIME_ELAPSED_EXT, query);\n return query;\n }\n\n endQuery() {\n if
(env().getNumber('WEBGL_DISJOINT_QUERY_TIMER_EXTENSION_VERSION') === 2) {\n const gl2 =
this.gl as WebGL2RenderingContext;\n const ext = this.getQueryTimerExtensionWebGL2();\n
gl2.endQuery(ext.TIME_ELAPSED_EXT);\n return;\n }\n const ext =
this.getQueryTimerExtensionWebGL1();\n ext.endQueryEXT(ext.TIME_ELAPSED_EXT);\n }\n\n public async
waitForQueryAndGetTime(query: WebGLQuery): Promise<number> {\n await util.repeatedTry(\n () =>
this.disposed || // while testing
contexts are created / disposed\n // in rapid succession, so without this check we\n
// may poll for the query timer indefinitely\n this.isQueryAvailable(\n query,\n
env().getNumber(\n 'WEBGL_DISJOINT_QUERY_TIMER_EXTENSION_VERSION')));\n return
this.getQueryTime(\n query,

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env().getNumber('WEBGL_DISJOINT_QUERY_TIMER_EXTENSION_VERSION'));\n }\n\n private
getQueryTime(query: WebGLQuery, queryTimerVersion: number): number {\n if (queryTimerVersion === 0) {\n return null;\n }\n if (queryTimerVersion === 2) {\n const gl2 = this.gl as WebGL2RenderingContext;\n const timeElapsedNanos = gl2.getQueryParameter(query, gl2.QUERY_RESULT);\n // Return milliseconds.\n return timeElapsedNanos / 1000000;\n } else {\n const ext = this.getQueryTimerExtensionWebGL1();\n const timeElapsedNanos =\n ext.getQueryObjectEXT(query,\n ext.QUERY_RESULT_EXT);\n // Return milliseconds.\n return timeElapsedNanos / 1000000;\n }\n }\n\n private isQueryAvailable(query: WebGLQuery, queryTimerVersion: number):\n boolean {\n if (queryTimerVersion === 0) {\n return true;\n }\n if (queryTimerVersion === 2) {\n const gl2 = this.gl\nas WebGL2RenderingContext;\n const ext = this.getQueryTimerExtensionWebGL2();\n const available =\n gl2.getQueryParameter(query, gl2.QUERY_RESULT_AVAILABLE);\n if (this.disjoint == null) {\n this.disjoint = this.gl.getParameter(ext.GPU_DISJOINT_EXT);\n }\n return available && !this.disjoint;\n } else {\n const ext = this.getQueryTimerExtensionWebGL1();\n const available =\n ext.getQueryObjectEXT(query, ext.QUERY_RESULT_AVAILABLE_EXT);\n if (this.disjoint == null) {\n this.disjoint = this.gl.getParameter(ext.GPU_DISJOINT_EXT);\n }\n return available && !this.disjoint;\n }\n }\n\n pollFence(fenceContext: FenceContext) {\n return new Promise<void>(resolve => {\n this.addItemToPoll(() => fenceContext.isFencePassed(), () => resolve());\n });\n }\n\n private itemsToPoll:\n PollItem[] = [];\n\n pollItems(): void {\n // Find the last query that has finished.\n const index =\nlinearSearchLastTrue(this.itemsToPoll.map(x => x.isDoneFn));\n for (let i = 0; i <= index; ++i) {\n const {resolveFn} = this.itemsToPoll[i];\n resolveFn();\n }\n this.itemsToPoll = this.itemsToPoll.slice(index + 1);\n }\n\n private addItemToPoll(isDoneFn: () => boolean, resolveFn: () => void) {\n this.itemsToPoll.push({isDoneFn, resolveFn});\n if (this.itemsToPoll.length > 1) {\n // We already have a running loop that polls.\n return;\n }\n // Start a new loop that polls.\n util.repeatedTry(() => {\n this.pollItems();\n // End the loop if no more items to poll.\n return this.itemsToPoll.length === 0;\n });\n }\n\n private bindTextureToFramebuffer(texture: WebGLTexture) {\n this.throwIfDisposed();\n webgl_util.bindColorTextureToFramebuffer(\n this.gl, texture, this.framebuffer);\n if (this.debug) {\n webgl_util.validateFramebuffer(this.gl);\n }\n }\n\n private unbindTextureToFramebuffer() {\n if (this.outputTexture != null) {\n webgl_util.bindColorTextureToFramebuffer(\n this.gl, this.outputTexture, this.framebuffer);\n if (this.debug) {\n webgl_util.validateFramebuffer(this.gl);\n }\n } else {\n webgl_util.unbindColorTextureFromFramebuffer(this.gl, this.framebuffer);\n }\n }\n\n private downloadMatrixDriver(\n texture: WebGLTexture,\n downloadAndDecode: () => Float32Array): Float32Array {\n this.bindTextureToFramebuffer(texture);\n const result = downloadAndDecode();\n this.unbindTextureToFramebuffer();\n return result;\n }\n\n private setOutputMatrixTextureDriver(\n outputMatrixTextureMaybePacked:\n WebGLTexture, width: number,\n height: number) {\n this.throwIfDisposed();\n const gl = this.gl;\n webgl_util.bindColorTextureToFramebuffer(\n gl, outputMatrixTextureMaybePacked, this.framebuffer);\n if (this.debug) {\n webgl_util.validateFramebuffer(gl);\n }\n this.outputTexture =\noutputMatrixTextureMaybePacked;\n webgl_util.callAndCheck(gl, () => gl.viewport(0, 0, width, height));\n webgl_util.callAndCheck(gl, () => gl.scissor(0, 0, width, height));\n }\n\n private setOutputMatrixWriteRegionDriver(\n x: number, y: number, width: number, height: number) {\n this.throwIfDisposed();\n webgl_util.callAndCheck(\n this.gl, () => this.gl.scissor(x, y, width, height));\n }\n\n private throwIfDisposed() {\n if (this.disposed) {\n throw new Error('Attempted to use disposed GPGPUContext.');\n }\n }\n\n private throwIfNoProgram() {\n if (this.program == null) {\n throw new Error('No GPU program is currently set.');\n }\n }\n\n }\n\n ntype PollItem = {\n isDoneFn: () => boolean,\n resolveFn: () => void\n};\n\n /** Finds the index of the last true element using linear search.\n * Note: We can't do binary search because Chrome expects us to explicitly\n * test all fences before download.\n */\nexport function linearSearchLastTrue(arr: Array<() =>
```

boolean>): number {\n let i = 0;\n for (; i < arr.length; ++i) {\n const isDone = arr[i]();\n if (!isDone) {\n break;\n }\n }\n return i - 1;\n}\n"/\*\*\n \* @license\n \* Copyright 2017 Google LLC. All Rights Reserved.\n \* Licensed under the Apache License, Version 2.0 (the "License");\n \* you may not use this file except in\n \* compliance with the License.\n \* You may obtain a copy of the License at\n \* \n \* http://www.apache.org/licenses/LICENSE-2.0\n \* Unless required by applicable law or agreed to in writing,\n \* software\n \* distributed under the License

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=====\n*\n\nimport {backend_util, util} from '@tensorflow/tfjs-core';\nconst {getBroadcastDims} = backend_util;\nimport {getGlsldifferences, GLSL} from './glsld_version';\nimport * as shader_util from './shader_compiler_util';\n\nexport type ShapeInfo = {\n logicalShape: number[],\n texShape: [number, number],\n isUniform: boolean,\n isPacked: boolean,\n flatOffset: number\n};\n\nexport type InputInfo = {\n name: string,\n shapeInfo: ShapeInfo\n};\n\nexport function makeShader(\n inputsInfo: InputInfo[],\n outputShape: ShapeInfo,\n userCode: string,\n usesPackedTextures: boolean): string {\n const prefixSnippets: string[] = [];\n inputsInfo.forEach(x => {\n const size = util.sizeFromShape(x.shapeInfo.logicalShape);\n\n // Snippet when we decided to upload the values as uniform.\n if (x.shapeInfo.isUniform) {\n prefixSnippets.push(\n `uniform float ${x.name}${size > 1 ? `[${size}]` : ''};`);\n } else {\n prefixSnippets.push(`uniform sampler2D ${x.name};`);\n prefixSnippets.push(`uniform int offset${x.name};`);\n }\n });\n const inputPrefixSnippet = prefixSnippets.join("\\n");\n const inputSamplingSnippet =\n inputsInfo\n .map(x => getInputSamplingSnippet(x, outputShape, usesPackedTextures))\n .join("\\n");\n const outTexShape = outputShape.texShape;\n const glsl = getGlsldifferences();\n const\n floatTextureSampleSnippet = getFloatTextureSampleSnippet(glsl);\n let outputSamplingSnippet: string;\n let\n floatTextureSetOutputSnippet: string;\n let shaderPrefix = getShaderPrefix(glsl);\n if (outputShape.isPacked) {\n outputSamplingSnippet =\n getPackedOutputSamplingSnippet(outputShape.logicalShape,\n outTexShape);\n floatTextureSetOutputSnippet = getFloatTextureSetRGBASnippet(glsl);\n } else {\n outputSamplingSnippet =\n getOutputSamplingSnippet(outputShape.logicalShape, outTexShape);\n floatTextureSetOutputSnippet = getFloatTextureSetRSnippet(glsl);\n }\n if (usesPackedTextures) {\n shaderPrefix += SHADER_PACKED_PREFIX;\n }\n const source = [\n shaderPrefix,\n floatTextureSampleSnippet, floatTextureSetOutputSnippet,\n inputPrefixSnippet, outputSamplingSnippet,\n inputSamplingSnippet, userCode\n].join("\\n");\n return source;\n}\n\nfunction getSamplerFromInInfo(inInfo:\n InputInfo): string {\n const shape = inInfo.shapeInfo.logicalShape;\n switch (shape.length) {\n case 0:\n return\n getSamplerScalar(inInfo);\n case 1:\n return\n getSampler1D(inInfo);\n case 2:\n return\n getSampler2D(inInfo);\n case 3:\n return\n getSampler3D(inInfo);\n case 4:\n return\n getSampler4D(inInfo);\n case 5:\n return\n getSampler5D(inInfo);\n case 6:\n return\n getSampler6D(inInfo);\n default:\n throw new Error(\n `${shape.length}-D input sampling` +\n ` is not yet supported`);\n }\n}\n\nfunction\n getPackedSamplerFromInInfo(inInfo: InputInfo): string {\n const shape = inInfo.shapeInfo.logicalShape;\n switch\n (shape.length) {\n case 0:\n return\n getPackedSamplerScalar(inInfo);\n case 1:\n return\n getPackedSampler1D(inInfo);\n case 2:\n return\n getPackedSampler2D(inInfo);\n case 3:\n return\n getPackedSampler3D(inInfo);\n default:\n return\n getPackedSamplerND(inInfo);\n }\n}\n\nfunction\n getInputSamplingSnippet(\n inInfo: InputInfo,\n outShapeInfo: ShapeInfo,\n usesPackedTextures = false): string {\n let res = "";\n if (usesPackedTextures) {\n res +=\n getPackedSamplerFromInInfo(inInfo);\n } else {\n res +=\n getSamplerFromInInfo(inInfo);\n }\n const inShape = inInfo.shapeInfo.logicalShape;\n const outShape =\n outShapeInfo.logicalShape;\n\n if (inShape.length <= outShape.length) {\n if (usesPackedTextures) {\n res +=\n getPackedSamplerAtOutputCoords(inInfo, outShapeInfo);\n } else {\n res +=
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getSamplerAtOutputCoords(inInfo, outShapeInfo);\n }\n }\n return res;\n}\n\nfunction
getPackedOutputSamplingSnippet(\n outShape: number[], outTexShape: [number, number]): string {\n switch
(outShape.length) {\n case 0:\n return getOutputScalarCoords();\n case 1:\n return
getOutputPacked1DCoords(outShape as [number], outTexShape);\n case 2:\n return
getOutputPacked2DCoords(outShape as [number, number], outTexShape);\n case 3:\n return
getOutputPacked3DCoords(\n outShape as [number, number, number], outTexShape);\n default:\n return
getOutputPackedNDCoords(outShape, outTexShape);\n }\n}\n\nfunction getOutputSamplingSnippet(\n
outShape: number[], outTexShape: [number, number]): string {\n switch (outShape.length) {\n case 0:\n return
getOutputScalarCoords();\n case 1:\n return getOutput1DCoords(outShape as [number], outTexShape);\n
case 2:\n return getOutput2DCoords(outShape as [number, number], outTexShape);\n case 3:\n return
getOutput3DCoords(\n outShape as [number, number, number], outTexShape);\n case 4:\n return
getOutput4DCoords(\n outShape as [number, number, number, number], outTexShape);\n case 5:\n return
getOutput5DCoords(\n outShape as [number, number, number, number, number], outTexShape);\n case 6:\n
return getOutput6DCoords(\n outShape as [number, number, number, number, number, number],\n
outTexShape);\n default:\n throw new Error(\n `${outShape.length}-D output sampling is not yet
supported`);\n }\n}\n\nfunction getFloatTextureSampleSnippet(glsl: GLSL): string {\n return `\n float
sampleTexture(sampler2D textureSampler, vec2 uv) {\n return ${glsl.texture2D}(textureSampler, uv).r;\n
}\n `;\n}\n\nfunction getFloatTextureSetRSnippet(glsl: GLSL): string {\n return `\n void setOutput(float val)
{\n ${glsl.output} = vec4(val, 0, 0, 0);\n }\n `;\n}\n\nfunction getFloatTextureSetRGBASnippet(glsl: GLSL):
string {\n return `\n void setOutput(vec4 val) {\n ${glsl.output} = val;\n }\n `;\n}\n\nfunction
getShaderPrefix(glsl: GLSL): string {\n const SHADER_PREFIX = `${glsl.version}\n precision highp float;\n
precision highp int;\n precision highp sampler2D;\n ${glsl.varyingFs} vec2 resultUV;\n
${glsl.defineOutput}\n const vec2 halfCR = vec2(0.5, 0.5);\n\n struct ivec5 {\n int x;\n int y;\n int
z;\n int w;\n int u;\n };\n\n struct ivec6 {\n int x;\n int y;\n int z;\n int w;\n int u;\n
int v;\n };\n\n uniform float NAN;\n ${glsl.defineSpecialNaN}\n ${glsl.defineSpecialInf}\n
${glsl.defineRound}\n\n int imod(int x, int y) {\n return
x - y * (x / y);\n }\n\n int idiv(int a, int b, float sign) {\n int res = a / b;\n int mod = imod(a, b);\n if
(sign < 0. && mod != 0) {\n res -= 1;\n }\n return res;\n }\n\n //Based on the work of Dave Hoskins\n
//https://www.shadertoy.com/view/4djSRW\n #define HASHSCALE1 443.8975\n float random(float seed){\n
vec2 p = resultUV * seed;\n vec3 p3 = fract(vec3(p.xyx) * HASHSCALE1);\n p3 += dot(p3, p3.yzx +
19.19);\n return fract((p3.x + p3.y) * p3.z);\n }\n\n ${SAMPLE_1D_SNIPPET}\n
${SAMPLE_2D_SNIPPET}\n ${SAMPLE_3D_SNIPPET}\n `;\n\n return SHADER_PREFIX;\n}\n\nconst
SAMPLE_1D_SNIPPET = `\nvec2 uvFromFlat(int texNumR, int texNumC, int index) {\n int texR = index /
texNumC;\n int texC = index - texR * texNumC;\n return (vec2(texC, texR) + halfCR) / vec2(texNumC,
texNumR);\n}\n\nvec2 packedUVfrom1D(int texNumR, int texNumC, int index) {\n int texelIndex = index / 2;\n int
texR = texelIndex / texNumC;\n
int texC = texelIndex - texR * texNumC;\n return (vec2(texC, texR) + halfCR) / vec2(texNumC,
texNumR);\n}\n\nconst SAMPLE_2D_SNIPPET = `\nvec2 packedUVfrom2D(int texelsInLogicalRow, int
texNumR,\n int texNumC, int row, int col) {\n int texelIndex = (row / 2) * texelsInLogicalRow + (col / 2);\n int
texR = texelIndex / texNumC;\n int texC = texelIndex - texR * texNumC;\n return (vec2(texC, texR) + halfCR) /
vec2(texNumC, texNumR);\n}\n\nconst SAMPLE_3D_SNIPPET = `\nvec2 packedUVfrom3D(int texNumR, int
texNumC,\n int texelsInBatch, int texelsInLogicalRow, int b,\n int row, int col) {\n int index = b * texelsInBatch
+ (row / 2) * texelsInLogicalRow + (col / 2);\n int texR = index / texNumC;\n int texC = index - texR *
texNumC;\n return (vec2(texC, texR) + halfCR) / vec2(texNumC, texNumR);\n}\n\nconst
SHADER_PACKED_PREFIX = `\n float getChannel(vec4 frag, vec2 innerDims) {\n vec2 modCoord =
mod(innerDims, 2.);\n return modCoord.x == 0. ?\n (modCoord.y
== 0. ? frag.r : frag.g) :\n (modCoord.y == 0. ? frag.b : frag.a);\n }\n float getChannel(vec4 frag, int dim) {\n
float modCoord = mod(float(dim), 2.);\n return modCoord == 0. ? frag.r : frag.g;\n }\n `;\n\nfunction

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number, number],\n texShape: [number, number]): string {\n const coordsFromIndexSnippet =
shader_util.getLogicalCoordinatesFromFlatIndex(\n [r, 'c', 'd', 'd2', 'd3', 'd4'], shape);\n\n return \n ivec6
getOutputCoords() {\n ivec2 resTexRC = ivec2(resultUV.yx * \n vec2(${texShape[0]}, ${texShape[1]}));\n
int index = resTexRC.x * ${texShape[1]} + resTexRC.y;\n\n ${coordsFromIndexSnippet}\n\n ivec6 result =
ivec6(r, c, d, d2, d3, d4);\n return result;\n }\n `;\n\n\nfunction getOutputPacked2DCoords(\n
shape: [number, number], texShape: [number, number]): string {\n const packedTexShape =\n
[Math.ceil(texShape[0] / 2), Math.ceil(texShape[1] / 2)];\n if (util.arraysEqual(shape, texShape)) {\n return \n
ivec2 getOutputCoords() {\n return 2 * ivec2(resultUV.yx * vec2(${packedTexShape[0]}, ${\n
packedTexShape[1]}));\n }\n `;\n }\n\n // texels needed to accommodate a logical row\n const
texelsInLogicalRow = Math.ceil(shape[1] / 2);\n\n /**\n * getOutputCoords\n * \n * resTexRC: The rows and
columns of the texels. If you move over one\n * texel to the right in the packed texture, you are moving over one
column\n * (not two).\n * \n * index: The texel index\n * \n return \n ivec2 getOutputCoords() {\n ivec2
resTexRC = ivec2(resultUV.yx * \n vec2(${packedTexShape[0]}, ${packedTexShape[1]}));\n\n
int index = resTexRC.x * ${packedTexShape[1]} + resTexRC.y;\n int r = 2 * (index
/ ${texelsInLogicalRow});\n int c = imod(index, ${texelsInLogicalRow}) * 2;\n\n return ivec2(r, c);\n }\n
`;\n\n\nfunction getOutput2DCoords(\n shape: [number, number], texShape: [number, number]): string {\n if
(util.arraysEqual(shape, texShape)) {\n return \n ivec2 getOutputCoords() {\n return ivec2(resultUV.yx *
vec2(${texShape[0]}, ${texShape[1]}));\n }\n `;\n }\n\n if (shape[1] === 1) {\n return \n ivec2
getOutputCoords() {\n ivec2 resTexRC = ivec2(resultUV.yx * \n vec2(${texShape[0]},
${texShape[1]}));\n int index = resTexRC.x * ${texShape[1]} + resTexRC.y;\n return ivec2(index, 0);\n
}\n `;\n }\n\n if (shape[0] === 1) {\n return \n ivec2 getOutputCoords() {\n ivec2 resTexRC =
ivec2(resultUV.yx * \n vec2(${texShape[0]}, ${texShape[1]}));\n int index = resTexRC.x *
${texShape[1]} + resTexRC.y;\n return ivec2(0,
index);\n }\n `;\n }\n\n return \n ivec2 getOutputCoords() {\n ivec2 resTexRC = ivec2(resultUV.yx * \n
vec2(${texShape[0]}, ${texShape[1]}));\n int index = resTexRC.x * ${texShape[1]} +
resTexRC.y;\n int r = index / ${shape[1]};\n int c = index - r * ${shape[1]};\n return ivec2(r, c);\n
}\n `;\n\n\nfunction getFlatOffsetUniformName(texName: string): string {\n return
`offset${texName}`;\n\n\nfunction getPackedSamplerScalar(inputInfo: InputInfo): string {\n const texName =
inputInfo.name;\n const funcName = 'get' + texName.charAt(0).toUpperCase() + texName.slice(1);\n const glsl =
getGlslDifferences();\n return \n vec4 ${funcName}() {\n return ${glsl.texture2D}(${texName}, halfCR);\n
}\n `;\n\n\nfunction getSamplerScalar(inputInfo: InputInfo): string {\n const texName = inputInfo.name;\n const
funcName = 'get' + texName.charAt(0).toUpperCase() + texName.slice(1);\n if (inputInfo.shapeInfo.isUniform)
{\n return `float ${funcName}() {return ${texName};};`\n }\n const [texNumR, texNumC] =
inputInfo.shapeInfo.texShape;\n if (texNumR === 1 && texNumC === 1) {\n return \n float ${funcName}()
{\n return sampleTexture(${texName}, halfCR);\n }\n `;\n }\n\n const [tNumR, tNumC] =
inputInfo.shapeInfo.texShape;\n const offset = getFlatOffsetUniformName(texName);\n return \n float
${funcName}() {\n vec2 uv = uvFromFlat(${tNumR}, ${tNumC}, ${offset});\n return
sampleTexture(${texName}, uv);\n }\n `;\n\n\nfunction getPackedSampler1D(inputInfo: InputInfo): string {\n
const texName = inputInfo.name;\n const funcName = 'get' + texName.charAt(0).toUpperCase() +
texName.slice(1);\n const texShape = inputInfo.shapeInfo.texShape;\n const packedTexShape =\n
[Math.ceil(texShape[0] / 2), Math.ceil(texShape[1] / 2)];\n const glsl = getGlslDifferences();\n\n return \n vec4
${funcName}(int index) {\n vec2 uv = packedUVfrom1D(\n
${packedTexShape[0]}, ${packedTexShape[1]}, index);\n return ${glsl.texture2D}(${texName}, uv);\n
}\n `;\n\n\nfunction getSampler1D(inputInfo: InputInfo): string {\n const texName = inputInfo.name;\n const
funcName = 'get' + texName.charAt(0).toUpperCase() + texName.slice(1);\n\n if (inputInfo.shapeInfo.isUniform)
{\n // Uniform arrays will be less than 65505 (no risk of float16 overflow).\n return \n float ${funcName}(int
index) {\n ${getUniformSampler(inputInfo)}\n }\n `;\n }\n\n const texShape =
inputInfo.shapeInfo.texShape;\n const tNumR = texShape[0];\n const tNumC = texShape[1];\n\n if (tNumC === 1

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&& tNumR === 1) {\n return \n float ${funcName}(int index) {\n return sampleTexture(${texName},
halfCR);\n }\n \n }\n const offset = getFlatOffsetUniformName(texName);\n if (tNumC === 1) {\n return \n float ${funcName}(int index) {\n vec2 uv = vec2(0.5, (float(index + ${offset}) + 0.5) / ${tNumR}.0);\n return sampleTexture(${texName}, uv);\n }\n }\n \n }\n if (tNumR === 1) {\n return \n float ${funcName}(int index) {\n vec2 uv = vec2((float(index + ${offset}) + 0.5) / ${tNumC}.0, 0.5);\n return sampleTexture(${texName}, uv);\n }\n }\n \n }\n return \n float ${funcName}(int index) {\n vec2 uv = uvFromFlat(${tNumR}, ${tNumC}, index + ${offset});\n return sampleTexture(${texName}, uv);\n }\n \n }\n}\n\nfunction getPackedSampler2D(inputInfo: InputInfo): string {\n const shape =
inputInfo.shapeInfo.logicalShape;\n const texName = inputInfo.name;\n const funcName = 'get' +
texName.charAt(0).toUpperCase() + texName.slice(1);\n const texShape = inputInfo.shapeInfo.texShape;\n \n const
texNumR = texShape[0];\n const texNumC = texShape[1];\n const glsl = getGlslDifferences();\n if (texShape !=
null && util.arraysEqual(shape, texShape)) {\n return \n vec4 ${funcName}(int row, int col) {\n vec2 uv
= (vec2(col,
row) + halfCR) / vec2(${texNumC}.0, ${texNumR}.0);\n return ${glsl.texture2D}(${texName}, uv);\n }\n }\n \n }\n \n const packedTexShape = \n [Math.ceil(texShape[0] / 2), Math.ceil(texShape[1] / 2)];\n const
valuesPerRow = Math.ceil(shape[1] / 2);\n \n return \n vec4 ${funcName}(int row, int col) {\n vec2 uv =
packedUVfrom2D(${valuesPerRow}, ${packedTexShape[0]}, ${\n packedTexShape[1]}, row, col);\n return
${glsl.texture2D}(${texName}, uv);\n }\n \n }\n}\n\nfunction getSampler2D(inputInfo: InputInfo): string {\n const
shape = inputInfo.shapeInfo.logicalShape;\n const texName = inputInfo.name;\n const funcName = 'get' +
texName.charAt(0).toUpperCase() + texName.slice(1);\n const texShape = inputInfo.shapeInfo.texShape;\n \n if
(texShape != null && util.arraysEqual(shape, texShape)) {\n const texNumR = texShape[0];\n const texNumC =
texShape[1];\n return \n float ${funcName}(int row, int col) {\n vec2 uv = (vec2(col,
row) + halfCR) / vec2(${texNumC}.0, ${texNumR}.0);\n return sampleTexture(${texName}, uv);\n }\n }\n \n }\n \n const {newShape, keptDims} = util.squeezeShape(shape);\n const squeezedShape = newShape;\n if
(squeezedShape.length < shape.length) {\n const newInputInfo = squeezeInputInfo(inputInfo, squeezedShape);\n const
params = ['row', 'col'];\n return \n ${getSamplerFromInInfo(newInputInfo)}\n float ${funcName}(int
row, int col) {\n return ${funcName}(${getSqueezedParams(params, keptDims)});\n }\n }\n \n }\n \n if
(inputInfo.shapeInfo.isUniform) {\n // Uniform arrays will be less than 65505 (no risk of float16 overflow).\n return \n float ${funcName}(int row, int col) {\n int index = round(dot(vec2(row, col), vec2(${shape[1]},
1)));\n ${getUniformSampler(inputInfo)}\n }\n }\n \n }\n \n const texNumR = texShape[0];\n const
texNumC = texShape[1];\n const offset = getFlatOffsetUniformName(texName);\n if (texNumC
=== 1) {\n // index is used directly as physical (no risk of float16 overflow).\n return \n float
${funcName}(int row, int col) {\n float index = dot(vec3(row, col, ${offset}), vec3(${shape[1]}, 1, 1));\n vec2 uv = vec2(0.5, (index + 0.5) / ${texNumR}.0);\n return sampleTexture(${texName}, uv);\n }\n }\n \n }\n \n if (texNumR === 1) {\n // index is used directly as physical (no risk of float16 overflow).\n return \n float
${funcName}(int row, int col) {\n float index = dot(vec3(row, col, ${offset}), vec3(${shape[1]}, 1, 1));\n vec2 uv = vec2((index + 0.5) / ${texNumC}.0, 0.5);\n return sampleTexture(${texName}, uv);\n }\n }\n \n }\n \n return \n float ${funcName}(int row, int col) {\n // Explicitly use integer operations as dot() only works on
floats.\n int index = row * ${shape[1]} + col + ${offset};\n vec2 uv = uvFromFlat(${texNumR}, ${texNumC},
index);\n return sampleTexture(${texName}, uv);\n }\n \n }\n}\n\nfunction
getPackedSampler3D(inputInfo: InputInfo): string {\n const shape = inputInfo.shapeInfo.logicalShape;\n const
texName = inputInfo.name;\n const funcName = 'get' + texName.charAt(0).toUpperCase() + texName.slice(1);\n const
texShape = inputInfo.shapeInfo.texShape;\n const packedTexShape = \n [Math.ceil(texShape[0] / 2),
Math.ceil(texShape[1] / 2)];\n \n if (shape[0] === 1) {\n const squeezedShape = shape.slice(1);\n const keptDims
= [1, 2];\n const newInputInfo = squeezeInputInfo(inputInfo, squeezedShape);\n const params = ['b', 'row',
'col'];\n return \n ${getPackedSamplerFromInInfo(newInputInfo)}\n vec4 ${funcName}(int b, int row,
int col) {\n return ${funcName}(${getSqueezedParams(params, keptDims)});\n }\n }\n \n }\n \n const
texNumR = packedTexShape[0];\n const texNumC = packedTexShape[1];\n \n const valuesPerRow =

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Math.ceil(shape[2] / 2);\n const texelsInBatch = valuesPerRow * Math.ceil(shape[1] / 2);\n const glsl
= getGlslDifferences();\n\n return `\n vec4 ${funcName}(int b, int row, int col) {\n vec2 uv =
packedUVfrom3D(\n ${texNumR}, ${texNumC}, ${texelsInBatch}, ${valuesPerRow}, b, row, col);\n
return ${glsl.texture2D}(${texName}, uv);\n }\n\n\nfunction getSampler3D(inputInfo: InputInfo): string {\n
const shape = inputInfo.shapeInfo.logicalShape;\n const texName = inputInfo.name;\n const funcName = 'get' +
texName.charAt(0).toUpperCase() + texName.slice(1);\n const stride0 = shape[1] * shape[2];\n const stride1 =
shape[2];\n\n const {newShape, keptDims} = util.squeezeShape(shape);\n const squeezedShape = newShape;\n if
(squeezedShape.length < shape.length) {\n const newInputInfo = squeezeInputInfo(inputInfo, squeezedShape);\n
const params = ['row', 'col', 'depth'];\n return `\n ${getSamplerFromInInfo(newInputInfo)}\n float
${funcName}(int row, int col, int depth) {\n return ${funcName}(${getSqueezedParams(params,
keptDims)});\n
}\n }\n\n }\n\n if (inputInfo.shapeInfo.isUniform) {\n // Uniform arrays will be less than 65505 (no risk of
float16 overflow).\n return `\n float ${funcName}(int row, int col, int depth) {\n int index =
round(dot(vec3(row, col, depth),\n vec3(${stride0}, ${stride1}, 1)));\n
${getUniformSampler(inputInfo)}\n }\n }\n\n const texShape = inputInfo.shapeInfo.texShape;\n const
texNumR = texShape[0];\n const texNumC = texShape[1];\n const flatOffset = inputInfo.shapeInfo.flatOffset;\n if
(texNumC === stride0 && flatOffset === null) {\n // texC is used directly as physical (no risk of float16
overflow).\n return `\n float ${funcName}(int row, int col, int depth) {\n float texR = float(row);\n
float texC = dot(vec2(col, depth), vec2(${stride1}, 1));\n vec2 uv = (vec2(texC, texR) + halfCR) /\n
vec2(${texNumC}.0, ${texNumR}.0);\n return sampleTexture(${texName},
uv);\n }\n }\n\n if (texNumC === stride1 && flatOffset === null) {\n // texR is used directly as
physical (no risk of float16 overflow).\n return `\n float ${funcName}(int row, int col, int depth) {\n
float texR = dot(vec2(row, col), vec2(${shape[1]}, 1));\n float texC = float(depth);\n vec2 uv = (vec2(texC, texR) +
halfCR) /\n vec2(${texNumC}.0, ${texNumR}.0);\n return sampleTexture(${texName}, uv);\n }\n }\n\n
}\n\n const offset = getFlatOffsetUniformName(texName);\n return `\n float ${funcName}(int row, int col, int depth)
{\n // Explicitly use integer operations as dot() only works on floats.\n int index = row * ${stride0} + col *
${stride1} + depth + ${offset};\n vec2 uv = uvFromFlat(${texNumR}, ${texNumC}, index);\n return
sampleTexture(${texName}, uv);\n }\n }\n\n\nfunction getPackedSamplerND(inputInfo: InputInfo): string {\n
const shape = inputInfo.shapeInfo.logicalShape;\n
const rank = shape.length;\n const texName = inputInfo.name;\n const funcName = 'get' +
texName.charAt(0).toUpperCase() + texName.slice(1);\n const texShape = inputInfo.shapeInfo.texShape;\n const
packedTexShape =\n [Math.ceil(texShape[0] / 2), Math.ceil(texShape[1] / 2)];\n const texNumR =
packedTexShape[0];\n const texNumC = packedTexShape[1];\n\n const valuesPerRow = Math.ceil(shape[rank - 1]
/ 2);\n let texelsInBatch = valuesPerRow * Math.ceil(shape[rank - 2] / 2);\n let params = `int b, int row, int col`;\n
let index = `b * ${texelsInBatch} + (row / 2) * ${valuesPerRow} + (col / 2)`;\n for (let b = 2; b < rank - 1; b++) {\n
 params = `int b${b}, ` + params;\n texelsInBatch *= shape[rank - b - 1];\n index = `b${b} * ${texelsInBatch} +
` + index;\n }\n const glsl = getGlslDifferences();\n return `\n vec4 ${funcName}(${params}) {\n int index =
${index};\n int texR = index / ${texNumC};\n int texC = index - texR * ${texNumC};\n
vec2 uv = (vec2(texC, texR) + halfCR) /\n vec2(${texNumC}, ${texNumR});\n return
${glsl.texture2D}(${texName}, uv);\n }\n\n\nfunction getSampler4D(inputInfo: InputInfo): string {\n const
shape = inputInfo.shapeInfo.logicalShape;\n const texName = inputInfo.name;\n const funcName = 'get' +
texName.charAt(0).toUpperCase() + texName.slice(1);\n const stride2 = shape[3];\n const stride1 = shape[2] *
stride2;\n const stride0 = shape[1] * stride1;\n\n const {newShape, keptDims} = util.squeezeShape(shape);\n if
(newShape.length < shape.length) {\n const newInputInfo = squeezeInputInfo(inputInfo, newShape);\n const
params = ['row', 'col', 'depth', 'depth2'];\n return `\n ${getSamplerFromInInfo(newInputInfo)}\n float
${funcName}(int row, int col, int depth, int depth2) {\n return ${funcName}(${getSqueezedParams(params,
keptDims)});\n }\n }\n\n }\n\n if (inputInfo.shapeInfo.isUniform) {\n // Uniform arrays will be less than
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risk of float16 overflow).\n return \n float ${funcName}(int row, int col, int depth, int depth2) {\n int
index = round(dot(vec4(row, col, depth, depth2),\n vec4(${stride0}, ${stride1}, ${stride2}, 1));\n
 ${getUniformSampler(inputInfo)}\n }\n \n }\n\n const flatOffset = inputInfo.shapeInfo.flatOffset;\n const
texShape = inputInfo.shapeInfo.texShape;\n const texNumR = texShape[0];\n const texNumC = texShape[1];\n\n if (texNumC === stride0 && flatOffset == null) {\n // texC is used directly as physical (no risk of float16
overflow).\n return \n float ${funcName}(int row, int col, int depth, int depth2) {\n float texR =
float(row);\n float texC =\n dot(vec3(col, depth, depth2),\n vec3(${stride1}, ${stride2}, 1));\n vec2 uv = (vec2(texC, texR) + halfCR) /\n vec2(${texNumC}.0, ${texNumR}.0);\n return
sampleTexture(${texName}, uv);\n }\n }\n\n if (texNumC === stride2 && flatOffset == null) {\n // texR is used directly as physical (no risk of
float16 overflow).\n return \n float ${funcName}(int row, int col, int depth, int depth2) {\n float texR =
dot(vec3(row, col, depth),\n vec3(${shape[1]} * shape[2]}, ${shape[2]}, 1));\n float texC =
float(depth2);\n vec2 uv = (vec2(texC, texR) + halfCR) /\n vec2(${texNumC}.0, ${texNumR}.0);\n return
sampleTexture(${texName}, uv);\n }\n }\n \n }\n\n const offset =
getFlatOffsetUniformName(texName);\n return \n float ${funcName}(int row, int col, int depth, int depth2) {\n
 // Explicitly use integer operations as dot() only works on floats.\n int index = row * ${stride0} + col *
${stride1} +\n depth * ${stride2} + depth2;\n vec2 uv = uvFromFlat(${texNumR}, ${texNumC}, index +
${offset});\n return sampleTexture(${texName}, uv);\n }\n \n }\n\n function getSampler5D(inputInfo:
InputInfo): string {\n const shape = inputInfo.shapeInfo.logicalShape;\n const texName = inputInfo.name;\n const
funcName = 'get' + texName.charAt(0).toUpperCase() + texName.slice(1);\n const stride3 = shape[4];\n const
stride2 = shape[3] * stride3;\n const stride1 = shape[2] * stride2;\n const stride0 = shape[1] * stride1;\n\n const
{newShape, keptDims} = util.squeezeShape(shape);\n if (newShape.length < shape.length) {\n const
newInputInfo = squeezeInputInfo(inputInfo, newShape);\n const params = ['row', 'col', 'depth', 'depth2', 'depth3'];\n
 return \n ${getSamplerFromInInfo(newInputInfo)}\n float ${funcName}(int row, int col, int depth, int
depth2, int depth3) {\n return ${funcName}(${getSqueezedParams(params, keptDims)});\n }\n \n }\n\n if (inputInfo.shapeInfo.isUniform) {\n // Uniform arrays will be less than 65505 (no risk of float16 overflow).\n
 return \n float ${funcName}(int row, int col, int depth,
int depth2, int depth3) {\n float index = dot(\n vec4(row, col, depth, depth2),\n vec4(${stride0},
${stride1}, ${stride2}, ${stride3})) +\n depth3;\n ${getUniformSampler(inputInfo)}\n }\n \n }\n\n const flatOffset = inputInfo.shapeInfo.flatOffset;\n const texShape = inputInfo.shapeInfo.texShape;\n const
texNumR = texShape[0];\n const texNumC = texShape[1];\n\n if (texNumC === stride0 && flatOffset == null) {\n // texC is used directly as physical (no risk of float16 overflow).\n
 return \n float ${funcName}(int row, int
col, int depth, int depth2, int depth3) {\n int texR = row;\n float texC = dot(vec4(col, depth, depth2,
depth3),\n vec4(${stride1}, ${stride2}, ${stride3}, 1));\n vec2 uv = (vec2(texC, texR) + halfCR)
/\n vec2(${texNumC}.0, ${texNumR}.0);\n return sampleTexture(${texName}, uv);\n }\n \n }\n\n if (texNumC === stride3 &&
flatOffset == null) {\n // texR is used directly as physical (no risk of float16 overflow).\n return \n float
${funcName}(int row, int col, int depth, int depth2, int depth3) {\n float texR = dot(\n vec4(row, col,
depth, depth2),\n vec4(${shape[1]} * shape[2] * shape[3]},\n ${shape[2]} * shape[3]}, ${shape[3]},
1));\n int texC = depth3;\n vec2 uv = (vec2(texC, texR) + halfCR) /\n vec2(${texNumC}.0,
${texNumR}.0);\n return sampleTexture(${texName}, uv);\n }\n \n }\n\n const offset =
getFlatOffsetUniformName(texName);\n return \n float ${funcName}(int row, int col, int depth, int depth2, int
depth3) {\n // Explicitly use integer operations as dot() only works on floats.\n int index = row * ${stride0} +
col * ${stride1} + depth * ${stride2} +\n depth2 * ${stride3} + depth3 + ${offset};\n vec2 uv =
uvFromFlat(${texNumR}, ${texNumC}, index);\n return sampleTexture(${texName},
uv);\n }\n }\n \n }\n\n function getSampler6D(inputInfo: InputInfo): string {\n const shape =
inputInfo.shapeInfo.logicalShape;\n const texName = inputInfo.name;\n const funcName = 'get' +
texName.charAt(0).toUpperCase() + texName.slice(1);\n\n const {newShape, keptDims} =

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util.squeezeShape(shape);\n if (newShape.length < shape.length) {\n const newInputInfo =
squeezeInputInfo(inputInfo, newShape);\n const params = ['row', 'col', 'depth', 'depth2', 'depth3', 'depth4'];\n
return \n ${getSamplerFromInInfo(newInputInfo)}\n float ${funcName}(int row, int col, int depth,\n int depth2, int depth3, int depth4) {\n return ${funcName}(${getSqueezedParams(params, keptDims)});\n
}\n \n }\n\n const stride4 = shape[5];\n const stride3 = shape[4] * stride4;\n const stride2 = shape[3] *
stride3;\n const stride1 = shape[2] * stride2;\n const stride0 = shape[1] * stride1;\n\n if
(inputInfo.shapeInfo.isUniform) {\n //
Uniform arrays will be less than 65505 (no risk of float16 overflow).\n return \n float ${funcName}(int row,\n int col, int depth,\n int depth2, int depth3, int depth4) {\n int index = round(dot(\n vec4(row,\n col, depth, depth2),\n vec4(${stride0}, ${stride1}, ${stride2}, ${stride3})) +\n dot(\n vec2(depth3, depth4),\n vec2(${stride4}, 1));\n ${getUniformSampler(inputInfo)}\n }\n \n }\n\n const flatOffset = inputInfo.shapeInfo.flatOffset;\n const texShape = inputInfo.shapeInfo.texShape;\n const
texNumR = texShape[0];\n const texNumC = texShape[1];\n if (texNumC === stride0 && flatOffset == null) {\n
// texC is used directly as physical (no risk of float16 overflow).\n return \n float ${funcName}(int row, int
col, int depth,\n int depth2, int depth3, int depth4) {\n int texR = row;\n float texC =
dot(vec4(col, depth, depth2, depth3),\n vec4(${stride1}, ${stride2}, ${stride3}, ${stride4})) +\n float(depth4);\n vec2 uv = (vec2(texC,\n texR) + halfCR) /\n vec2(${texNumC}.0, ${texNumR}.0);\n return sampleTexture(${texName},
uv);\n }\n \n }\n\n if (texNumC === stride4 && flatOffset == null) {\n // texR is used directly as physical
(no risk of float16 overflow).\n return \n float ${funcName}(int row, int col, int depth,\n int
depth2, int depth3, int depth4) {\n float texR = dot(vec4(row, col, depth, depth2),\n vec4(${shape[1] *
shape[2] * shape[3] * shape[4]},\n ${shape[2] * shape[3] * shape[4]},\n ${shape[3] * shape[4]},\n
${shape[4]})) + float(depth3);\n int texC = depth4;\n vec2 uv = (vec2(texC, texR) + halfCR) /\n
 vec2(${texNumC}.0, ${texNumR}.0);\n return sampleTexture(${texName}, uv);\n }\n \n }\n\n
const offset = getFlatOffsetUniformName(texName);\n
return \n float ${funcName}(int row, int col, int depth,\n int depth2, int depth3, int depth4) {\n //
Explicitly use integer operations as dot() only works on floats.\n int index = row * ${stride0} + col * ${stride1}
+ depth * ${stride2} +\n depth2 * ${stride3} + depth3 * ${stride4} + depth4 + ${offset};\n vec2 uv =
uvFromFlat(${texNumR}, ${texNumC}, index);\n return sampleTexture(${texName}, uv);\n }\n\n
}\n\n\nfunction getUniformSampler(inputInfo: InputInfo): string {\n const texName = inputInfo.name;\n const
inSize = util.sizeFromShape(inputInfo.shapeInfo.logicalShape);\n\n if (inSize < 2) {\n return \n return
${texName};\n }\n\n return \n for (int i = 0; i < ${inSize}; i++) {\n if (i == index) {\n return
${texName}[i];\n }\n }\n\n }\n\n\nfunction getPackedSamplerAtOutputCoords(\n inputInfo: InputInfo,\n outShapeInfo: ShapeInfo) {\n const texName = inputInfo.name;\n const
texFuncSnippet = texName.charAt(0).toUpperCase() + texName.slice(1);\n const funcName = 'get' +
texFuncSnippet + 'AtOutCoords';\n const inRank = inputInfo.shapeInfo.logicalShape.length;\n const outRank =
outShapeInfo.logicalShape.length;\n\n const broadcastDims = getBroadcastDims(\n inputInfo.shapeInfo.logicalShape, outShapeInfo.logicalShape);\n\n const type = getCoordsDataType(outRank);\n const rankDiff = outRank - inRank;\n let coordsSnippet: string;\n const fields = ['x', 'y', 'z', 'w', 'u', 'v'];\n\n if
(inRank === 0) {\n coordsSnippet = ";\n } else if (outRank < 2 && broadcastDims.length >= 1) {\n
coordsSnippet = 'coords = 0;'\n } else {\n coordsSnippet =\n broadcastDims.map(d => `coords.${fields[d +
rankDiff]} = 0;`)\n .join("\\n");\n }\n\n let unpackedCoordsSnippet = ";\n if (outRank < 2 && inRank > 0) {\n
unpackedCoordsSnippet = 'coords;'\n } else {\n unpackedCoordsSnippet = inputInfo.shapeInfo.logicalShape\n
\n .map((s, i) => `coords.${fields[i + rankDiff]}`)\n .join(', ');\n }\n\n let output =
`return outputValue;`\n const inSize = util.sizeFromShape(inputInfo.shapeInfo.logicalShape);\n const
isInputScalar = inSize === 1;\n const outSize = util.sizeFromShape(outShapeInfo.logicalShape);\n const
isOutputScalar = outSize === 1;\n\n if (inRank === 1 && !isInputScalar && !isOutputScalar) {\n output = \n

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return vec4(outputValue.xy, outputValue.x);\n `;\n } else if (isInputScalar && !isOutputScalar) {\n if (outRank === 1) {\n output = `\n return vec4(outputValue.x, outputValue.x, 0., 0.);`\n `;\n } else {\n output = `\n return vec4(outputValue.x);\n `;\n }\n } else if (broadcastDims.length) {\n const rows = inRank - 2;\n const cols = inRank - 1;\n if (broadcastDims.indexOf(rows) > -1 && broadcastDims.indexOf(cols) > -1) {\n output = `return vec4(outputValue.x);`\n }\n } else if (broadcastDims.indexOf(rows) > -1) {\n output = `return vec4(outputValue.x, outputValue.y, ` +\n `outputValue.x, outputValue.y);`\n } else if (broadcastDims.indexOf(cols) > -1) {\n output = `return\n vec4(outputValue.xx, outputValue.zz);`\n }\n }\n\nreturn `\n vec4 ${funcName}() {\n ${type} coords =\n getOutputCoords();\n ${coordsSnippet}\n vec4 outputValue =\n get${texFuncSnippet}(${unpackedCoordsSnippet});\n ${output}\n }\n`;\n}\n\nfunction\ngetSamplerAtOutputCoords(\n inputInfo: InputInfo, outShapeInfo: ShapeInfo) {\n const texName =\n inputInfo.name;\n const texFuncSnippet = texName.charAt(0).toUpperCase() + texName.slice(1);\n const\n funcName = 'get' + texFuncSnippet + 'AtOutCoords';\n const outTexShape = outShapeInfo.texShape;\n const\n inTexShape = inputInfo.shapeInfo.texShape;\n const inRank = inputInfo.shapeInfo.logicalShape.length;\n const\n outRank = outShapeInfo.logicalShape.length;\n if (!inputInfo.shapeInfo.isUniform\n && inRank === outRank &&\n inputInfo.shapeInfo.flatOffset == null &&\n util.arraysEqual(inTexShape,\n outTexShape)) {\n return `\n float ${funcName}() {\n return sampleTexture(`${texName}`, resultUV);\n }\n `;\n }\n const type = getCoordsDataType(outRank);\n const broadcastDims = getBroadcastDims(\n inputInfo.shapeInfo.logicalShape, outShapeInfo.logicalShape);\n const rankDiff = outRank - inRank;\n let\n coordsSnippet: string;\n const fields = ['x', 'y', 'z', 'w', 'u', 'v'];\n if (inRank === 0) {\n coordsSnippet = ";\n }\n else if (outRank < 2 && broadcastDims.length >= 1) {\n coordsSnippet = 'coords = 0;'\n } else {\n coordsSnippet =\n broadcastDims.map(d => `coords.${fields[d + rankDiff]} = 0;`) \n .join("\\n");\n }\n let unpackedCoordsSnippet = ";\n if (outRank < 2 && inRank > 0) {\n unpackedCoordsSnippet = 'coords';\n }\n else {\n unpackedCoordsSnippet = inputInfo.shapeInfo.logicalShape\n .map((s, i) => `coords.${fields[i + rankDiff]}`)\n .join(',');\n }\n return `\n float ${funcName}() {\n ${type} coords = getOutputCoords();\n ${coordsSnippet}\n return\n get${texFuncSnippet}(${unpackedCoordsSnippet});\n }\n`;\n}\n\nexport function getCoordsDataType(rank:\nnumber): string {\n if (rank <= 1) {\n return 'int';\n } else if (rank === 2) {\n return 'ivec2';\n } else if (rank\n=== 3) {\n return 'ivec3';\n } else if (rank === 4) {\n return 'ivec4';\n } else if (rank === 5) {\n return\n'ivec5';\n } else if (rank === 6) {\n return 'ivec6';\n } else {\n throw Error(`GPU for rank ${rank} is not yet\nsupported`);\n }\n}\n\n/** Returns a new input info (a copy) that has a squeezed logical shape. */\nfunction\nsqueezeInputInfo(\n inInfo: InputInfo, squeezedShape: number[]): InputInfo {\n // Deep copy.\n const\n newInputInfo: InputInfo = JSON.parse(JSON.stringify(inInfo));\n\n newInputInfo.shapeInfo.logicalShape = squeezedShape;\n return newInputInfo;\n}\n\nfunction\ngetSqueezedParams(params: string[], keptDims: number[]): string {\n return keptDims.map(d => params[d]).join(',')\n .join("\\n"), `/*\n * @license\n * Copyright 2017 Google LLC. All Rights Reserved.\n * Licensed under the Apache\nLicense, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You\nmay obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required\nby applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\"\nBASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the\nLicense for the specific language governing permissions and\n * limitations under the License.\n *\n=====\n\n*/\n\nimport {env, Tensor, TypedArray, util} from '@tensorflow/tfjs-core';\nimport\n{GPGPUContext} from './gpgpu_context';\nimport * as shader_compiler from './shader_compiler';\nimport\n{InputInfo, ShapeInfo} from './shader_compiler';\nimport {PackingScheme, TextureData, TextureUsage} from\n'./tex_util';\n\nexport interface GPGPUProgram {\n variableNames: string[];\n outputShape: number[];\n\n userCode: string;\n /** If true, this program expects packed input textures. Defaults to false. */\n packedInputs?:\nboolean;\n /** If true, this program produces a packed texture. Defaults to false. */\n packedOutput?: boolean;\n}
```



```

/**\n * Affects what type of texture we allocate for the output. Defaults to\n * `TextureUsage.RENDER`.\n */\n
outTexUsage?: TextureUsage;\n /**\n * The type of scheme to use when packing texels for the output values.\n * See `PackingScheme` for details. Defaults to `PackingScheme.SHARED_BATCH`.\n */\n outPackingScheme?:
PackingScheme;\n}\n\nexport interface GPGPUBinary {\n webGLProgram: WebGLProgram;\n program:
GPGPUProgram;\n uniformLocations: {[name: string]: WebGLUniformLocation};\n source: string;\n
inShapeInfos: ShapeInfo[];\n outShapeInfo: ShapeInfo;\n infLoc: WebGLUniformLocation;\n nanLoc:
WebGLUniformLocation;\n}\n\nexport interface TensorData {\n shape: number[];\n texData: TextureData;\n
isUniform: boolean;\n // Available when we decide to upload as uniform instead of texture.\n uniformValues?:
TypedArray;\n}\n\nexport function compileProgram<T extends Tensor, K extends Tensor>(\n gpgpu:
GPGPUContext, program: GPGPUProgram, inputs: TensorData[],\n output: TensorData): GPGPUBinary {\n
const userCode = program.userCode;\n const inputInfos: InputInfo[] = inputs.map((input, i) => {\n const
shapeInfo: ShapeInfo = {\n logicalShape: input.shape,\n texShape: input.isUniform ? null :
input.texData.texShape,\n isUniform: input.isUniform,\n isPacked: input.isUniform ? false :
input.texData.isPacked,\n flatOffset: null\n }; \n if (input.texData
!= null && input.texData.slice != null &&\n input.texData.slice.flatOffset > 0) {\n shapeInfo.flatOffset =
input.texData.slice.flatOffset;\n }\n return {name: program.variableNames[i], shapeInfo};\n });\n const
inShapeInfos = inputInfos.map(x => x.shapeInfo);\n const outShapeInfo: ShapeInfo = {\n logicalShape:
output.shape,\n texShape: output.texData.texShape,\n isUniform: false,\n isPacked: output.texData.isPacked,\n
flatOffset: null\n }; \n const source = shader_compiler.makeShader(\n inputInfos, outShapeInfo, userCode,
program.packedInputs);\n const webGLProgram = gpgpu.createProgram(source);\n\n // Add special uniforms
(NAN, INFINITY)\n let infLoc: WebGLUniformLocation = null;\n const nanLoc =
gpgpu.getUniformLocation(webGLProgram, 'NAN', false);\n if (env().getNumber('WEBGL_VERSION') === 1)
{\n infLoc = gpgpu.getUniformLocation(webGLProgram, 'INFINITY', false);\n }\n\n // Add user-defined
uniforms\n const uniformLocations:
{[name: string]: WebGLUniformLocation} = {};\n for (let i = 0; i < program.variableNames.length; i++) {\n
const varName = program.variableNames[i];\n const shouldThrow = false;\n uniformLocations[varName] =\n
gpgpu.getUniformLocation(webGLProgram, varName, shouldThrow);\n uniformLocations[`offset${varName}`]
=\n gpgpu.getUniformLocation(webGLProgram, `offset${varName}`, shouldThrow);\n }\n\n return {\n
program,\n source,\n webGLProgram,\n uniformLocations,\n inShapeInfos,\n outShapeInfo,\n infLoc,\n
nanLoc,\n };\n}\n\nfunction validateBinaryAndProgram(\n shapeInfos: ShapeInfo[], inputs: TensorData[]) {\n if
(shapeInfos.length !== inputs.length) {\n throw Error(\n `Binary was compiled with ${shapeInfos.length}
inputs, but ` +\n `was executed with ${inputs.length} inputs`);\n }\n\n shapeInfos.forEach((s, i) => {\n const
shapeA = s.logicalShape;\n const input = inputs[i];\n const shapeB = input.shape;\n\n if (!util.arraysEqual(shapeA, shapeB)) {\n throw Error(\n `Binary was compiled with different shapes
than ` +\n `the current args. Shapes ${shapeA} and ${shapeB} must match`);\n }\n\n // The input is uploaded
as uniform.\n if (s.isUniform && input.isUniform) {\n return;\n }\n\n const texShapeA = s.texShape;\n
const texShapeB = input.isUniform ? null : input.texData.texShape;\n if (!util.arraysEqual(texShapeA,
texShapeB)) {\n throw Error(\n `Binary was compiled with different texture shapes than the ` +\n `
current args. Shape ${texShapeA} and ${texShapeB} must match`);\n }\n\n });\n}\n\nexport function
runProgram<T extends Tensor, K extends Tensor>(\n gpgpu: GPGPUContext, binary: GPGPUBinary, inputs:
TensorData[],\n output: TensorData,\n customSetup?: (gpgpu: GPGPUContext, webGLProgram:
WebGLProgram) =>\n void): void {\n validateBinaryAndProgram(binary.inShapeInfos, inputs);\n
validateBinaryAndProgram([binary.outShapeInfo],
[output]);\n\n const outTex = output.texData.texture;\n const outTexShape = output.texData.texShape;\n if
(output.texData.isPacked) {\n gpgpu.setOutputPackedMatrixTexture(outTex, outTexShape[0], outTexShape[1]);\n
} else {\n gpgpu.setOutputMatrixTexture(outTex, outTexShape[0], outTexShape[1]);\n }\n\n
gpgpu.setProgram(binary.webGLProgram);\n\n // Set special uniforms (NAN, INFINITY)\n if
(env().getNumber('WEBGL_VERSION') === 1) {\n if (binary.infLoc !== null) {\n

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gpgpu.gl.uniform1f(binary.infLoc, Infinity);\n }\n }\n if (binary.nanLoc !== null) {\n
gpgpu.gl.uniform1f(binary.nanLoc, NaN);\n }\n\n // Set user-defined inputs\n inputs.forEach((input, i) => {\n
const varName = binary.program.variableNames[i];\n const varLoc = binary.uniformLocations[varName];\n
const varOffsetLoc = binary.uniformLocations[`${varName}_offset`];\n if (varLoc == null) {\n // The
compiler inferred that this variable is not used
in this shader.\n return;\n }\n\n if (input.isUniform) {\n // Upload the values of the tensor as uniform.\n
if (util.sizeFromShape(input.shape) < 2) {\n gpgpu.gl.uniform1f(varLoc, input.uniformValues[0]);\n } else
{\n let vals = input.uniformValues;\n if (!(vals instanceof Float32Array)) {\n vals = new
Float32Array(vals);\n }\n gpgpu.gl.uniform1fv(varLoc, vals);\n }\n return;\n }\n\n // If the input
was sliced, upload the flat offset index.\n if (input.texData.slice != null && varOffsetLoc != null) {\n
gpgpu.gl.uniform1i(varOffsetLoc, input.texData.slice.flatOffset);\n }\n\n
gpgpu.setInputMatrixTexture(input.texData.texture, varLoc, i);\n });\n\n if (customSetup != null) {\n
customSetup(gpgpu, binary.webGLProgram);\n }\n gpgpu.executeProgram();\n }\n\n\nexport function
makeShaderKey(\n program: GPGPUProgram, inputs: TensorData[], output: TensorData): string {\n let keyInputs
=
";\n inputs.concat(output).forEach(x => {\n const hasOffset = x.texData != null && x.texData.slice != null &&\n
 x.texData.slice.flatOffset > 0;\n const texShape = x.isUniform ? 'uniform' : x.texData.texShape;\n keyInputs
+= `${x.shape}_${texShape}_${hasOffset}`;\n });\n const keyUserCode = program.userCode;\n let key =
program.constructor.name;\n // Fast string concat. See https://jsperf.com/string-concatenation/14.\n key += '_' +
keyInputs + '_' + keyUserCode;\n return key;\n }\n\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF
ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n *
limitations under the License.\n *\n
=====
*\n\nimport {TensorInfo, util} from '@tensorflow/tfjs-core';\n\nexport function assertNotComplex(\n tensor:
TensorInfo|TensorInfo[], opName: string): void {\n if (!Array.isArray(tensor)) {\n tensor = [tensor];\n }\n
tensor.forEach(t => {\n if (t != null) {\n util.assert(\n t.dtype !== 'complex64',\n () => `${\n
opName} does not support complex64 tensors in the CPU backend.`);\n }\n });\n }\n\n", "/*\n * @license\n *
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BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the
License for the specific language governing permissions and\n * limitations under the License.\n *\n
=====
*\n\nimport {Abs, AbsInputs, KernelConfig, KernelFunc, TypedArray, util} from '@tensorflow/tfjs-
core';\n\nimport {MathBackendCPU} from '../backend_cpu';\n\nimport {assertNotComplex} from
'../cpu_util';\n\nexport function simpleAbsImpl(vals: TypedArray): Float32Array {\n const resultValues = new
Float32Array(vals.length);\n for (let i = 0; i < vals.length; ++i) {\n resultValues[i] = Math.abs(vals[i]);\n }\n
return resultValues;\n }\n\nexport const abs = (args: {inputs: AbsInputs, backend: MathBackendCPU}) => {\n const
{x} = args.inputs;\n const cpuBackend = args.backend;\n\n assertNotComplex(x, 'abs');\n\n let resultValues = new Float32Array(util.sizeFromShape(x.shape));\n const values =
cpuBackend.data.get(x.dataId).values as TypedArray;\n resultValues = simpleAbsImpl(values);\n\n return
cpuBackend.makeOutput(resultValues, x.shape, 'float32');\n }\n\nexport const absConfig: KernelConfig = {\n

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kernelName: Abs,\n backendName: 'cpu',\n kernelFunc: abs as { } as KernelFunc,\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\n * License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or\n * agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n * the specific language governing permissions and\n * limitations under the License.\n *

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*\n\nimport { backend_util, DataType, NumericDataType, TypedArray, util } from '@tensorflow/tfjs-
core';\n\nimport { SimpleBinaryKernelImpl, SimpleBinaryOperation } from './binary_types';\n\n/**\n * Template that\n * creates implementation for binary ops. Supports broadcast.\n */\n\nexport function createSimpleBinaryKernelImpl(op:\n SimpleBinaryOperation):\n SimpleBinaryKernelImpl {\n return (aShape: number[], bShape: number[], aVals:\n TypedArray,\n bVals: TypedArray, dtype: DataType): [TypedArray, number[]] => {\n const newShape =\n backend_util.assertAndGetBroadcastShape(aShape, bShape);\n\n const resultRank = newShape.length;\n const\n resultStrides = util.computeStrides(newShape);\n const resultSize = util.sizeFromShape(newShape);\n\n const\n result =\n util.getTypedArrayFromDType(dtype as NumericDataType, resultSize);\n\n const aRank =\n aShape.length;\n\n const bRank = bShape.length;\n const aStrides = util.computeStrides(aShape);\n const bStrides =\n util.computeStrides(bShape);\n\n const aBroadcastDims = backend_util.getBroadcastDims(aShape, newShape);\n const bBroadcastDims = backend_util.getBroadcastDims(bShape, newShape);\n\n if (aBroadcastDims.length +\n bBroadcastDims.length === 0) {\n for (let i = 0; i < result.length; ++i) {\n result[i] = op(aVals[i %\n aVals.length], bVals[i % bVals.length]);\n }\n } else {\n for (let i = 0; i < result.length; ++i) {\n const\n loc = util.indexToLoc(i, resultRank, resultStrides);\n const aLoc = loc.slice(-aRank);\n aBroadcastDims.forEach(d => aLoc[d] = 0);\n const aIndex = util.locToIndex(aLoc, aRank, aStrides);\n const bLoc = loc.slice(-bRank);\n bBroadcastDims.forEach(d => bLoc[d] = 0);\n const bIndex =\n util.locToIndex(bLoc, bRank, bStrides);\n result[i] = op(aVals[aIndex], bVals[bIndex]);\n }\n }\n\n return [result, newShape];\n };\n }\n};\n\n", "/*\n * @license\n * Copyright 2020 Google LLC. All\n * Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this\n * file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\n * OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n * governing permissions and\n * limitations under the License.\n *

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\n\nimport { Complex, ComplexInputs, KernelConfig, KernelFunc, TensorInfo, TypedArray } from\n '@tensorflow/tfjs-core';\n\nimport { MathBackendCPU } from '../backend_cpu';\n\nexport function complex(args:\n { inputs: ComplexInputs,\n backend: MathBackendCPU }):\n TensorInfo {\n const { inputs, backend } = args;\n const { real, imag } =\n inputs;\n\n const realVals = backend.data.get(real.dataId).values as TypedArray;\n const imagVals =\n backend.data.get(imag.dataId).values as TypedArray;\n\n const complexInfo =\n backend.makeTensorInfo(real.shape, 'complex64');\n\n const complex = backend.data.get(complexInfo.dataId);\n\n // The complex tensor owns the underlying real and imag tensorInfos, only the\n // complex tensor tracks refCount,\n when complexData is disposed the\n // underlying tensorData will be disposed.\n complex.complexTensorInfos =\n {\n real: backend.makeTensorInfo(real.shape, 'float32', realVals),\n imag: backend.makeTensorInfo(imag.shape,\n 'float32', imagVals)\n };\n\n return complexInfo;\n }\n\nexport const complexConfig: KernelConfig = {\n kernelName: Complex,\n backendName: 'cpu',\n kernelFunc: complex as { } as KernelFunc\n};\n\n", "/\n * @license\n * Copyright 2020 Google LLC. All Rights

```

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=====
*\n\nimport {DataType, TensorInfo, util} from '@tensorflow/tfjs-core';\nimport {MathBackendCPU} from './backend_cpu';\nimport {complex} from './kernels/Complex';\n\n/**\n * Generates a tensorInfo with all zeros value.\n * @param backend cpu backend.\n * @param shape Shape for the zeros tensor.\n * @param dtype Optional. If set, the result has this dtype.\n */\nexport function zeros(\n backend: MathBackendCPU, shape: number[],\n dtype: DataType = 'float32'): TensorInfo {\n if (dtype === 'complex64') {\n const real = zeros(backend, shape, 'float32');\n const imag = zeros(backend, shape, 'float32');\n return complex({inputs: {real, imag}, backend});\n }\n\n const values = util.makeZerosTypedArray(util.sizeFromShape(shape), dtype);\n return backend.makeTensorInfo(shape, dtype, values);\n}\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */
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=====
*\n\nimport {Identity, IdentityInputs, KernelConfig, KernelFunc, TensorInfo} from '@tensorflow/tfjs-core';\nimport {MathBackendCPU} from './backend_cpu';\n\nexport function identity(\n args: {inputs: IdentityInputs, backend: MathBackendCPU}): TensorInfo {\n const {inputs, backend} = args;\n const {x} = inputs;\n backend.incRef(x.dataId);\n return {dataId: x.dataId, shape: x.shape, dtype: x.dtype};\n}\n\nexport const identityConfig: KernelConfig = {\n kernelName: Identity,\n backendName: 'cpu',\n kernelFunc: identity as { } as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */
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=====
*\n\nimport {KernelConfig, KernelFunc, Real, RealInputs, TensorInfo} from '@tensorflow/tfjs-core';\nimport {MathBackendCPU} from './backend_cpu';\n\nexport function real(args: {inputs: RealInputs, backend: MathBackendCPU}):\n TensorInfo {\n const {inputs, backend} = args;\n const {input} = inputs;\n const real = backend.data.get(input.dataId).complexTensorInfos.real;\n const realVal = backend.data.get(real.dataId).values;\n\n // When complex tensor is disposed, its underlying parts will be disposed too.\n // Make new tensor out of the real value of the complex. This makes sure the\n // value is still accessible even if complex tensor is disposed.\n return backend.makeTensorInfo(real.shape, real.dtype, realVal);\n}\n\nexport const realConfig: KernelConfig = {\n kernelName: Real,\n backendName: 'cpu',\n kernelFunc: real as { } as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n */
```

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*\\nimport {Cast, CastAttrs, CastInputs, KernelConfig, KernelFunc, TensorInfo, TypedArray, util} from
'@tensorflow/tfjs-core';\\nimport {MathBackendCPU} from '../backend_cpu';\\nimport
{createSimpleBinaryKernelImpl} from '../utils/binary_impl';\\nimport {zeros} from '../utils/zeros_impl';\\nimport
{complex} from './Complex';\\nimport {identity} from './Identity';\\nimport {real} from './Real';\\n\\nexport function
cast(\\n args: {inputs: CastInputs, backend: MathBackendCPU, attrs: CastAttrs}):\\n TensorInfo {\\n const
{inputs, backend, attrs} = args;\\n const {x} = inputs;\\n const {dtype} = attrs;\\n // Casting to complex64.\\n if
(dtype === 'complex64') {\\n if (x.dtype === 'complex64') {\\n return identity({inputs: {x}, backend});\\n }\\n\\n
 const zerosTensorInfo = zeros(backend, x.shape, x.dtype);\\n const floatX = cast({inputs: {x}, backend, attrs:
{dtype: 'float32'}});\\n\\n
 const result =\\n complex({inputs: {real: floatX, imag: zerosTensorInfo}, backend});\\n\\n
 backend.disposeIntermediateTensorInfo(zerosTensorInfo);\\n backend.disposeIntermediateTensorInfo(floatX);\\n\\n
 return result;\\n }\\n\\n // Casting from complex64\\n if (x.dtype === 'complex64') {\\n const realPart =
real({inputs: {input: x}, backend});\\n const result = cast({inputs: {x: realPart}, backend, attrs: {dtype}});\\n\\n
 backend.disposeIntermediateTensorInfo(realPart);\\n\\n return result;\\n }\\n\\n if (!util.hasEncodingLoss(x.dtype,
dtype)) {\\n // We don't change the underlying data, since we cast to higher\\n // precision.\\n const result =
identity({inputs: {x}, backend});\\n return {dataId: result.dataId, shape: result.shape, dtype};\\n }\\n\\n if (dtype
=== 'int32') {\\n const values = backend.data.get(x.dataId).values as TypedArray;\\n const resultValues =
Int32Array.from(values);\\n return backend.makeTensorInfo(x.shape, 'int32', resultValues);\\n }\\n\\n if (dtype === 'bool') {\\n // This is essentially the result of notEqual(x, 0). We avoid using\\n // kernel
notEqual to avoid circular dependency, i.e. binary_utils ->\\n // cast -> notEqual -> binary_utils.\\n const xVals =
backend.data.get(x.dataId).values as TypedArray;\\n const zero = util.toTypedArray([0], x.dtype);\\n\\n const
[resultData, resultShape] = createSimpleBinaryKernelImpl(\\n (a, b) => (a !== b) ? 1 : 0)(x.shape, [], xVals,
zero, 'bool');\\n\\n return backend.makeTensorInfo(resultShape, 'bool', resultData);\\n }\\n\\n throw new Error(`Error
in Cast: failed to cast ${x.dtype} to ${dtype}`);\\n}\\n\\nexport const castConfig: KernelConfig = {\\n kernelName:
Cast,\\n backendName: 'cpu',\\n kernelFunc: cast as {} as KernelFunc\\n};\\n\\n"/**\\n * @license\\n * Copyright 2020
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BASIS,\\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\\n * See the
License for the specific language governing permissions and\\n * limitations under the License.\\n *
=====
*\\nimport {backend_util, BinaryInputs, DataType, KernelFunc, TypedArray, util} from '@tensorflow/tfjs-
core';\\nimport {MathBackendCPU} from '../backend_cpu';\\nimport {assertNotComplex} from
'../cpu_util';\\nimport {cast} from './kernels/Cast';\\nimport {complex} from './kernels/Complex';\\nimport
{ComplexBinaryKernelImpl, ComplexBinaryOperation, SimpleBinaryKernelImpl} from './binary_types';\\n\\n/**\\n *
Template that creates a `KernelFunc` for binary ops.\\n * @param name Kernel name.\\n * @param
binaryKernelImpl A `SimpleBinaryKernelImpl` for the kernel.\\n * @param binaryKernelComplexImpl Optional. If
exists, represents a\\n * `ComplexBinaryKernelImpl` for the kernel, will be used when input dtype\\n * is
`complex64`.\\n * @param dtype Optional. If set, the result has this dtype. Otherwise, the\\n * result has the same
dtype as the first input. This is mainly used in\\n * comparison kernels, such as Equal, Less, Greater, etc.\\n
*\\nexport function binaryKernelFunc(\\n name: string, simpleImpl: SimpleBinaryKernelImpl,\\n complexImpl?:
```

```

ComplexBinaryKernelImpl, dtype?: DataType): KernelFunc {\n if (complexImpl == null) {\n return ({inputs,
backend}) => {\n const {a, b} = inputs as BinaryInputs;\n const cpuBackend = backend as
MathBackendCPU;\n\n assertNotComplex([a, b], name);\n const aVals =
cpuBackend.data.get(a.dataId).values as TypedArray;\n const bVals = cpuBackend.data.get(b.dataId).values as
TypedArray;\n const $dtype
= dtype || a.dtype;\n const [resultData, resultShape] =\n simpleImpl(a.shape, b.shape, aVals, bVals,
$dtype);\n return cpuBackend.makeTensorInfo(resultShape, $dtype, resultData);\n };\n }\n\n return ({inputs,
backend}) => {\n const {a, b} = inputs as BinaryInputs;\n const cpuBackend = backend as
MathBackendCPU;\n\n if (a.dtype === 'complex64' || b.dtype === 'complex64') {\n const $aComplex = cast(\n
 {inputs: {x: a}, backend: cpuBackend, attrs: {dtype: 'complex64'}});\n const $aComplexVals =
cpuBackend.data.get($aComplex.dataId);\n const aReal = $aComplexVals.complexTensorInfos.real;\n const
aImag = $aComplexVals.complexTensorInfos.imag;\n const aRealVals =\n
cpuBackend.data.get(aReal.dataId).values as Float32Array;\n const aImagVals =\n
cpuBackend.data.get(aImag.dataId).values as Float32Array;\n const $bComplex = cast(\n {inputs: {x: b},
backend: cpuBackend, attrs: {dtype:
'complex64'}});\n const $bComplexVals = cpuBackend.data.get($bComplex.dataId);\n const bReal =
$bComplexVals.complexTensorInfos.real;\n const bImag = $bComplexVals.complexTensorInfos.imag;\n const
bRealVals =\n cpuBackend.data.get(bReal.dataId).values as Float32Array;\n const bImagVals =\n
cpuBackend.data.get(bImag.dataId).values as Float32Array;\n const [resultRealData, resultImagData,
resultShape] = complexImpl(\n a.shape, b.shape, aRealVals, aImagVals, bRealVals, bImagVals);\n const
resultReal =\n cpuBackend.makeTensorInfo(resultShape, 'float32', resultRealData);\n const resultImag
=\n cpuBackend.makeTensorInfo(resultShape, 'float32', resultImagData);\n const result = complex(\n
 {inputs: {real: resultReal, imag: resultImag}, backend: cpuBackend});\n cpuBackend.disposeIntermediateTensorInfo($aComplex);\n
cpuBackend.disposeIntermediateTensorInfo($bComplex);\n
 cpuBackend.disposeIntermediateTensorInfo(resultReal);\n
cpuBackend.disposeIntermediateTensorInfo(resultImag);\n return result;\n } else {\n const aVals =
cpuBackend.data.get(a.dataId).values as TypedArray;\n const bVals = cpuBackend.data.get(b.dataId).values as
TypedArray;\n const $dtype = dtype || a.dtype;\n const [resultData, resultShape] =\n
 simpleImpl(a.shape, b.shape, aVals, bVals, $dtype);\n return cpuBackend.makeTensorInfo(resultShape, $dtype,
resultData);\n };\n }\n\n /**\n * Template that creates the complex type implementation for binary ops.\n *
Supports broadcast.\n */\n export function createComplexBinaryKernelImpl(op: ComplexBinaryOperation):\n
ComplexBinaryKernelImpl {\n return (aShape: number[], bShape: number[], aRealVals: Float32Array,\n
aImagVals: Float32Array, bRealVals: Float32Array,\n bImagVals: Float32Array): [TypedArray, TypedArray,
number[]] => {\n const resultShape = backend_util.assertAndGetBroadcastShape(aShape,
bShape);\n const resultSize = util.sizeFromShape(resultShape);\n const resultRank = resultShape.length;\n
const resultStrides = util.computeStrides(resultShape);\n const resultRealVals =
util.getTypedArrayFromDType('float32', resultSize);\n const resultImagVals =
util.getTypedArrayFromDType('float32', resultSize);\n const aBroadcastDims =
backend_util.getBroadcastDims(aShape, resultShape);\n const bBroadcastDims =
backend_util.getBroadcastDims(bShape, resultShape);\n const aVals =
backend_util.mergeRealAndImagArrays(aRealVals, aImagVals);\n const bVals =
backend_util.mergeRealAndImagArrays(bRealVals, bImagVals);\n const aRank = aShape.length;\n const
aStrides = util.computeStrides(aShape);\n const bRank = bShape.length;\n const bStrides =
util.computeStrides(bShape);\n if (aBroadcastDims.length + bBroadcastDims.length === 0) {\n for (let i = 0;
i < resultRealVals.length; i++) {\n const aIdx = i % aVals.length;\n const bIdx = i % bVals.length;\n const result =\n
op(aVals[aIdx * 2], aVals[aIdx * 2 + 1], bVals[bIdx * 2],\n bVals[bIdx * 2 + 1]);\n resultRealVals[i]

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for (let i = 0; i < resultRealVals.length;
i++) {\n const loc = util.indexToLoc(i, resultRank, resultStrides);\n const aLoc = loc.slice(-aRank);\n aBroadcastDims.forEach(d => aLoc[d] = 0);\n const aIndex = util.locToIndex(aLoc, aRank, aStrides);\n\n const bLoc = loc.slice(-bRank);\n bBroadcastDims.forEach(d => bLoc[d] = 0);\n const bIndex =\n util.locToIndex(bLoc, bRank, bStrides);\n const opResult =\n op(aVals[aIndex * 2], aVals[aIndex * 2 +\n1], bVals[bIndex * 2],\n bVals[bIndex * 2 + 1]);\n resultRealVals[i] = opResult.real;\n resultImagVals[i] = opResult.imag;\n}\n\nreturn [resultRealVals, resultImagVals, resultShape];\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software distributed under the License is distributed on an "AS IS"\n * BASIS, WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n\nimport {Add, KernelConfig} from '@tensorflow/tfjs-core';\nimport {createSimpleBinaryKernelImpl} from './utils/binary_impl';\nimport {binaryKernelFunc, createComplexBinaryKernelImpl} from './utils/binary_utils';\nexport\nconst addImpl = createSimpleBinaryKernelImpl(((a, b) => a + b));\nexport const addComplexImpl =\ncreateComplexBinaryKernelImpl(((aReal, aImag, bReal, bImag) => {\n return {real: aReal + bReal, imag: aImag + bImag};\n}));\nexport const add = binaryKernelFunc(Add, addImpl, addComplexImpl);\nexport const\naddConfig: KernelConfig = {\n kernelName: Add,\n backendName: 'cpu',\n kernelFunc: add\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n\nimport {buffer, DataType, Rank, TensorBuffer, TypedArray, util} from '@tensorflow/tfjs-core';\nexport\nfunction bincountImpl(\n xVals: TypedArray, weightsVals: TypedArray, weightsDType: DataType,\n weightsShape: number[], size: number): TypedArray {\n const weightsSize = util.sizeFromShape(weightsShape);\n const outVals = util.makeZerosTypedArray(size, weightsDType) as TypedArray;\n\n for (let i = 0; i < xVals.length; i++) {\n const value = xVals[i];\n if (value < 0) {\n throw new Error('Input x must be non-negative!');\n }\n if (value >= size) {\n continue;\n }\n if (weightsSize > 0) {\n outVals[value] +=\n weightsVals[i];\n } else {\n outVals[value] += 1;\n }\n }\n return outVals;\n}\n\nexport function\nbincountReduceImpl<R extends Rank>(\n xBuf: TensorBuffer<R>,\n weightsBuf: TensorBuffer<R>, size: number,\n binaryOutput = false): TensorBuffer<R> {\n const numRows = xBuf.shape[0];\n const numCols = xBuf.shape[1];\n const outBuf = buffer([numRows, size],\n weightsBuf.dtype);\n for (let i = 0; i < numRows; i++) {\n for (let j = 0; j < numCols; j++) {\n const value =\n xBuf.get(i, j);\n if (value < 0) {\n throw new Error('Input x must be non-negative!');\n }\n if (value >= size) {\n continue;\n }\n if (binaryOutput) {\n outBuf.set(1, i, value);\n } else {\n if (\n weightsBuf.size > 0)\n outBuf.set(outBuf.get(i, value) +\n weightsBuf.get(i, j), i, value);\n else {\n outBuf.set(outBuf.get(i, value) + 1, i, value);\n }\n }\n }\n }\n return outBuf as\nTensorBuffer<R>;\n}\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
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*\n\nimport {NumericDataType, util} from '@tensorflow/tfjs-core';\n\nimport {SimpleUnaryImpl, SimpleUnaryOperation} from './unary_types';\n\n/**\n * Template that creates implementation for unary op.\n */\n\nexport function createSimpleUnaryImpl(op: SimpleUnaryOperation):\n SimpleUnaryImpl {\n return (values, dtype, attrs) => {\n const newValues =\n util.getTypedArrayFromDType(dtype as NumericDataType, values.length);\n\n for (let i = 0; i < values.length; ++i) {\n newValues[i] = op(values[i], attrs);\n }\n return newValues;\n };\n}\n\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n\n=====
*\n\nimport {DataType, KernelFunc, TypedArray, UnaryInputs, util} from '@tensorflow/tfjs-core';\n\nimport {MathBackendCPU} from './backend_cpu';\n\nimport {assertNotComplex} from './cpu_util';\n\nimport {SimpleUnaryImpl, SimpleUnaryOperation} from './unary_types';\n\n/**\n * Template that creates a `KernelFunc` for unary ops.\n * @param name Kernel name.\n * @param op A `SimpleUnaryOperation` for the kernel.\n * @param dtype Optional. If set, the result has this dtype. Otherwise, the\n * result has the same dtype as the input. This is mainly used in certain\n * kernels that return bool type, such as isFinite, isInf, etc.\n */\n\nexport function unaryKernelFunc(\n name: string, op: SimpleUnaryOperation, dtype?: DataType): KernelFunc {\n return ({inputs, attrs, backend}) => {\n const {x} = inputs as UnaryInputs;\n assertNotComplex(x, name);\n if (x.dtype === 'string' || dtype === 'string') {\n throw new Error('unaryKernelFunc does not support string input/output');\n }\n\n const cpuBackend = backend as MathBackendCPU;\n const values = cpuBackend.data.get(x.dataId).values as TypedArray;\n const xSize = util.sizeFromShape(x.shape);\n const $dtype = dtype || x.dtype;\n const newValues = util.getArrayFromDType($dtype, xSize);\n\n for (let i = 0; i < xSize; ++i) {\n newValues[i] = op(values[i], attrs);\n }\n\n return cpuBackend.makeTensorInfo(x.shape, $dtype, newValues);\n };\n}\n\n", "/*\n * Template that creates a `KernelFunc` for unary ops from the given\n * `SimpleUnaryImpl`.\n * @param name Kernel name.\n * @param unaryImpl A `SimpleUnaryImpl` that implements the op.\n * @param dtype Optional. If set, the result has this dtype. Otherwise, the\n * result has the same dtype as the input. This is mainly used in certain\n * kernels that return bool type, such as isFinite, isInf, etc.\n */\n\nexport function unaryKernelFuncFromImpl(\n name: string, unaryImpl: SimpleUnaryImpl, dtype?: DataType): KernelFunc {\n return ({inputs, attrs, backend}) => {\n const {x} = inputs as UnaryInputs;\n assertNotComplex(x, name);\n if (x.dtype === 'string' || dtype === 'string') {\n throw new Error('unaryKernelFunc does not support string input/output');\n }\n\n const cpuBackend = backend as MathBackendCPU;\n const values = cpuBackend.data.get(x.dataId).values as TypedArray;\n const $dtype = dtype || x.dtype;\n const newValues = unaryImpl(values, $dtype, attrs);\n\n return cpuBackend.makeTensorInfo(x.shape, $dtype, newValues);\n };\n}\n\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the License);\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an AS IS BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n */
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*\n\nimport {Ceil, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createSimpleUnaryImpl} from
'./utils/unary_impl';\n\nimport {unaryKernelFuncFromImpl} from './utils/unary_utils';\n\nexport const ceilImpl =
createSimpleUnaryImpl((xi) => Math.ceil(xi));\n\nexport const ceil = unaryKernelFuncFromImpl(Ceil,
ceilImpl);\n\nexport const ceilConfig: KernelConfig = {\n kernelName: Ceil,\n backendName: 'cpu',\n kernelFunc:
ceil,\n};\n\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache
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IS"\n * BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n *
See the License for the specific language governing permissions and\n * limitations under the License.\n *
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*\n\nimport {backend_util, BackendValues, DataType, TypedArray, util} from '@tensorflow/tfjs-core';\n\nexport
function concatImpl(\n inputs: Array<{ vals: BackendValues, shape: number[]}>, outShape: number[],\n dtype:
DataType, simplyConcat: boolean): TypedArray|string[] {\n const outVals = util.getArrayFromDType(dtype,
util.sizeFromShape(outShape));\n\n if (simplyConcat && dtype !== 'string') {\n // Use built-in TypedArray.set()
method for speed.\n let offset = 0;\n inputs.forEach(input => {\n const size =
util.sizeFromShape(input.shape);\n (outVals as TypedArray).set(input.vals as TypedArray, offset);\n offset
+= size;\n });\n } else {\n let colOffset = 0;\n inputs.forEach(input
=> {\n const decodedData = dtype === 'string' ?\n backend_util.fromUint8ToStringArray(input.vals as
Uint8Array[]) : \n input.vals as TypedArray;\n let tIdx = 0;\n for (let row = 0; row < input.shape[0];
++row) {\n const resIdx = row * outShape[1] + colOffset;\n for (let col = 0; col < input.shape[1]; ++col) {\n
 outVals[resIdx + col] = decodedData[tIdx++];\n }\n colOffset += input.shape[1];\n });\n }\n return outVals;\n }\n\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed
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on an AS IS BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
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*\n\nimport {Exp, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createSimpleUnaryImpl} from
'./utils/unary_impl';\n\nimport {unaryKernelFuncFromImpl} from './utils/unary_utils';\n\nexport const expImpl =
createSimpleUnaryImpl((xi) => Math.exp(xi));\n\nexport const exp = unaryKernelFuncFromImpl(Exp,
expImpl);\n\nexport const expConfig: KernelConfig = {\n kernelName: Exp,\n backendName: 'cpu',\n kernelFunc:
exp,\n};\n\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache
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BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the
License for the specific language governing permissions and\n * limitations under the License.\n *
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*\n\nimport {Expm1, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createSimpleUnaryImpl} from
'./utils/unary_impl';\n\nimport {unaryKernelFuncFromImpl} from './utils/unary_utils';\n\nexport const expm1Impl =
createSimpleUnaryImpl((xi) => Math.expm1(xi));\n\nexport const expm1 = unaryKernelFuncFromImpl(Expm1,
expm1Impl);\n\nexport const expm1Config: KernelConfig = {\n kernelName: Expm1,\n backendName: 'cpu',\n kernelFunc:
expm1,\n};\n\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed
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CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing
permissions and\n * limitations under the License.\n *
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\n
*/\n\nimport {Floor, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createSimpleUnaryImpl} from
'../utils/unary_impl';\nimport {unaryKernelFuncFromImpl} from '../utils/unary_utils';\n\nexport const floorImpl =
createSimpleUnaryImpl((xi) => Math.floor(xi));\nexport const floor = unaryKernelFuncFromImpl(Floor,
floorImpl);\n\nexport const floorConfig: KernelConfig = {\n kernelName: Floor,\n backendName: 'cpu',\n kernelFunc: floor,\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version
2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
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\n
*/\n\nimport {buffer, DataType, Rank, TensorBuffer} from '@tensorflow/tfjs-core';\n\nexport function
gatherV2Impl<R extends Rank, D extends DataType>(\n xBuf: TensorBuffer<R, D>, indicesBuf:
TensorBuffer<R, D>,\n flattenOutputShape: number[]): TensorBuffer<R, D> {\n const
outBuf = buffer(flattenOutputShape, xBuf.dtype);\n for (let i = 0; i < outBuf.size; ++i) {\n const newLoc =
outBuf.indexToLoc(i);\n const originalLoc: number[] = newLoc.slice();\n const batchIdx = originalLoc[0];\n const indicesIdx = originalLoc[2];\n const indicesIndex = indicesBuf.locToIndex([batchIdx, indicesIdx]);\n originalLoc[2] = indicesBuf.values[indicesIndex] as number;\n const originalIndex =
xBuf.locToIndex(originalLoc);\n outBuf.values[i] = xBuf.values[originalIndex];\n }\n return outBuf as
TensorBuffer<R, D>;\n}\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed
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an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
=====
\n
*/\n\nimport {Greater, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {createSimpleBinaryKernelImpl}
from '../utils/binary_impl';\nimport {binaryKernelFunc} from '../utils/binary_utils';\n\nexport const greaterImpl =\n
createSimpleBinaryKernelImpl((a: number, b: number) => (a > b) ? 1 : 0);\nexport const greater =\n
binaryKernelFunc(Greater, greaterImpl, null /* complexImpl */, 'bool');\n\nexport const greaterConfig:
KernelConfig = {\n kernelName: Greater,\n backendName: 'cpu',\n kernelFunc: greater,\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
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express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n *

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*/\n\nimport { KernelConfig, Less } from '@tensorflow/tfjs-core';\n\nimport { createSimpleBinaryKernelImpl } from
'./utils/binary_impl';\n\nimport { binaryKernelFunc } from './utils/binary_utils';\n\n\nexport const lessImpl =\ncreateSimpleBinaryKernelImpl((a: number, b: number) => (a < b) ? 1 : 0);\n\nexport const less =\nbinaryKernelFunc(Less, lessImpl, null /* complexImpl */, 'bool');\n\n\nexport const lessConfig: KernelConfig = {\nkernelName: Less,\nbackendName:
'cpu',\nkernelFunc: less\n};\n\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n *
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http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*/\n\nimport { TypedArray, util } from '@tensorflow/tfjs-core';\n\n\nexport function linspaceImpl(\nstart: number,
stop: number, num: number): TypedArray {\nconst step = (stop - start) / (num - 1);\n\nconst values =
util.makeZerosTypedArray(num,\n'float32');\nvalues[0] = start;\nfor (let i = 1; i < values.length; i++) {\nvalues[i] = values[i - 1] + step;\n}\n\nreturn values;\n}\n\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under
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License.\n *
=====
*/\n\nimport { KernelConfig, Log } from '@tensorflow/tfjs-core';\n\nimport { createSimpleUnaryImpl } from
'./utils/unary_impl';\n\nimport
{ unaryKernelFuncFromImpl } from './utils/unary_utils';\n\n\nexport const logImpl = createSimpleUnaryImpl((xi) =>
Math.log(xi));\n\nexport const log = unaryKernelFuncFromImpl(Log, logImpl);\n\n\nexport const logConfig:
KernelConfig = {\nkernelName: Log,\nbackendName: 'cpu',\nkernelFunc: log,\n};\n\n", "/*\n * @license\n *
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====
*/\n\nimport { DataType, NumericDataType, TypedArray, util } from '@tensorflow/tfjs-core';\n\n\nexport function
maxImpl(\n aVals: TypedArray, reduceSize: number, outShape: number[],\n dtype: DataType): TypedArray {\nconst vals = util.getTypedArrayFromDType(\n dtype as NumericDataType, util.sizeFromShape(outShape));\n\nfor (let i = 0; i < vals.length; ++i) {\nconst offset = i * reduceSize;\nlet max = aVals[offset];\nfor (let j = 0; j < reduceSize; ++j) {\nconst value = aVals[offset + j];\nif (value > max) {\nmax = value;\n}\n}\nvals[i] = max;\n}\n\nreturn vals;\n}\n\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n *
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=====
*\n\nimport { KernelConfig, Maximum } from '@tensorflow/tfjs-core';\n\nimport { createSimpleBinaryKernelImpl } from '../utils/binary_impl';\n\nimport { binaryKernelFunc } from '../utils/binary_utils';\n\n\nexport const maximumImpl = createSimpleBinaryKernelImpl(\n ((aValue, bValue) => Math.max(aValue, bValue)));
\nexport const maximum = binaryKernelFunc(Maximum, maximumImpl);\n\n\nexport const maximumConfig: KernelConfig = {\n kernelName: Maximum,\n backendName: 'cpu',\n kernelFunc: maximum\n};\n\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
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=====
*\n\nimport { KernelConfig, Minimum } from '@tensorflow/tfjs-core';\n\nimport { createSimpleBinaryKernelImpl } from '../utils/binary_impl';\n\nimport { binaryKernelFunc } from '../utils/binary_utils';\n\n\nexport const minimumImpl = createSimpleBinaryKernelImpl(\n ((aValue, bValue) => Math.min(aValue, bValue)));
\nexport const minimum = binaryKernelFunc(Minimum, minimumImpl);\n\n\nexport const minimumConfig: KernelConfig = {\n kernelName: Minimum,\n backendName: 'cpu',\n kernelFunc: minimum\n};\n\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
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=====
*\n\nimport { KernelConfig, Multiply } from '@tensorflow/tfjs-core';\n\nimport { createSimpleBinaryKernelImpl } from '../utils/binary_impl';\n\nimport { binaryKernelFunc, createComplexBinaryKernelImpl } from '../utils/binary_utils';\n\n\nexport const multiplyImpl =\n createSimpleBinaryKernelImpl(((aValue, bValue) => aValue * bValue));\n\nexport const multiplyComplexImpl =\n createComplexBinaryKernelImpl(((aReal, aImag, bReal, bImag) => {\n return {\n real: aReal * bReal - aImag * bImag,\n imag: aReal * bImag + aImag * bReal\n };\n }));\n\nexport const multiply =\n binaryKernelFunc(Multiply, multiplyImpl, multiplyComplexImpl);\n\n\nexport const multiplyConfig: KernelConfig = {\n kernelName: Multiply,\n backendName: 'cpu',\n kernelFunc: multiply\n};\n\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
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=====
*\n\nimport { DataType, KernelConfig, KernelFunc, Neg, TensorInfo, TypedArray, UnaryInputs, util } from '@tensorflow/tfjs-core';\n\nimport { MathBackendCPU } from '../backend_cpu';\n\nimport { assertNotComplex } from '../cpu_util';\n\nimport { multiplyImpl } from './Multiply';\n\n\nexport function negImpl(xVals: TypedArray, xShape: number[], xDtype: DataType):\n [TypedArray, number[]] {\n const minusOne =\n util.createScalarValue(-1 as
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{ } as 'float32', xDtype) as TypedArray;\n return multiplyImpl([], xShape, minusOne, xVals, xDtype);\n}\n\n\nexport
function neg(args: {inputs: UnaryInputs, backend: MathBackendCPU}): \n TensorInfo {\n const {inputs,
backend} = args;\n const {x} =
inputs;\n\n assertNotComplex(x, 'neg');\n\n const xVals = backend.data.get(x.dataId).values as TypedArray;\n
const [res, newShape] = negImpl(xVals, x.shape, x.dtype);\n\n return backend.makeTensorInfo(newShape, x.dtype,
res);\n}\n\n\nexport const negConfig: KernelConfig = {\n kernelName: Neg,\n backendName: 'cpu',\n kernelFunc:
neg as { } as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n *
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n
* =====\n
*\n\nimport { KernelConfig, NotEqual } from '@tensorflow/tfjs-core';\n\nimport { createSimpleBinaryKernelImpl }
from '../utils/binary_impl';\nimport { binaryKernelFunc } from '../utils/binary_utils';\n\nexport const notEqualImpl
=\n createSimpleBinaryKernelImpl(((a, b) => (a !== b) ? 1 : 0));\nexport const notEqual =\n
binaryKernelFunc(NotEqual, notEqualImpl, null /* complexOp */, 'bool');\n\nexport const notEqualConfig:
KernelConfig = {\n kernelName: NotEqual,\n backendName: 'cpu',\n kernelFunc: notEqual\n};\n", "/*\n *
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under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF
ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n *
limitations under the License.\n
* =====\n
*\n\nimport { DataType, NumericDataType, TypedArray } from '@tensorflow/tfjs-core';\nimport { util } from
'@tensorflow/tfjs-core';\n\nexport function transposeImpl(\n xVals: TypedArray, xShape: number[], dtype:
DataType, perm: number[],\n newShape: number[]): TypedArray {\n const xRank = xShape.length;\n const xSize
= util.sizeFromShape(xShape);\n const xStrides = util.computeStrides(xShape);\n const newStrides =
util.computeStrides(newShape);\n\n const result = util.getTypedArrayFromDType(\n dtype as
NumericDataType, util.sizeFromShape(newShape));\n\n for (let i = 0; i < xSize; ++i) {\n const loc =
util.indexToLoc(i, xRank, xStrides);\n\n // Permute
location.\n const newLoc: number[] = new Array(loc.length);\n for (let i = 0; i < newLoc.length; i++) {\n
newLoc[i] = loc[perm[i]];\n }\n\n const newIndex = util.locToIndex(newLoc, xRank, newStrides);\n
result[newIndex] = xVals[i];\n }\n return result;\n}\n", "/*\n * @license\n * Copyright 2020 Google LLC. All
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http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n
* =====\n
*\n\nimport { KernelConfig, KernelFunc, TensorInfo, Transpose, TransposeAttrs, TransposeInputs, TypedArray }
from '@tensorflow/tfjs-core';\nimport { MathBackendCPU } from '../backend_cpu';\nimport { assertNotComplex }
from '../cpu_util';\nimport { transposeImpl } from './Transpose_impl';\n\nexport function transpose(args: {\n inputs:
TransposeInputs,\n attrs: TransposeAttrs,\n backend: MathBackendCPU\n}): TensorInfo {\n const {inputs, attrs,

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backend} = args;\n const {x} = inputs;\n const {perm} = attrs;\n\n assertNotComplex(x, 'transpose');\n\n const
xRank = x.shape.length;\n\n const newShape: number[] = new Array(xRank);\n for (let i = 0; i < newShape.length;
i++) {\n newShape[i] = x.shape[perm[i]];\n }\n\n const values = backend.data.get(x.dataId).values as
TypedArray;\n const result = transposeImpl(values, x.shape, x.dtype, perm, newShape);\n\n const dataId =
backend.write(result, newShape, x.dtype);\n return {dataId, shape: newShape, dtype: x.dtype};\n}\n\n\nexport
const transposeConfig: KernelConfig = {\n kernelName: Transpose,\n backendName: 'cpu',\n kernelFunc:
transpose as {} as KernelFunc\n};\n\n", "/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n *
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
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=====
*/\n\nimport {backend_util, DataType, KernelConfig, KernelFunc, Prod, ProdAttrs, ProdInputs, TensorInfo,
TypedArray, upcastType, util}
from '@tensorflow/tfjs-core';\n\nimport {MathBackendCPU} from '../backend_cpu';\n\nimport {assertNotComplex}
from '../cpu_util';\n\nimport {transpose} from '../Transpose';\n\n\nexport function prodImpl(\n xShape: number[],
xDtype: DataType, xVals: TypedArray,\n reductionAxes: number[]:\n {outVals: TypedArray, outShape:
number[], outDtype: DataType} {\n const [outShape, reduceShape] =\n backend_util.computeOutAndReduceShapes(xShape, reductionAxes);\n const outDtype = upcastType(xDtype,
'int32');\n const outVals = util.makeZerosTypedArray(\n util.sizeFromShape(outShape), outDtype) as
TypedArray;\n const reduceSize = util.sizeFromShape(reduceShape);\n\n for (let i = 0; i < outVals.length; ++i) {\n
 const offset = i * reduceSize;\n let prod = 1;\n for (let j = 0; j < reduceSize; ++j) {\n prod *= xVals[offset +
j];\n }\n outVals[i] = prod;\n }\n\n return {outVals, outShape, outDtype};\n}\n\n\nexport function prod(\n args:
{inputs: ProdInputs,
 backend: MathBackendCPU, attrs: ProdAttrs});\n TensorInfo {\n const {inputs, backend, attrs} = args;\n const
{x} = inputs;\n const {axis, keepDims} = attrs;\n\n assertNotComplex(x, 'prod');\n\n const xRank =
x.shape.length;\n const axes = util.parseAxisParam(axis, x.shape);\n\n const permutation =
backend_util.getAxesPermutation(axes, xRank);\n let reductionAxes = axes;\n let permutedX = x;\n const
intermediateTensorInfos = [];\n if (permutation != null) {\n permutedX = transpose({inputs: {x}, backend, attrs:
{perm: permutation}});\n intermediateTensorInfos.push(permutedX);\n reductionAxes =
backend_util.getInnerMostAxes(reductionAxes.length, xRank);\n }\n\n const xVals =
backend.data.get(permutedX.dataId).values as TypedArray;\n const {outVals, outShape, outDtype} =\n prodImpl(permutedX.shape, permutedX.dtype, xVals, reductionAxes);\n\n let resultShape = outShape;\n if
(keepDims) {\n resultShape = backend_util.expandShapeToKeepDim(outShape,
axes);\n }\n\n intermediateTensorInfos.forEach(\n t => backend.disposeIntermediateTensorInfo(t);\n);\n\n return
backend.makeTensorInfo(resultShape, outDtype, outVals);\n}\n\n\nexport const prodConfig: KernelConfig = {\n
 kernelName: Prod,\n backendName: 'cpu',\n kernelFunc: prod as {} as KernelFunc\n};\n\n", "/**\n * @license\n *
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====
*/\n\nimport {DataTypeMap, util} from '@tensorflow/tfjs-core';\n\n\nexport function rangeImpl(\n start: number,
stop: number, step: number,\n dtype: 'float32'|'int32'): DataTypeMap['float32' | 'int32'] {\n const sameStartStop =

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start === stop;\n const increasingRangeNegativeStep = start < stop && step < 0;\n const
decreasingRangePositiveStep = stop < start && step > 1;\n\n if (sameStartStop || increasingRangeNegativeStep ||\n
 decreasingRangePositiveStep) {\n return util.makeZerosTypedArray(0, dtype);\n } \n\n const numElements =
Math.abs(Math.ceil((stop - start) / step));\n const values = util.makeZerosTypedArray(numElements, dtype);\n\n if
(stop < start && step === 1) {\n // Auto adjust the step's sign if it hasn't been set\n // (or was set to 1)\n step = -
1;\n } \n\n values[0] = start;\n for (let i = 1; i < values.length; i++) {\n values[i] = values[i - 1] + step;\n } \n
return values;\n } \n", "/*\n * @license\n * Copyright
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CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing
permissions and\n * limitations under the License.\n *
===== \n
*/\n\nimport { KernelConfig, Rsqrt } from '@tensorflow/tfjs-core';\n\nimport { createSimpleUnaryImpl } from
'./utils/unary_impl';\nimport { unaryKernelFuncFromImpl } from './utils/unary_utils';\n\nexport const rsqrtImpl =
createSimpleUnaryImpl((xi) => 1 / Math.sqrt(xi));\n\nexport const rsqrt = unaryKernelFuncFromImpl(Rsqrt,
rsqrtImpl);\n\nexport const rsqrtConfig: KernelConfig = {\n kernelName: Rsqrt,\n backendName: 'cpu',\n kernelFunc: rsqrt,\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed
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on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
===== \n
*/\n\nimport { backend_util, BackendValues, buffer, DataType, KernelConfig, KernelFunc, Slice, slice_util,
SliceAttrs, SliceInputs, TensorInfo,
TypedArray, util } from '@tensorflow/tfjs-core';\n\nimport { MathBackendCPU } from './backend_cpu';\nimport
{ assertNotComplex } from './cpu_util';\n\nexport function sliceImpl(\n vals: BackendValues, begin: number[],
size: number[], shape: number[],\n dtype: DataType): BackendValues {\n const isContinuous =
slice_util.isSliceContinuous(shape, begin, size);\n const length = util.sizeFromShape(size);\n const xStrides =
util.computeStrides(shape);\n\n if (isContinuous) {\n const flatOffset = slice_util.computeFlatOffset(begin,
xStrides);\n\n if (dtype === 'string') {\n return (vals as Uint8Array[]).slice(flatOffset, flatOffset + length);\n
 }\n\n return (vals as TypedArray).subarray(flatOffset, flatOffset + length);\n }\n\n const decodedData = dtype
=== 'string' ?\n backend_util.fromUint8ToStringArray(vals as Uint8Array[]) :\n vals as TypedArray;\n\n const inBuf = buffer(shape, dtype, decodedData);\n const outBuf = buffer(size, dtype);\n for (let i =
0; i < outBuf.size; ++i) {\n const outLoc = outBuf.indexToLoc(i);\n const inLoc = outLoc.map((idx: number, j)
=> idx + begin[j]);\n outBuf.set(inBuf.get(...inLoc), ...outLoc);\n }\n\n if (dtype === 'string') {\n return
backend_util.fromStringArrayToUint8(outBuf.values as string[]);\n }\n return outBuf.values as
TypedArray;\n}\n\nexport function slice(\n args: { inputs: SliceInputs, backend: MathBackendCPU, attrs:
SliceAttrs }):\n TensorInfo {\n const { inputs, backend, attrs } = args;\n const { x } = inputs;\n const { begin, size } =
attrs;\n\n assertNotComplex(x, 'slice');\n\n const [$begin, $size] = slice_util.parseSliceParams(x, begin, size);\n\n
slice_util.assertParamsValid(x, $begin, $size);\n\n const vals = backend.data.get(x.dataId).values;\n const outVals
= sliceImpl(vals, $begin, $size, x.shape, x.dtype);\n return backend.makeTensorInfo($size, x.dtype,
outVals);\n}\n\nexport const sliceConfig: KernelConfig = {\n kernelName: Slice,\n backendName: 'cpu',\n kernelFunc: slice as { } as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
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=====
*\n\nimport { KernelConfig, SquaredDifference } from '@tensorflow/tfjs-core';\n\nimport
{createSimpleBinaryKernelImpl} from '../utils/binary_impl';\nimport {binaryKernelFunc} from
'../utils/binary_utils';\n\nexport const squaredDifferenceImpl
= createSimpleBinaryKernelImpl(((a, b) => {\n const diff = a - b;\n return diff * diff;\n}));\nexport const
squaredDifference =\n binaryKernelFunc(SquaredDifference, squaredDifferenceImpl);\n\nexport const
squaredDifferenceConfig: KernelConfig = {\n kernelName: SquaredDifference,\n backendName: 'cpu',\n kernelFunc: squaredDifference\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n *
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http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
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=====
*\n\nimport { buffer, Rank, TensorBuffer } from '@tensorflow/tfjs-core';\n\nexport function stridedSliceImpl<R
extends Rank>(\n outShape: number[], xBuf: TensorBuffer<R>, strides: number[],\n begin: number[]):
TensorBuffer<R> {\n const outBuf = buffer(outShape, xBuf.dtype);\n for (let i = 0; i < outBuf.size; i++) {\n
const loc = outBuf.indexToLoc(i);\n const newLoc: number[] = new Array(loc.length);\n for (let j = 0; j <
newLoc.length; j++) {\n newLoc[j] = loc[j] * strides[j] + begin[j];\n }\n outBuf.set(xBuf.get(...newLoc),
...loc);\n }\n return outBuf as TensorBuffer<R>;\n}\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All
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express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n *
=====
*\n\nimport { KernelConfig, Sub } from '@tensorflow/tfjs-core';\n\nimport {createSimpleBinaryKernelImpl} from
'../utils/binary_impl';\nimport {binaryKernelFunc, createComplexBinaryKernelImpl} from
'../utils/binary_utils';\n\nexport const subImpl =\n createSimpleBinaryKernelImpl(((aValue, bValue) => aValue -
bValue));\nexport const subComplexImpl =\n createComplexBinaryKernelImpl(((aReal, aImag, bReal, bImag) =>
{\n return {real: aReal - bReal, imag: aImag - bImag};\n }));\nexport const sub = binaryKernelFunc(Sub,
subImpl, subComplexImpl);\n\nexport const subConfig:
KernelConfig = {\n kernelName: Sub,\n backendName: 'cpu',\n kernelFunc: sub\n};\n\n"/**\n * @license\n *
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*\/n\nimport {buffer, DataType, Rank, TensorBuffer} from '@tensorflow/tfjs-core';\n\n/**\n * An implementation of the tile kernel shared between webgl and cpu for string\n * tensors only.\n\n *\/n\nexport function tileImpl<R extends Rank>(\n xBuf: TensorBuffer<R, DataType>,\n reps: number[]:\n TensorBuffer<R, DataType> {\n const newShape: number[] = new Array(xBuf.rank);\n for (let i = 0; i < newShape.length; i++) {\n newShape[i] = xBuf.shape[i] * reps[i];\n }\n const result = buffer(newShape, xBuf.dtype);\n for (let i = 0; i < result.values.length; ++i) {\n const newLoc = result.indexToLoc(i);\n const originalLoc: number[] = new Array(xBuf.rank);\n for (let j = 0; j < originalLoc.length; j++) {\n originalLoc[j] = newLoc[j] % xBuf.shape[j];\n }\n const originalIndex = xBuf.locToIndex(originalLoc);\n result.values[i] = xBuf.values[originalIndex];\n }\n return result as TensorBuffer<R, DataType>;\n }\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */

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*\/n\n/** An implementation of the TopK kernel shared between webgl and cpu. */\n\nimport {buffer, NumericDataType, Rank, ShapeMap, Tensor, TensorBuffer, TypedArray, util} from '@tensorflow/tfjs-core';\n\nexport function topKImpl<T extends Tensor, R extends Rank>(\n x: TypedArray, xShape: number[],\n xDtype: NumericDataType, k: number,\n sorted: boolean):\n [TensorBuffer<R, NumericDataType>,\n TensorBuffer<R, 'int32'>] {\n // Reshape into a 2d tensor [batch, lastDim] and compute topk along lastDim.\n const lastDim = xShape[xShape.length - 1];\n const [batch, size] = [x.length / lastDim, lastDim];\n const allTopKVals = util.getTypedArrayFromDType(xDtype, batch * k);\n const allTopKIndices = util.getTypedArrayFromDType('int32', batch * k);\n\n for (let b = 0; b < batch; b++) {\n const offset = b * size;\n const vals = x.subarray(offset, offset + size);\n const valAndInd: Array<{value: number, index: number}> = [];\n for (let i = 0; i < vals.length; i++) {\n valAndInd.push({value: vals[i], index: i});\n }\n valAndInd.sort((a, b) => b.value - a.value);\n const outOffset = b * k;\n const topKVals = allTopKVals.subarray(outOffset, outOffset + k);\n const topKIndices = allTopKIndices.subarray(outOffset, outOffset + k);\n for (let i = 0; i < k; i++) {\n topKVals[i] = valAndInd[i].value;\n topKIndices[i] = valAndInd[i].index;\n }\n }\n // Reshape back to the original input shape, except that the last\n // dimension is k.\n const outputShape = xShape.slice();\n outputShape[outputShape.length - 1] = k;\n\n return [\n buffer(outputShape as ShapeMap[R], xDtype, allTopKVals),\n buffer(outputShape as ShapeMap[R], 'int32', allTopKIndices)\n];\n }\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */

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*\/n\nimport {BackendValues, DataType, TensorBuffer, TypedArray, util} from '@tensorflow/tfjs-core';\n\nexport function uniqueImpl(\n values: BackendValues, axis: number, shape: number[], dtype: DataType): {\n outputValues: BackendValues,\n outputShape: number[],\n indices: BackendValues\n } {\n // Normalize and validate axis.\n const $axis = util.parseAxisParam(axis, shape)[0];\n\n // Calculate the new shape that is suitable for extracting data along the\n // given axis.\n // The rank is 3.\n // The size of the 1st dimension is the size of all the axes < the given axis.\n // The size of the 2nd dimension is the same as the size of the given axis.\n // The size of the 3rd dimension is the size of all the axes > the given axis.\n // For example, for a 4D tensor with shape=[2, 3, 5, 4] and axis=2, the\n // newShape would be: [2*3, 5, 4].\n // Note that this is not the final output shape. This will be the shape for an\n // intermediate TensorBuffer (see inputBuffer

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below) to allow us to extract\n // values along

the given axis. To demonstrate how it works, consider the\n // following example:\n //\n // Input: a 3D tensor, with shape [1, 2, 3]\n // [\n // [\n // [1,2,3],\n // [4,5,6]\n // ]\n // ]\n // Axis: 2 (the last axis).\n // Along axis 2, we expect to extract 3 tensors: [1,4], [2,5], [3,6].\n //\n // For this example, newShape would be: [2, 3, 1], where 2 is calculated from\n // 1\*2. The re-shaped data would look like:\n //\n // [\n // [\n // [1], [2], [3]\n // ],\n // [\n // [4], [5], [6]\n // ]\n // ]\n //\n // Then, we can construct a 3-level nested loop by the following dimension\n // order to extract the values along the axis (dimension1):\n // i: dimension1 // 0,1,2

(newShape[1])\n // m: dimension0 // 0,1 (newShape[0])\n // n: dimension2 // 0 (newShape[2])\n //\n // m, i, n\n // ----- \n // Iteration 0: data at [0, 0, 0] => \"1\"\n // Iteration 1:

data at [1, 0, 0] => \"4\"\n // We got [1,4].\n // Iteration 2: data at [0, 1, 0] => \"2\"\n // Iteration 3: data at [1, 1, 0] => \"5\"\n // We got [2,5].\n // Iteration 4: data at [0, 2, 0] => \"3\"\n // Iteration 5: data at [1, 2, 0] => \"6\"\n // We got [3,6].

const newShape = [1, shape[0], 1];\n for (let i = 0; i < \$axis; i++) {\n newShape[0] \*= shape[i];\n }\n newShape[1] = shape[\$axis];\n for (let i = \$axis + 1; i < shape.length; i++) {\n newShape[2] \*= shape[i];\n }\n\n

// A map from unique elements (their string representations) to their values\n // in \"indices\" (below).\n const uniqueElements: {[key: string]: number} = {};\n // The indices of each unique element in the original tensor along the given\n // axis. It is 1D and has the same size as the given axis.\n const indices = new

Int32Array(shape[\$axis]);\n // Create a buffer so we can easily extract value at a given location.\n const inputBuffer = new TensorBuffer(newShape, dtype, values as

TypedArray);\n // The indices along the given axis that have unique elements. This is a\n // de-duped version of \"indices\" above.\n const uniqueIndices: number[] = [];\n const is1DTensor = newShape[0] === 1 && newShape[2] === 1;\n for (let i = 0; i < shape[\$axis]; i++) {\n // Extract values along the axis.\n let element: string;\n if (is1DTensor) {\n // Fast path for 1D tensor input.\n element = values[i].toString();\n } else {\n const axisValues = [];\n for (let m = 0; m < newShape[0]; m++) {\n for (let n = 0; n < newShape[2]; n++) {\n axisValues.push(inputBuffer.get(m, i, n));\n }\n }\n element = axisValues.join(',');\n }\n\n // Dedup and update various indices.\n if (uniqueElements[element] !== undefined) {\n indices[i] = uniqueElements[element];\n } else {\n const uniqueIndex = Object.keys(uniqueElements).length;\n uniqueElements[element] = uniqueIndex;\n indices[i] = uniqueIndex;\n

uniqueIndices.push(i);\n }\n }\n\n // Now we know where each of the unique elements are located along the axis\n // (uniqueIndices). Extract them from input buffer and store them in the\n // output buffer.\n const outputTmpShape = newShape.slice();\n outputTmpShape[1] = Object.keys(uniqueElements).length;\n const outputBuffer = new TensorBuffer(outputTmpShape, dtype);\n uniqueIndices.forEach((uniqueElementIndex, i) => {\n for (let m = 0; m < newShape[0]; m++) {\n for (let n = 0; n < newShape[2]; n++) {\n outputBuffer.set(inputBuffer.get(m, uniqueElementIndex, n), m, i, n);\n }\n }\n });\n\n // The output shape can be calculated from the input shape with the size of\n // the given axis replaced by the number of unique elements along that axis.\n const outputShape = shape.slice();\n outputShape[\$axis] = outputTmpShape[1];\n\n return {\n outputValues: outputBuffer.values as BackendValues,\n outputShape,\n indices,\n };\n }, \"/\*\*\n

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=====\n\n \*\n // Shared functionality among backends.\n export {simpleAbsImpl} from './kernels/Abs';\n export {addImpl} from './kernels/Add';\n export {bincountImpl, bincountReduceImpl} from './kernels/Bincount\_impl';\n export {ceilImpl} from './kernels/Ceil';\n export {concatImpl} from './kernels/Concat\_impl';\n export {expImpl} from './kernels/Exp';\n export {expm1Impl} from './kernels/Expm1';\n export {floorImpl} from './kernels/Floor';\n export {gatherV2Impl} from './kernels/GatherV2\_impl';\n export {greaterImpl} from

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./kernels/Greater';\nextport {lessImpl} from './kernels/Less';\nextport {linSpaceImpl} from
./kernels/LinSpace_impl';\nextport {logImpl} from './kernels/Log';\nextport {maxImpl} from
./kernels/Max_impl';\nextport {maximumImpl} from './kernels/Maximum';\nextport {minimumImpl} from
./kernels/Minimum';\nextport {multiplyImpl} from './kernels/Multiply';\nextport {negImpl} from
./kernels/Neg';\nextport {notEqualImpl} from './kernels/NotEqual';\nextport {prodImpl} from
./kernels/Prod';\nextport {rangeImpl} from './kernels/Range_impl';\nextport {rsqrtImpl} from
./kernels/Rsqrt';\nextport {sliceImpl} from './kernels/Slice';\nextport {squaredDifferenceImpl} from
./kernels/SquaredDifference';\nextport {stridedSliceImpl} from './kernels/StridedSlice_impl';\nextport {subImpl}
from './kernels/Sub';\nextport
{tileImpl} from './kernels/Tile_impl';\nextport {topKImpl} from './kernels/TopK_impl';\nextport {transposeImpl}
from './kernels/Transpose_impl';\nextport {uniqueImpl} from './kernels/Unique_impl';\nextport
{ComplexBinaryKernelImpl, SimpleBinaryKernelImpl} from './utils/binary_types';\n", "\n/**\n * @license\n *
Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
"License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====
*/\n\n// Import shared functionality from tfjs-backend-cpu without triggering\n// side effects.\n\n// tslint:disable-next-
line: no-imports-from-dist\nimport * as shared from '@tensorflow/tfjs-backend-cpu/dist/shared';\n\n// tslint:disable-
next-line: no-imports-from-dist\nimport {SimpleBinaryKernelImpl} from '@tensorflow/tfjs-backend-
cpu/dist/shared';\n\n// tslint:disable-next-line: no-imports-from-dist\nimport {SimpleUnaryImpl} from
'@tensorflow/tfjs-backend-cpu/dist/utils/unary_types';\n\n\nexport type SimpleBinaryKernelImplCPU =
SimpleBinaryKernelImpl;\nextport type SimpleUnaryKernelImplCPU = SimpleUnaryImpl;\nconst {\n addImpl:
addImplCPU,\n bincountImpl: bincountImplCPU,\n bincountReduceImpl: bincountReduceImplCPU,\n ceilImpl:
ceilImplCPU,\n concatImpl: concatImplCPU,\n expImpl: expImplCPU,\n expm1Impl: expm1ImplCPU,\n
floorImpl: floorImplCPU,\n gatherV2Impl: gatherV2ImplCPU,\n greaterImpl: greaterImplCPU,\n lessImpl:
lessImplCPU,\n linSpaceImpl: linSpaceImplCPU,\n
logImpl: logImplCPU,\n maxImpl: maxImplCPU,\n maximumImpl: maximumImplCPU,\n minimumImpl:
minimumImplCPU,\n multiplyImpl: multiplyImplCPU,\n negImpl: negImplCPU,\n prodImpl: prodImplCPU,\n
rangeImpl: rangeImplCPU,\n rsqrtImpl: rsqrtImplCPU,\n simpleAbsImpl: simpleAbsImplCPU,\n sliceImpl:
sliceImplCPU,\n stridedSliceImpl: stridedSliceImplCPU,\n subImpl: subImplCPU,\n tileImpl: tileImplCPU,\n
topKImpl: topKImplCPU,\n transposeImpl: transposeImplCPU,\n uniqueImpl: uniqueImplCPU,\n} =
shared;\n\nexport {\n addImplCPU,\n bincountImplCPU,\n bincountReduceImplCPU,\n ceilImplCPU,\n
concatImplCPU,\n expImplCPU,\n expm1ImplCPU,\n floorImplCPU,\n gatherV2ImplCPU,\n
greaterImplCPU,\n lessImplCPU,\n linSpaceImplCPU,\n logImplCPU,\n maxImplCPU,\n maximumImplCPU,\n
minimumImplCPU,\n multiplyImplCPU,\n negImplCPU,\n prodImplCPU,\n simpleAbsImplCPU,\n
sliceImplCPU,\n stridedSliceImplCPU,\n subImplCPU,\n rangeImplCPU,\n rsqrtImplCPU,\n tileImplCPU,\n
topKImplCPU,\n transposeImplCPU,\n uniqueImplCPU,\n};\n", "\n/**\n * @license\n * Copyright 2018 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not
use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*/\n\nexport function getVecChannels(name: string, rank: number): string[] {\n return ['x', 'y', 'z', 'w', 'u', 'v'].slice(0,

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rank).map(d => `${name}.${d}`);\n\n\nexport function getChannels(name: string, rank: number):
string[] {\n if (rank === 1) {\n return [name];\n }\n return getVecChannels(name, rank);\n}\n\n\nexport function
getSourceCoords(rank: number, dims: string[]): string {\n if (rank === 1) {\n return 'rc';\n }\n\n let coords = ";\n
for (let i = 0; i < rank; i++) {\n coords += dims[i];\n if (i < rank - 1) {\n coords += ',';\n }\n }\n return
coords;\n}" , "/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations
under the License.\n *
=====
*\n\nimport {GPGPUProgram} from './gpgpu_math';\nimport {getChannels} from './packing_util';\nimport
{getCoordsDataType} from './shader_compiler';\n\nexport class PackProgram implements GPGPUProgram {\n
variableNames = ['A'];\n outputShape: number[];\n userCode: string;\n packedInputs = false;\n packedOutput =
true;\n\n constructor(\n outputShape: number[]) {\n //
TODO(https://github.com/tensorflow/tfjs/issues/893):\n // Only input / output 3D tensors.\n
this.outputShape = outputShape;\n const rank = outputShape.length;\n\n if (rank === 0) {\n this.userCode =
`\n void main() {\n setOutput(vec4(getA(), 0., 0., 0.));\n }\n `;\n } else {\n const channels =
getChannels('rc', rank);\n const dtype = getCoordsDataType(rank);\n const outOfBoundsCondition =\n
getOutOfBoundsCondition(rank,
outputShape, channels);\n const setup = getSetup(\n rank, outputShape[outputShape.length - 1],\n
outputShape[outputShape.length - 2], channels);\n const output = getOutput(outputShape, channels);\n\n
this.userCode = `\n void main() {\n ${dtype} rc = getOutputCoords();\n\n
if(${outOfBoundsCondition}) {\n setOutput(vec4(0));\n } else {\n ${setup}\n\n
setOutput(vec4(${output}));\n }\n }\n `;\n }\n }\n\n\nfunction getSourceCoordsArr(rank: number,
dims: string[]): string[] {\n const coords = [];\n\n for (let row = 0; row <= 1; row++) {\n for (let col = 0; col <= 1;
col++) {\n let coord = `${row === 0 ? 'r' : 'rp1'}`, ${col === 0 ? 'c' : 'cp1'}`;\n\n for (let d = 2; d < rank; d++)
{\n coord = `${dims[dims.length - 1 - d]},` + coord;\n }\n\n coords.push(coord);\n }\n }\n\n return
coords;\n}\n\n\nfunction getOutOfBoundsCondition(\n
rank: number, shape: number[], dims: string[]): string {\n if (rank === 1) {\n return `rc > ${shape[0]}`;\n }\n\n
let cond = ";\n for (let i = rank - 2; i < rank; i++) {\n cond += `${dims[i]} >= ${shape[i]}`;\n if (i < rank - 1) {\n
cond += '||';\n }\n }\n\n return cond;\n}\n\n\nfunction getSetup(\n rank: number, cols: number, rows: number,
dims: string[]): string {\n if (rank === 1) {\n return ";\n }\n\n const innerDims = dims.slice(-2);\n\n return `\n
int r = ${innerDims[0]};\n int c = ${innerDims[1]};\n int rp1 = r + 1;\n int cp1 = c + 1;\n bool cEdge = cp1
>= ${cols};\n bool rEdge = rp1 >= ${rows};\n `;\n }\n\n\nfunction getOutput(shape: number[], dims: string[]):
string {\n const rank = shape.length;\n const sourceCoords = getSourceCoordsArr(rank, dims);\n if (rank === 1)
{\n return `getA(rc),\n rc + 1 >= ${shape[0]} ? 0 : getA(rc + 1),\n 0, 0`;\n }\n\n return
`getA(${sourceCoords[0]}),\n
cEdge ? 0 : getA(${sourceCoords[1]}),\n rEdge ? 0 : getA(${sourceCoords[2]}),\n rEdge || cEdge ?
0 : getA(${sourceCoords[3]})`;\n }\n\n" , "/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n *
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compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
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*\n\nimport { GPGPUProgram } from './gpgpu_math';\nimport * as shader_util from
'./shader_compiler_util';\n\nexport class
ReshapePackedProgram implements GPGPUProgram {\n variableNames = ['A'];\n packedInputs = true;\n packedOutput = true;\n outputShape: number[];\n userCode: string;\n\n constructor(outputShape: [number,
number, number], inputShape: [number, number, number]\n) {\n this.outputShape = outputShape;\n\n let
mainLoop = ``;\n for (let i = 0; i < 4; i++) {\n let thisRC = `thisRC = rc;`\n if (i % 2 === 1) {\n thisRC
+= `thisRC.z += 1;`\n }\n if (i > 1) {\n thisRC += `thisRC.y += 1;`\n }\n mainLoop += `\n
${thisRC}\n ${i > 0 ? `if(thisRC.y < rows && thisRC.z < cols){` : ``}\n int flatIndex =
getFlatIndex(thisRC);\n ivec3 inputRC = inputCoordsFromReshapedOutCoords(flatIndex);\n vec2
inputRCInnerDims = vec2(float(inputRC.y),float(inputRC.z));\n result[${i}] =\n getChannel(getA(inputRC.x, inputRC.y, inputRC.z), inputRCInnerDims);\n ${i > 0 ? `}` : ``}\n
`;\n }\n\n this.userCode = `\n ${getReshapedInputCoords(inputShape)}\n
${shader_util.getFlatIndexFrom3D(outputShape)}\n\n void main() {\n ivec3 rc = getOutputCoords();\n\n
vec4 result = vec4(0.);\n ivec3 thisRC;\n int rows = ${outputShape[1]};\n int cols =
${outputShape[2]};\n\n ${mainLoop}\n\n setOutput(result);\n }\n `;\n\n }\n\n function
getReshapedInputCoords(shape: [number, number, number]): string {\n const coordsFromIndexSnippet =\n shader_util.getLogicalCoordinatesFromFlatIndex(['r', 'c', 'd'], shape);\n\n return `\n ivec3
inputCoordsFromReshapedOutCoords(int index) {\n ${coordsFromIndexSnippet}\n return ivec3(r, c, d);\n
}\n `;\n }\n /**\n * @license\n * Copyright 2017 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the
License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n */
}\n\n\n*\n\nimport { env } from '@tensorflow/tfjs-core';\nimport { GPGPUContext } from './gpgpu_context';\nimport
{ getInternalFormatForFloat16MatrixTexture, getInternalFormatForFloat16PackedMatrixTexture,
getInternalFormatForFloat32MatrixTexture, getInternalFormatForPackedMatrixTexture,
getInternalFormatForUnsignedBytesMatrixTexture } from './gpgpu_util';\nimport
{ getPackedMatrixTextureShapeWidthHeight, getUnpackedMatrixTextureShapeWidthHeight, PhysicalTextureType,
TextureConfig, TextureUsage } from './tex_util';\n\nexport class
TextureManager {\n private numUsedTextures = 0;\n private numFreeTextures = 0;\n private
_numBytesAllocated = 0;\n private _numBytesFree = 0; // How many bytes that have been allocated\n
// are available for reuse.\n private freeTextures: {[shape: string]: WebGLTexture[]} = {};\n private
logEnabled = false;\n private usedTextures: {[shape: string]: WebGLTexture[]} = {};\n\n constructor(private
gpgpu: GPGPUContext) {\n\n acquireTexture(\n shapeRC: [number, number], usage: TextureUsage,\n
isPacked: boolean): WebGLTexture {\n const physicalTexType = getPhysicalFromLogicalTextureType(usage,
isPacked);\n\n const shapeKey = getKeyFromTextureShape(shapeRC, physicalTexType, isPacked);\n if
(! (shapeKey in this.freeTextures)) {\n this.freeTextures[shapeKey] = [];\n }\n if (! (shapeKey in
this.usedTextures)) {\n this.usedTextures[shapeKey] = [];\n }\n\n const texBytes = computeBytes(\n
shapeRC, physicalTexType,
this.gpgpu.gl, this.gpgpu.textureConfig,\n isPacked);\n\n if (this.freeTextures[shapeKey].length > 0) {\n
this.numFreeTextures--;\n this.numUsedTextures++;\n this._numBytesFree -= texBytes;\n this.log();\n
const newTexture = this.freeTextures[shapeKey].shift();\n this.usedTextures[shapeKey].push(newTexture);\n
return newTexture;\n }\n\n let newTexture: WebGLTexture;\n if (physicalTexType ===
PhysicalTextureType.PACKED_2X2_FLOAT32) {\n newTexture =
this.gpgpu.createPackedMatrixTexture(shapeRC[0], shapeRC[1]);\n } else if (physicalTexType ===

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PhysicalTextureType.PACKED_2X2_FLOAT16) {\n newTexture =\n
this.gpgpu.createFloat16PackedMatrixTexture(shapeRC[0], shapeRC[1]);\n } else if (physicalTexType ===
PhysicalTextureType.UNPACKED_FLOAT32) {\n newTexture =\n
this.gpgpu.createFloat32MatrixTexture(shapeRC[0], shapeRC[1]);\n } else if (physicalTexType ===
PhysicalTextureType.UNPACKED_FLOAT16) {\n
 newTexture =\n this.gpgpu.createFloat16MatrixTexture(shapeRC[0], shapeRC[1]);\n } else if (\n
physicalTexType === PhysicalTextureType.PACKED_4X1_UNSIGNED_BYTE) {\n newTexture =\n
this.gpgpu.createUnsignedBytesMatrixTexture(shapeRC[0], shapeRC[1]);\n }\n
this.usedTextures[shapeKey].push(newTexture);\n\n this.numUsedTextures++;\n this._numBytesAllocated +=
texBytes;\n this.log();\n\n return newTexture;\n }\n\n releaseTexture(\n texture: WebGLTexture, shape:
[number, number],\n logicalTexType: TextureUsage, isPacked: boolean): void {\n if (this.freeTextures == null)
{\n // Already disposed.\n return;\n }\n const physicalTexType =\n
getPhysicalFromLogicalTextureType(logicalTexType, isPacked);\n const shapeKey =
getKeyFromTextureShape(shape, physicalTexType, isPacked);\n if (!(shapeKey in this.freeTextures)) {\n
this.freeTextures[shapeKey] = [];\n }\n\n const texBytes = computeBytes(\n
 shape, physicalTexType, this.gpgpu.gl, this.gpgpu.textureConfig,\n isPacked);\n const
deleteTexThreshold = env().get('WEBGL_DELETE_TEXTURE_THRESHOLD');\n if (deleteTexThreshold !== -
1 &&\n this._numBytesAllocated > deleteTexThreshold) {\n this.gpgpu.deleteMatrixTexture(texture);\n
this._numBytesAllocated -= texBytes;\n } else {\n this.freeTextures[shapeKey].push(texture);\n
this.numFreeTextures++;\n this._numBytesFree += texBytes;\n }\n\n this.numUsedTextures--;\n\n const
texList = this.usedTextures[shapeKey];\n const texIndex = texList.indexOf(texture);\n if (texIndex < 0) {\n
throw new Error(\n 'Cannot release a texture that was never provided by this ' +\n 'texture manager');\n
}\n texList.splice(texIndex, 1);\n this.log();\n }\n\n private log() {\n if (!this.logEnabled) {\n return;\n
}\n const total = this.numFreeTextures + this.numUsedTextures;\n console.log(\n
 'Free/Used', `${this.numFreeTextures} / ${this.numUsedTextures}`, \n `${total}`);\n const freeRatio =
this._numBytesFree / this._numBytesAllocated;\n console.log('Bytes allocated: ${this._numBytesAllocated}');\n
console.log('Bytes unused: ${this._numBytesFree} (${Math.round(100 * freeRatio)}%');\n }\n\n get
numBytesAllocated(): number {\n return this._numBytesAllocated;\n }\n\n get numBytesFree(): number {\n
return this._numBytesFree;\n }\n\n getNumUsedTextures(): number {\n return this.numUsedTextures;\n }\n\n
getNumFreeTextures(): number {\n return this.numFreeTextures;\n }\n\n dispose() {\n if (this.freeTextures ==
null) {\n // Already disposed.\n return;\n }\n for (const texShape in this.freeTextures) {\n
this.freeTextures[texShape].forEach(tex => {\n this.gpgpu.deleteMatrixTexture(tex);\n });\n }\n for
(const texShape in this.usedTextures) {\n this.usedTextures[texShape].forEach(tex
=> {\n this.gpgpu.deleteMatrixTexture(tex);\n });\n }\n this.freeTextures = null;\n
this.usedTextures =
null;\n this.numUsedTextures = 0;\n this.numFreeTextures = 0;\n this._numBytesAllocated = 0;\n
this._numBytesFree = 0;\n }\n}\n\nfunction numBytesForInternalFormat(\n gl: WebGLRenderingContext,
internalFormat: number): number {\n // tslint:disable-next-line:no-any\n const glany = gl as any;\n if
(internalFormat === glany.R32F) {\n return 4;\n } else if (internalFormat === glany.R16F) {\n return 2;\n }
else if (internalFormat === glany.RGBA32F) {\n return 16;\n } else if (internalFormat === gl.RGBA) {\n
return 16;\n } else if (internalFormat === glany.RGBA16F) {\n return 8;\n }\n throw new Error('Unknown
internal format ${internalFormat}');\n }\n\nexport function computeBytes(\n shape: [number, number],
physicalTexType: PhysicalTextureType,\n gl: WebGLRenderingContext, textureConfig: TextureConfig,\n isPacked:
boolean): number {\n // It is not possible to infer packed status from the texture type because\n // depending on the
textureConfig, different texture types may resolve to the\n // same internal format (e.g. in WebGL1, the internal
format for\n // UNPACKED_FLOAT16 textures is gl.RGBA). Therefore we pass in `isPacked`\n // explicitly.\n const internalFormat =\n internalFormatForPhysicalTexType(physicalTexType, textureConfig);\n let
numElements: number;\n if (isPacked) {\n const [packedWidth, packedHeight] =\n

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getPackedMatrixTextureShapeWidthHeight(shape[0], shape[1]);\n numElements = packedWidth *
packedHeight;\n\n } else {\n const [width, height] =\ngetUnpackedMatrixTextureShapeWidthHeight(shape[0], shape[1]);\n numElements = width * height;\n }\n\nconst bytesPerElement = numBytesForInternalFormat(gl, internalFormat);\n return numElements *
bytesPerElement;\n}\n\nfunction internalFormatForPhysicalTexType(\n physicalTexType:
PhysicalTextureType,\n textureConfig: TextureConfig): number {\n switch (physicalTexType) {\n case
PhysicalTextureType.PACKED_2X2_FLOAT32:\n return
getInternalFormatForPackedMatrixTexture(textureConfig);\n case
PhysicalTextureType.PACKED_2X2_FLOAT16:\n return
getInternalFormatForFloat16PackedMatrixTexture(textureConfig);\n case
PhysicalTextureType.UNPACKED_FLOAT32:\n return
getInternalFormatForFloat32MatrixTexture(textureConfig);\n case
PhysicalTextureType.UNPACKED_FLOAT16:\n return
getInternalFormatForFloat16MatrixTexture(textureConfig);\n case
PhysicalTextureType.PACKED_4X1_UNSIGNED_BYTE:\n return
getInternalFormatForUnsignedBytesMatrixTexture(textureConfig);\n default:\n throw new Error(`Unknown
physical texture type ${physicalTexType}`);\n }\n}\n\nfunction getPhysicalTextureForRendering(isPacked:
boolean):\n PhysicalTextureType {\n if (env().getBool('WEBGL_RENDER_FLOAT32_ENABLED')) {\n if
(isPacked) {\n return PhysicalTextureType.PACKED_2X2_FLOAT32;\n }\n return PhysicalTextureType.UNPACKED_FLOAT32;\n }\n if (isPacked) {\n return
PhysicalTextureType.PACKED_2X2_FLOAT16;\n }\n return
PhysicalTextureType.UNPACKED_FLOAT16;\n}\n}\n\nfunction getPhysicalFromLogicalTextureType(\n
logicalTexType: TextureUsage, isPacked: boolean): PhysicalTextureType {\n if (logicalTexType ===
TextureUsage.UPLOAD) {\n return PhysicalTextureType.PACKED_2X2_FLOAT32;\n } else if (logicalTexType
=== TextureUsage.RENDER || logicalTexType == null) {\n return getPhysicalTextureForRendering(isPacked);\n }
else if (\n logicalTexType === TextureUsage.DOWNLOAD ||\n logicalTexType ===
TextureUsage.PIXELS) {\n return PhysicalTextureType.PACKED_4X1_UNSIGNED_BYTE;\n }\n throw new
Error(`Unknown logical texture type ${logicalTexType}`);\n}\n}\n\nfunction getKeyFromTextureShape(\n
shapeRowsCol: [number, number], physicalTexType: PhysicalTextureType,\n isPacked: boolean): string {\n
return `${shapeRowsCol[0]}_${shapeRowsCol[1]}_${physicalTexType}_${isPacked}`;\n}\n\n"/**\n
* @license\n* Copyright 2017 Google LLC. All Rights Reserved.\n* Licensed under the Apache License, Version
2.0 (the "License");\n* you may not use this file except in compliance with the License.\n* You may obtain a
copy of the License at\n* http://www.apache.org/licenses/LICENSE-2.0\n* Unless required by applicable
law or agreed to in writing, software\n* distributed under the License is distributed on an "AS IS" BASIS,\n*
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n* See the License for
the specific language governing permissions and\n* limitations under the License.\n*
=====\\n
*\n\\nimport {GPGPUProgram} from './gpgpu_math';\n\\nexport class UnaryOpProgram implements
GPGPUProgram {\n variableNames = ['A'];\n userCode: string;\n outputShape: number[];\n\n constructor(aShape: number[], opSnippet:
string) {\n this.outputShape = aShape;\n this.userCode = `\\n float unaryOperation(float x) {\n
${opSnippet}\n }\n\n void main() {\n float x = getAAtOutCoords();\n float y =
unaryOperation(x);\n\n setOutput(y);\n }\n `;\n }\n}\n\\n\\nexport const CHECK_NAN_SNIPPET = `if
(isnan(x)) return x;`\n\\n\\nexport const LINEAR = `return x;`\n\\n\\nexport const ABS = `return abs(x);`\n\\n\\nexport
function STEP(alpha = 0.0) {\n return CHECK_NAN_SNIPPET + `\\n return x > 0.0 ? 1.0 : float(${alpha});\n
`;\n}\n\\n\\nexport const ELU = `return (x >= 0.0) ? x : (exp(x) - 1.0);`\n\\n\\nexport const RELU =
CHECK_NAN_SNIPPET + `\\n return (x < 0.0) ? 0.0 : x;`\n\\n\\nexport const RELU6 = CHECK_NAN_SNIPPET +

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\n return (x < 0.0) ? 0.0 : min(6.0, x);\n`;\n\nexport const CLONE = 'return x;';\n","/**\n * @license\n * Copyright\n 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this
```

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=====
*/\n\nimport { GPGPUProgram } from './gpgpu_math';\n\nexport const LINEAR = `return x;`;\n\nexport const ELU = `\n vec4 result;\n result.r = (x.r >= 0.0) ? x.r : (exp(x.r) - 1.0);\n result.g = (x.g >= 0.0) ? x.g : (exp(x.g) - 1.0);\n result.b = (x.b >= 0.0) ? x.b : (exp(x.b) - 1.0);\n result.a = (x.a >= 0.0) ? x.a : (exp(x.a) - 1.0);\n return result;\n`;\n\nexport const RELU = `\n vec4 result = x * vec4(greaterThanEqual(x, vec4(0.0)));\n bvec4 isNaN = isnan(x);\n result.r = isNaN.r ? x.r : result.r;\n result.g = isNaN.g ? x.g : result.g;\n result.b = isNaN.b ? x.b : result.b;\n result.a = isNaN.a ? x.a : result.a;\n return result;\n`;\n\nexport const RELU6 = `\n vec4 result = min(x, vec4(6.)) * vec4(greaterThanEqual(x, vec4(0.0)));\n bvec4 isNaN = isnan(x);\n result.r = isNaN.r ? x.r : result.r;\n result.g = isNaN.g ? x.g : result.g;\n result.b = isNaN.b ? x.b : result.b;\n result.a = isNaN.a ? x.a : result.a;\n return result;\n`;\n\nexport class UnaryOpPackedProgram implements GPGPUProgram {\n variableNames = ['A'];\n userCode: string;\n outputShape: number[];\n packedInputs = true;\n packedOutput = true;\n\n constructor(aShape: number[], opSnippet: string) {\n this.outputShape = aShape;\n this.userCode = `\n vec4 unaryOperation(vec4 x) {\n ${opSnippet}\n }\n void main() {\n vec4 x = getAAtOutCoords();\n vec4 y = unaryOperation(x);\n }\n `;

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*\\n\\nimport { GPGPUProgram } from './gpgpu_math';\\nimport { getChannels, getSourceCoords } from
'./packing_util';\\nimport { getCoordsDataType } from './shader_compiler';\\n\\nexport class UnpackProgram
implements GPGPUProgram {\\n variableNames
= ['A'];\\n packedInputs = true;\\n packedOutput = false;\\n outputShape: number[];\\n userCode: string;\\n\\n
constructor(outputShape: number[]) {\\n this.outputShape = outputShape;\\n const rank = outputShape.length;\\n\\n
 const channels = getChannels('rc', rank);\\n const dtype = getCoordsDataType(rank);\\n const sourceCoords =
getSourceCoords(rank, channels);\\n const innerDims = channels.slice(-2);\\n const coords = rank <= 1 ? 'rc' :
`vec2(${innerDims.join(',')})`;\\n\\n this.userCode = `\\n void main() {\\n ${dtype} rc = getOutputCoords();\\n
 vec4 packedInput = getA(${sourceCoords});\\n setOutput(getChannel(packedInput, ${coords}));\\n }\\n
`;\\n }\\n}\\n"/**\\n * @license\\n * Copyright 2017 Google LLC. All Rights Reserved.\\n * Licensed under the
Apache License, Version 2.0 (the "License");\\n * you may not use this file except in compliance with the
License.\\n * You may obtain a copy of the License at\\n *\\n * http://www.apache.org/licenses/LICENSE-2.0\\n
*\\n * Unless required by applicable law or agreed to in writing, software\\n * distributed under the License is
distributed on an "AS IS" BASIS,\\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
express or implied.\\n * See the License for the specific language governing permissions and\\n * limitations under
the License.\\n *

```



```

{backend_util, BackendValues, buffer, DataId, DataStorage, DataType, DataValues, engine, env, kernel_impls,
KernelBackend, MemoryInfo, NumericDataType, Rank, RecursiveArray, scalar, ShapeMap, Tensor, Tensor2D,
TensorBuffer, TensorInfo, tidy, TimingInfo, TypedArray, util} from '@tensorflow/tfjs-core';\n\nimport
{getWebGLContext} from './canvas_util';\n\nimport {DecodeMatrixProgram} from './decode_matrix_gpu';\n\nimport
{DecodeMatrixPackedProgram} from './decode_matrix_packed_gpu';\n\nimport
{EncodeFloatProgram} from './encode_float_gpu';\n\nimport {EncodeFloatPackedProgram} from
'./encode_float_packed_gpu';\n\nimport {EncodeMatrixProgram} from './encode_matrix_gpu';\n\nimport
{EncodeMatrixPackedProgram} from './encode_matrix_packed_gpu';\n\nimport {GPGPUContext} from
'./gpgpu_context';\n\nimport * as gpgpu_math from './gpgpu_math';\n\nimport {GPGPUBinary, GPGPUProgram,
TensorData} from './gpgpu_math';\n\nimport {simpleAbsImplCPU} from './kernel_utils/shared';\n\nimport
{PackProgram} from './pack_gpu';\n\nimport {ReshapePackedProgram} from './reshape_packed_gpu';\n\nimport * as
tex_util from './tex_util';\n\nimport {TextureData, TextureUsage} from './tex_util';\n\nimport {TextureManager} from
'./texture_manager';\n\nimport * as unary_op from './unaryop_gpu';\n\nimport {UnaryOpProgram} from
'./unaryop_gpu';\n\nimport {UnaryOpPackedProgram} from './unaryop_packed_gpu';\n\nimport {UnpackProgram} from
'./unpack_gpu';\n\nimport * as webgl_util from './webgl_util';\n\n\nconst whereImpl
= kernel_impls.whereImpl;\n\n\nexport const EPSILON_FLOAT32 = 1e-7;\n\nexport const EPSILON_FLOAT16 =
1e-4;\n\n\ninterface KernelInfo = {\n name: string;\n query: Promise<number>;\n};\n\n\nexport type TimerNode =
RecursiveArray<KernelInfo>|KernelInfo;\n\n\nexport interface CPUTimerQuery {\n startMs: number;\n endMs?:
number;\n}\n\n\nexport interface WebGLMemoryInfo extends MemoryInfo {\n numBytesInGPU: number;\n //
Tracks the total number of bytes allocated on the GPU, accounting for the\n // physical texture type.\n numBytesInGPUAllocated: number;\n // Tracks byte size of textures that were created and then made available
for\n // reuse (disposed).\n numBytesInGPUFree: number;\n unreliable: boolean;\n}\n\n\nexport interface
WebGLTimingInfo extends TimingInfo {\n uploadWaitMs: number;\n downloadWaitMs: number;\n}\n\n\nconst
binaryCaches: {[webGLVersion: string]: {[key: string]: GPGPUBinary}} = {};\n\n\nexport function
getBinaryCache(webGLVersion: number) {\n if (webGLVersion in binaryCaches)
{\n return binaryCaches[webGLVersion];\n }\n binaryCaches[webGLVersion] = {};\n return
binaryCaches[webGLVersion];\n}\n\n\n// Empirically determined constant used to determine size threshold for
handling\n// off execution to the CPU.\n\nconst CPU_HANDOFF_SIZE_THRESHOLD = 128;\n\n\n// Empirically
determined constant used to decide the number of MB on GPU\n// before we warn about high memory use. The MB
are this constant * screen area\n// * dpi / 1024 / 1024.\n\nconst BEFORE_PAGING_CONSTANT = 600;\n\n\nfunction
numMBBeforeWarning(): number {\n if (env().global.screen == null) {\n return 1024; // 1 GB.\n }\n return
(env().global.screen.height * env().global.screen.width * \n window.devicePixelRatio) * \n BEFORE_PAGING_CONSTANT / 1024 / 1024;\n}\n\n\nexport class MathBackendWebGL extends KernelBackend
{\n texData: DataStorage<TextureData>;\n gpgpu: GPGPUContext;\n\n private static nextDataId = 0;\n private
nextDataId(): number {\n return MathBackendWebGL.nextDataId++;\n }\n\n // Maps data ids that have a pending read operation, to list of subscribers.\n private pendingRead = new
WeakMap<DataId, Array<(arr: TypedArray) => void>>();\n // List of data ids that are scheduled for disposal, but
are waiting on a\n // pending read operation.\n private pendingDisposal = new WeakSet<DataId>();\n\n // Used to
count the number of 'shallow' sliced tensors that point to the\n // same data id.\n dataRefCount = new
WeakMap<DataId, number>();\n private numBytesInGPU = 0;\n\n private canvas:
HTMLCanvasElement|OffscreenCanvas;\n\n private programTimersStack: TimerNode[];\n private activeTimers:
TimerNode[];\n // Accumulated time spent (including blocking) in uploading data to webgl.\n private
uploadWaitMs = 0;\n // Accumulated time spent (including blocking in downloading data from webgl.\n private
downloadWaitMs = 0;\n private cpuBackend: KernelBackend;\n\n // Number of bits of precision of this backend.\n private floatPrecisionValue: 32|16;\n\n private
textureManager: TextureManager;\n private binaryCache: {[key: string]: GPGPUBinary};\n private
gpgpuCreatedLocally: boolean;\n private numMBBeforeWarning: number;\n private warnedAboutMemory =
false;\n private warnedAboutCPUBackend = false;\n\n constructor(gpgpu?: GPGPUContext) {\n super();\n if

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(!env().getBool('HAS_WEBGL')) {\n throw new Error('WebGL is not supported on this device');\n }\n\n if
(gpgpu == null) {\n const gl = getWebGLContext(env().getNumber('WEBGL_VERSION'));\n
this.binaryCache = getBinaryCache(env().getNumber('WEBGL_VERSION'));\n this.gpgpu = new
GPGPUContext(gl);\n this.canvas = gl.canvas;\n this.gpgpuCreatedLocally = true;\n } else {\n this.gpgpu
= gpgpu;\n this.binaryCache = {};\n this.gpgpuCreatedLocally = false;\n this.canvas = gpgpu.gl.canvas;\n
}\n this.textureManager = new TextureManager(this.gpgpu);\n this.numMBBeforeWarning =
numMBBeforeWarning();\n\n this.texData = new DataStorage(this,
engine());\n }\n\n numDataIds() {\n return this.texData.numDataIds() +\n (this.cpuBackend ?
this.cpuBackend.numDataIds() : 0) -\n this.pendingDeletes;\n }\n\n write(values: BackendValues, shape:
number[], dtype: DataType): DataId {\n if (env().getBool('WEBGL_CHECK_NUMERICAL_PROBLEMS') ||\n
env().getBool('DEBUG')) {\n this.checkNumericalProblems(values);\n }\n if (dtype === 'complex64' &&
values != null) {\n throw new Error(\n `Cannot write to a complex64 dtype. ` +\n `Please use
tf.complex(real, imag).`);\n }\n const dataId = {id: this.nextDataId()};\n this.texData.set(\n dataId,\n
{shape, dtype, values, usage: TextureUsage.UPLOAD, refCount: 1});\n return dataId;\n }\n\n /** Return
refCount of a `TensorData`. */\n refCount(dataId: DataId): number {\n if (this.texData.has(dataId)) {\n const
tensorData = this.texData.get(dataId);\n return tensorData.refCount;\n }\n
return 0;\n }\n\n /** Increase refCount of a `TextureData`. */\n incRef(dataId: DataId): void {\n const texData
= this.texData.get(dataId);\n texData.refCount++;\n }\n\n /** Decrease refCount of a `TextureData`. */\n
decRef(dataId: DataId): void {\n if (this.texData.has(dataId)) {\n const texData = this.texData.get(dataId);\n
texData.refCount--;\n }\n }\n\n move(\n dataId: DataId, values: BackendValues, shape: number[], dtype:
DataType,\n refCount: number): void {\n if (env().getBool('DEBUG')) {\n
this.checkNumericalProblems(values);\n }\n if (dtype === 'complex64') {\n throw new Error(\n `Cannot
write to a complex64 dtype. ` +\n `Please use tf.complex(real, imag).`);\n }\n this.texData.set(\n
dataId, {shape, dtype, values, usage: TextureUsage.UPLOAD, refCount});\n }\n\n disposeIntermediateTensorInfo(tensorInfo: TensorInfo): void {\n this.disposeData(tensorInfo.dataId);\n }\n\n readSync(dataId:
DataId): BackendValues {\n const texData = this.texData.get(dataId);\n const {values, dtype,
complexTensorInfos, slice, shape, isPacked} = texData;\n\n // The presence of `slice` indicates this tensor is a
shallow slice of a\n // different tensor, and is using that original tensor's texture. Run\n // `clone` in order to copy
that texture and read from it.\n if (slice != null) {\n let program;\n if (isPacked) {\n program = new
UnaryOpPackedProgram(shape, unary_op.CLONE);\n } else {\n program = new UnaryOpProgram(shape,
unary_op.CLONE);\n }\n const res =\n this.runWebGLProgram(program, [{dataId, shape, dtype}],
dtype);\n const data = this.readSync(res.dataId);\n this.disposeIntermediateTensorInfo(res);\n return data;\n
}\n if (values != null) {\n return this.convertAndCacheOnCPU(dataId);\n }\n if (dtype === 'string') {\n
return values;\n }\n const shouldTimeProgram = this.activeTimers
!= null;\n let start: number;\n if (shouldTimeProgram) {\n start = util.now();\n }\n\n let result:
Float32Array;\n if (dtype === 'complex64') {\n const realValues =\n
this.readSync(complexTensorInfos.real.dataId) as Float32Array;\n const imagValues =\n
this.readSync(complexTensorInfos.imag.dataId) as Float32Array;\n result =
backend_util.mergeRealAndImagArrays(realValues, imagValues);\n } else {\n result =
this.getValuesFromTexture(dataId);\n }\n\n if (shouldTimeProgram) {\n this.downloadWaitMs += util.now()
- start;\n }\n return this.convertAndCacheOnCPU(dataId, result);\n }\n\n async read(dataId: DataId):
Promise<BackendValues> {\n if (this.pendingRead.has(dataId)) {\n const subscribers =
this.pendingRead.get(dataId);\n return new Promise<TypedArray>(resolve => subscribers.push(resolve));\n }\n
const texData = this.texData.get(dataId);\n const {values, shape, slice, dtype,
complexTensorInfos, isPacked} = texData;\n\n // The presence of `slice` indicates this tensor is a shallow slice of
a\n // different tensor, and is using that original tensor's texture. Run\n // `clone` in order to copy that texture and
read from it.\n if (slice != null) {\n let program;\n if (isPacked) {\n program = new

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UnaryOpPackedProgram(shape, unary_op.CLONE);\n } else {\n program = new UnaryOpProgram(shape,
unary_op.CLONE);\n }\n const res =\n this.runWebGLProgram(program, [{dataId, shape, dtype}],
dtype);\n const data = this.read(res.dataId);\n this.disposeIntermediateTensorInfo(res);\n return data;\n}\n\nif (values != null) {\n return this.convertAndCacheOnCPU(dataId);\n}\n\nif
(!env().getBool('WEBGL_DOWNLOAD_FLOAT_ENABLED') &&\n
env().getNumber('WEBGL_VERSION') === 2) {\n throw new Error(\n `tensor.data() with
WEBGL_DOWNLOAD_FLOAT_ENABLED=false and ` +\n
 `WEBGL_VERSION=2 not yet supported.`);\n}\n\nlet buffer = null;\nlet tmpDownloadTarget:
TensorInfo;\n\nif (dtype !== 'complex64' && env().get('WEBGL_BUFFER_SUPPORTED')) {\n // Possibly
copy the texture into a buffer before inserting a fence.\n tmpDownloadTarget = this.decode(dataId);\n const
tmpData = this.texData.get(tmpDownloadTarget.dataId);\n buffer = this.gpgpu.createBufferFromTexture(\n
 tmpData.texture, ...tex_util.getDenseTexShape(shape));\n}\n\nthis.pendingRead.set(dataId, []);\n\nif (dtype
!== 'complex64') {\n // Create a fence and wait for it to resolve.\n await
this.gpgpu.createAndWaitForFence();\n}\n\n// Download the values from the GPU.\nlet vals:
Float32Array;\n\nif (dtype === 'complex64') {\n const ps = await Promise.all([\n
 this.read(complexTensorInfos.real.dataId),\n this.read(complexTensorInfos.imag.dataId)\n]);\n const
realValues = ps[0];\n const
imagValues = ps[1];\n vals = backend_util.mergeRealAndImagArrays(\n realValues as Float32Array,
imagValues as Float32Array);\n } else if (buffer === null) {\n vals = this.getValuesFromTexture(dataId);\n }
else {\n const size = util.sizeFromShape(shape);\n vals =
this.gpgpu.downloadFloat32MatrixFromBuffer(buffer, size);\n }\n\nif (tmpDownloadTarget !== null) {\n
 this.disposeIntermediateTensorInfo(tmpDownloadTarget);\n}\n\nconst dTypeVals =
this.convertAndCacheOnCPU(dataId, vals);\n\nconst subscribers = this.pendingRead.get(dataId);\n
this.pendingRead.delete(dataId);\n\n// Notify all pending reads.\nsubscribers.forEach(resolve =>
resolve(dTypeVals));\n\nif (this.pendingDisposal.has(dataId)) {\n this.pendingDisposal.delete(dataId);\n}\n\nif
(this.disposeData(dataId)) {\n engine().removeDataId(dataId, this);\n}\n\nthis.pendingDeletes--;\n}\n\nreturn dTypeVals;\n}\n\nbufferSync<R extends Rank>(t:
TensorInfo): TensorBuffer<R> {\n const data = this.readSync(t.dataId);\n let decodedData = data as
DataValues;\n\n if (t.dtype === 'string') {\n try {\n // Decode the bytes into string.\n decodedData = (data
as Uint8Array[]).map(d => util.decodeString(d));\n } catch {\n throw new Error('Failed to decode encoded
string bytes into utf-8');\n }\n }\n\n return buffer(t.shape as ShapeMap[R], t.dtype, decodedData) as\n
TensorBuffer<R>;\n}\n\nprivate checkNumericalProblems(values: BackendValues): void {\n if (values === null)\n return;\n\n for (let i = 0; i < values.length; i++) {\n const num = values[i] as number;\n if
(!webgl_util.canBeRepresented(num)) {\n if (env().getBool('WEBGL_RENDER_FLOAT32_CAPABLE')) {\n
 throw Error(\n `The value ${num} cannot be represented with your ` +\n
 `current settings. Consider enabling float32 rendering: ` +\n
 `tf.env().set('WEBGL_RENDER_FLOAT32_ENABLED',
true);`);\n }\n throw Error(`The value ${num} cannot be represented on this device.`);\n }\n }\n}\n\nprivate getValuesFromTexture(dataId: DataId): Float32Array {\n const {shape, dtype, isPacked} =
this.texData.get(dataId);\n const size = util.sizeFromShape(shape);\n if
(env().getBool('WEBGL_DOWNLOAD_FLOAT_ENABLED')) {\n const tmpTarget = this.decode(dataId);\n const tmpData = this.texData.get(tmpTarget.dataId);\n const vals = this.gpgpu\n .downloadMatrixFromPackedTexture(\n
 tmpData.texture, ...tex_util.getDenseTexShape(shape))\n .subarray(0, size);\n this.disposeIntermediateTensorInfo(tmpTarget);\n return vals;\n }\n\n const shouldUsePackedProgram =\n env().getBool('WEBGL_PACK') && isPacked === true;\n const
outputShape =\n shouldUsePackedProgram ? webgl_util.getShapeAs3D(shape) : shape;\n\n const program = shouldUsePackedProgram ?\n new EncodeFloatPackedProgram(outputShape as [number,
number, number]) :\n new EncodeFloatProgram(outputShape);\n const output = this.runWebGLProgram(\n
 program, [{shape: outputShape, dtype, dataId}], 'float32');\n const tmpData = this.texData.get(output.dataId);\n

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const vals = \n this.gpgpu\n .downloadByteEncodedFloatMatrixFromOutputTexture(\n
tmpData.texture, tmpData.texShape[0], tmpData.texShape[1])\n .subarray(0, size);\n
this.disposeIntermediateTensorInfo(output);\n\n return vals;\n }\n\n timerAvailable(): boolean {\n return
env().getNumber('WEBGL_DISJOINT_QUERY_TIMER_EXTENSION_RELIABLE') > 0;\n }\n\n async time(f:
() => void): Promise<WebGLTimingInfo> {\n const oldActiveTimers = this.activeTimers;\n const
newActiveTimers: TimerNode[] = [];\n let outerMostTime = false;\n if (this.programTimersStack == null) {\n
this.programTimersStack
= newActiveTimers;\n outerMostTime = true;\n } else {\n this.activeTimers.push(newActiveTimers);\n
}\n this.activeTimers = newActiveTimers;\n\n f();\n\n // needing to split these up because util.flatten only
accepts certain types\n const flattenedActiveTimerQueries = \n util.flatten(this.activeTimers.map((d:
KernelInfo) => d.query))\n .filter(d => d != null);\n const flattenedActiveTimerNames = \n
util.flatten(this.activeTimers.map((d: KernelInfo) => d.name))\n .filter(d => d != null);\n
this.activeTimers = oldActiveTimers;\n\n if (outerMostTime) {\n this.programTimersStack = null;\n }\n\n
const res: WebGLTimingInfo = {\n uploadWaitMs: this.uploadWaitMs,\n downloadWaitMs:
this.downloadWaitMs,\n kernelMs: null,\n wallMs: null // will be filled by the engine\n }; \n\n if
(env().getNumber('WEBGL_DISJOINT_QUERY_TIMER_EXTENSION_RELIABLE') > 0) {\n const kernelMs
= await Promise.all(flattenedActiveTimerQueries);\n\n
res['kernelMs'] = util.sum(kernelMs);\n res['getExtraProfileInfo'] = () => \n kernelMs.map((d, i) =>
({name: flattenedActiveTimerNames[i], ms: d}))\n .map(d => `${d.name}: ${d.ms}`)\n .join(', '); \n
} else {\n res['kernelMs'] = {\n error: 'WebGL query timers are not supported in this environment.'\n }; \n
}\n\n this.uploadWaitMs = 0;\n this.downloadWaitMs = 0;\n return res;\n }\n\n memory():
WebGLMemoryInfo {\n return {\n unreliable: false,\n numBytesInGPU: this.numBytesInGPU,\n
numBytesInGPUAllocated: this.textureManager.numBytesAllocated,\n numBytesInGPUFree:
this.textureManager.numBytesFree\n } as WebGLMemoryInfo;\n }\n\n private startTimer():
WebGLQuery|CPUTimerQuery {\n if
(env().getNumber('WEBGL_DISJOINT_QUERY_TIMER_EXTENSION_RELIABLE') > 0) {\n return
this.gpgpu.beginQuery();\n }\n return {startMs: util.now(), endMs: null};\n
}\n\n private endTimer(query: WebGLQuery|CPUTimerQuery): WebGLQuery|CPUTimerQuery {\n if
(env().getNumber('WEBGL_DISJOINT_QUERY_TIMER_EXTENSION_RELIABLE') > 0) {\n
this.gpgpu.endQuery();\n return query;\n }\n (query as CPUTimerQuery).endMs = util.now();\n return
query;\n }\n\n private async getQueryTime(query: WebGLQuery|CPUTimerQuery): Promise<number> {\n if
(env().getNumber('WEBGL_DISJOINT_QUERY_TIMER_EXTENSION_RELIABLE') > 0) {\n return
this.gpgpu.waitForQueryAndGetTime(query as WebGLQuery);\n }\n const timerQuery = query as
CPUTimerQuery;\n return timerQuery.endMs - timerQuery.startMs;\n }\n\n private pendingDeletes = 0;\n\n
/**\n * Decrease the RefCount on the dataId and dispose the memory if the dataId\n * has 0 refCount. If there are
pending read on the data, the disposal would\n * added to the pending delete queue. Return true if the dataId is
removed\n * from backend or the backend does not contain the dataId, false if
the\n * dataId is not removed. Memory may or may not be released even when dataId\n * is removed, which also
depends on dataRefCount, see `releaseGPU`.\n * @param dataId\n * @oaram force Optional, remove the data
regardless of refCount\n */\n disposeData(dataId: DataId, force = false): boolean {\n if
(this.pendingDisposal.has(dataId)) {\n return false;\n }\n\n // No-op if already disposed.\n if
(!this.texData.has(dataId)) {\n return true;\n }\n\n // if force flag is set, change refCount to 0, this would
ensure disposal\n // when added to the pendingDisposal queue. Memory may or may not be\n // released, which
also depends on dataRefCount, see `releaseGPU`.\n if (force) {\n this.texData.get(dataId).refCount = 0;\n }
else {\n this.texData.get(dataId).refCount--;\n }\n\n if (!force && this.texData.get(dataId).refCount > 0) {\n
return false;\n }\n\n if (this.pendingRead.has(dataId)) {\n this.pendingDisposal.add(dataId);\n
this.pendingDeletes++;\n return false;\n }\n\n this.releaseGPUData(dataId);\n const
{complexTensorInfos} = this.texData.get(dataId);\n if (complexTensorInfos != null) {\n

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this.disposeData(complexTensorInfos.real.dataId, force);\n this.disposeData(complexTensorInfos.imag.dataId,
force);\n }\n\n this.texData.delete(dataId);\n\n return true;\n }\n\n private releaseGPUData(dataId: DataId):
void {\n const {texture, dtype, texShape, usage, isPacked, slice} =\n this.texData.get(dataId);\n const key =
slice && slice.origDataId || dataId;\n const refCount = this.dataRefCount.get(key);\n\n if (refCount > 1) {\n this.dataRefCount.set(key, refCount - 1);\n } else {\n this.dataRefCount.delete(key);\n if (texture != null) {\n
 this.numBytesInGPU -= this.computeBytes(texShape, dtype);\n this.textureManager.releaseTexture(texture,
texShape, usage, isPacked);\n }\n }\n\n const texData
= this.texData.get(dataId);\n texData.texture = null;\n texData.texShape = null;\n texData.isPacked = false;\n
texData.slice = null;\n }\n\n getTexture(dataId: DataId): WebGLTexture {\n this.uploadToGPU(dataId);\n
return this.texData.get(dataId).texture;\n }\n\n /**\n * Returns internal information for the specific data bucket.
Used in unit\n * tests.\n */\n getDataInfo(dataId: DataId): TextureData {\n return this.texData.get(dataId);\n
}\n\n private getCPUBackend(): KernelBackend|null {\n if (!env().getBool('WEBGL_CPU_FORWARD')) {\n
return null;\n }\n\n if (this.cpuBackend == null) {\n this.cpuBackend = engine().findBackend('cpu');\n }\n\n
return this.cpuBackend;\n }\n\n /**\n Tests whether all the inputs to an op are small and on the CPU. This
heuristic\n determines when it would be faster to execute a kernel on the CPU. WebGL\n kernels opt into running
this check and forwarding when appropriate.\n TODO(https://github.com/tensorflow/tfjs/issues/872):
Develop a more\n sustainable strategy for optimizing backend execution of ops.\n */\n shouldExecuteOnCPU(\n
inputs: TensorInfo[],\n sizeThreshold = CPU_HANDOFF_SIZE_THRESHOLD): boolean {\n const
cpuBackend = this.getCPUBackend();\n if (!env().getBool('IS_TEST') && !this.warnedAboutCPUBackend &&\n
cpuBackend == null) {\n console.warn(\n 'Your application contains ops that are small enough to be '
+\n 'executed on the CPU backend, however the CPU backend cannot ' +\n 'be found. Consider importing
the CPU backend ' +\n '(@tensorflow/tfjs-backend-cpu) for better performance.);\n\n
this.warnedAboutCPUBackend = true;\n }\n\n return cpuBackend != null &&\n inputs.every(\n input
=> this.texData.get(input.dataId).texture == null &&\n util.sizeFromShape(input.shape) <
sizeThreshold);\n }\n\n getGPGPUContext(): GPGPUContext {\n return this.gpgpu;\n
}\n\n where(condition: Tensor): Tensor2D {\n backend_util.warn(\n 'tf.where() in webgl locks the UI thread.
' +\n 'Call tf.whereAsync() instead);\n const condVals = condition.dataSync();\n return
whereImpl(condition.shape, condVals);\n }\n\n private packedUnaryOp(x: TensorInfo, op: string, dtype:
DataType) {\n const program = new UnaryOpPackedProgram(x.shape, op);\n const outInfo =
this.compileAndRun(program, [x], dtype);\n return engine().makeTensorFromDataId(\n outInfo.dataId,
outInfo.shape, outInfo.dtype);\n }\n\n // TODO(msoulanille) remove this once the backend has been modularized\n
// a copy is needed here to break a circular dependency.\n // Also remove the op from unary_op.\n abs<T extends
Tensor>(x: T): T {\n // TODO: handle cases when x is complex.\n if (this.shouldExecuteOnCPU([x]) &&
x.dtype !== 'complex64') {\n const outValues =\n simpleAbsImplCPU(this.texData.get(x.dataId).values as
TypedArray);\n\n return this.makeOutput(x.shape, x.dtype, outValues);\n }\n\n if
(env().getBool('WEBGL_PACK_UNARY_OPERATIONS')) {\n return this.packedUnaryOp(x, unary_op.ABS,
x.dtype) as T;\n }\n\n const program = new UnaryOpProgram(x.shape, unary_op.ABS);\n const outInfo =
this.compileAndRun(program, [x]);\n return engine().makeTensorFromDataId(\n outInfo.dataId,
outInfo.shape, outInfo.dtype) as T;\n }\n\n makeTensorInfo(\n shape: number[], dtype: DataType,\n values?:
BackendValues|string[]): TensorInfo {\n let dataId;\n if (dtype === 'string' && values != null && values.length
> 0 &&\n util.isString(values[0])) {\n const encodedValues =\n (values as {} as string[]).map(d =>
util.encodeString(d));\n dataId = this.write(encodedValues, shape, dtype);\n } else {\n dataId =
this.write(values as TypedArray, shape, dtype);\n }\n\n this.texData.get(dataId).usage = null;\n return {dataId,
shape, dtype};\n }\n\n private makeOutput<T extends Tensor>(\n shape: number[], dtype: DataType, values?: BackendValues): T {\n
const {dataId} = this.makeTensorInfo(shape, dtype, values);\n return engine().makeTensorFromDataId(dataId,
shape, dtype, this) as T;\n }\n\n private unpackTensor(input: TensorInfo): TensorInfo {\n const program = new

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UnpackProgram(input.shape);\n return this.runWebGLProgram(program, [input], input.dtype);\n }\n\n private
packTensor(input: TensorInfo): TensorInfo {\n const program = new PackProgram(input.shape);\n const
preventEagerUnpackingOutput = true;\n return this.runWebGLProgram(\n program, [input], input.dtype, null
/* customSetup */,\n preventEagerUnpackingOutput);\n }\n\n private packedReshape(input: TensorInfo,
afterShape: number[]): TensorInfo {\n const input3DShape = [\n webgl_util.getBatchDim(input.shape),\n
...webgl_util.getRowsCols(input.shape)\n] as [number, number, number];\n const input3D: TensorInfo
= {\n dtype: input.dtype,\n shape: input3DShape,\n dataId: input.dataId\n };\n const afterShapeAs3D =
[\n webgl_util.getBatchDim(afterShape), ...webgl_util.getRowsCols(afterShape)\n] as [number, number,
number];\n const program = new ReshapePackedProgram(afterShapeAs3D, input3DShape);\n const
preventEagerUnpackingOfOutput = true;\n const output = this.runWebGLProgram(\n program, [input3D],
input.dtype, null /* customSetup */,\n preventEagerUnpackingOfOutput);\n return { dataId: output.dataId,
shape: afterShape, dtype: output.dtype};\n }\n\n private decode(dataId: DataId): TensorInfo {\n const texData =
this.texData.get(dataId);\n const {isPacked, shape, dtype} = texData;\n const shapeAs3D =\n
webgl_util.getShapeAs3D(shape) as [number, number, number];\n let program;\n if (isPacked) {\n program =
new DecodeMatrixPackedProgram(shapeAs3D);\n } else {\n program = new
DecodeMatrixProgram(shapeAs3D);\n
\n const preventEagerUnpackingOfOutput = true;\n const out = this.runWebGLProgram(\n program,
[{\n shape: shapeAs3D, dtype, dataId\n }], dtype,\n null /* customSetup */,\n preventEagerUnpackingOfOutput);\n return { dtype, shape, dataId: out.dataId};\n }\n\n runWebGLProgram(\n program: GPGPUProgram, inputs:
TensorInfo[], outputDType: DataType,\n customSetup?: (gpgpu: GPGPUContext, webGLProgram:
WebGLProgram) => void,\n preventEagerUnpackingOfOutput = false): TensorInfo {\n const output =
this.makeTensorInfo(program.outputShape, outputDType);\n const outData = this.texData.get(output.dataId);\n if
(program.packedOutput) {\n outData.isPacked = true;\n }\n if (program.outPackingScheme ===
tex_util.PackingScheme.DENSE) {\n const texelShape = tex_util.getDenseTexShape(program.outputShape);\n
// For a densely packed output, we explicitly set texShape\n // so it doesn't get assigned later according to our
typical packing\n
 // scheme wherein a single texel can only contain values from adjacent\n // rows/cols.\n outData.texShape
= texelShape.map(d => d * 2) as [number, number];\n }\n if (program.outTexUsage != null) {\n
outData.usage = program.outTexUsage;\n }\n if (util.sizeFromShape(output.shape) === 0) {\n // Short-circuit
the computation since the result is empty (has 0 in its\n // shape).\n outData.values =\n
util.getTypedArrayFromDType(output.dtype as 'float32', 0);\n return output;\n }\n const dataToDispose:
TensorInfo[] = [];\n const inputsData: TensorData[] = inputs.map(input => {\n if (input.dtype === 'complex64')
{\n throw new Error(\n `GPGPUProgram does not support complex64 input. For complex64 ` +\n
`dtypes, please separate the program into real and imaginary ` +\n `parts.`);\n }\n });\n let texData =
this.texData.get(input.dataId);\n if (texData.texture ==
null) {\n if (!program.packedInputs &&\n util.sizeFromShape(input.shape) <= \n
env().getNumber('WEBGL_SIZE_UPLOAD_UNIFORM')) {\n // Upload small tensors that live on the CPU
as uniforms, not as\n // textures. Do this only when the environment supports 32bit floats\n // due to
problems when comparing 16bit floats with 32bit floats.\n //
TODO(https://github.com/tensorflow/tfjs/issues/821): Make it\n // possible for packed shaders to sample from
uniforms.\n return {\n shape: input.shape,\n texData: null,\n isUniform: true,\n
uniformValues: texData.values as TypedArray\n };\n }\n // This ensures that if a packed program's
inputs have not yet been\n // uploaded to the GPU, they get uploaded as packed right off the bat.\n if
(program.packedInputs) {\n texData.isPacked = true;\n texData.shape = input.shape;\n
 }\n } else if (!texData.isPacked !== !program.packedInputs) {\n input = texData.isPacked ?
this.unpackTensor(input) : \n this.packTensor(input);\n dataToDispose.push(input);\n
texData = this.texData.get(input.dataId);\n } else if (\n texData.isPacked &&\n
!webgl_util.isReshapeFree(texData.shape, input.shape)) {\n // This is a special case where a texture exists for a

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tensor\n // but the shapes are incompatible (due to packing constraints) because\n // the tensor did not have
a chance to go through the packed reshape\n // shader. This only happens when we reshape the *same* tensor to
form\n // *distinct* inputs to an op, e.g. dotting a vector with itself. This\n // case will disappear once
packed uploading is the default.\n\n const savedInput = input;\n const targetShape = input.shape;\n\n input.shape = texData.shape;\n input =
 this.packedReshape(input as Tensor, targetShape);\n dataToDispose.push(input);\n texData =
 this.texData.get(input.dataId);\n savedInput.shape = targetShape;\n }\n\n this.uploadToGPU(input.dataId);\n return {shape: input.shape, texData, isUniform: false};\n });\n\n this.uploadToGPU(output.dataId);\n const outputData:\n TensorData = {shape: output.shape, texData:
 outData, isUniform: false};\n const key = gpgpu_math.makeShaderKey(program, inputsData, outputData);\n
 const binary = this.getAndSaveBinary(key, () => {\n return gpgpu_math.compileProgram(\n this.gpgpu,
 program, inputsData, outputData);\n });\n const shouldTimeProgram = this.activeTimers != null;\n let query:
 WebGLQuery|CPUTimerQuery;\n if (shouldTimeProgram) {\n query = this.startTimer();\n }\n\n gpgpu_math.runProgram(\n this.gpgpu, binary, inputsData, outputData, customSetup);\n\n dataToDispose.forEach(info => this.disposeIntermediateTensorInfo(info));\n\n if (shouldTimeProgram) {\n query = this.endTimer(query);\n this.activeTimers.push(\n {name:
 program.constructor.name, query: this.getQueryTime(query)});\n }\n\n if
 (!env().getBool('WEBGL_LAZILY_UNPACK') && outData.isPacked &&\n preventEagerUnpackingOfOutput
 === false) {\n const unpacked = this.unpackTensor(output);\n this.disposeIntermediateTensorInfo(output);\n
 return unpacked;\n }\n return output;\n })\n\n compileAndRun(\n program: GPGPUProgram, inputs:
 TensorInfo[], outputDtype?: DataType,\n customSetup?: (gpgpu: GPGPUContext, webGLProgram:
 WebGLProgram) => void,\n preventEagerUnpackingOfOutput = false): TensorInfo {\n outputDtype =
 outputDtype || inputs[0].dtype;\n const outInfo = this.runWebGLProgram(\n program, inputs, outputDtype,
 customSetup,\n preventEagerUnpackingOfOutput);\n return outInfo;\n })\n\n private getAndSaveBinary(key:
 string, getBinary:
 () => GPGPUBinary):\n GPGPUBinary {\n if (!(key in this.binaryCache)) {\n this.binaryCache[key] =
 getBinary();\n }\n return this.binaryCache[key];\n })\n\n getTextureManager(): TextureManager {\n return
 this.textureManager;\n })\n\n private disposed = false;\n\n dispose() {\n if (this.disposed) {\n return;\n }\n
 // Avoid disposing the compiled webgl programs during unit testing because\n // it slows down test execution.\n
 if (!env().getBool('IS_TEST')) {\n const allKeys = Object.keys(this.binaryCache);\n allKeys.forEach(key =>
 {\n this.gpgpu.deleteProgram(this.binaryCache[key].webGLProgram);\n delete this.binaryCache[key];\n
 });\n }\n this.textureManager.dispose();\n if (this.canvas != null &&\n (typeof (HTMLCanvasElement)
 != 'undefined' &&\n this.canvas instanceof HTMLCanvasElement)) {\n this.canvas.remove();\n } else
 {\n this.canvas = null;\n }\n if (this.gpgpuCreatedLocally)
 {\n this.gpgpu.program = null;\n this.gpgpu.dispose();\n }\n this.disposed = true;\n })\n\n
 floatPrecision(): 16|32 {\n if (this.floatPrecisionValue == null) {\n this.floatPrecisionValue = tidy() => {\n
 if (!env().get('WEBGL_RENDER_FLOAT32_ENABLED')) {\n // Momentarily switching DEBUG flag to
 false so we don't throw an\n // error trying to upload a small value.\n const debugFlag =
 env().getBool('DEBUG');\n env().set('DEBUG', false);\n const underflowCheckValue =
 this.abs(scalar(1e-8)).dataSync()[0];\n env().set('DEBUG', debugFlag);\n\n if (underflowCheckValue >
 0) {\n return 32;\n }\n }\n return 16;\n });\n }\n return this.floatPrecisionValue;\n })\n\n
 /** Returns the smallest representable number. */\n epsilon(): number {\n return this.floatPrecision() === 32 ?
 EPSILON_FLOAT32 : EPSILON_FLOAT16;\n })\n\n uploadToGPU(dataId: DataId):
 void {\n const texData = this.texData.get(dataId);\n const {shape, dtype, values, texture, usage, isPacked} =
 texData;\n\n if (texture != null) {\n // Array is already on GPU. No-op.\n return;\n }\n const
 shouldTimeProgram = this.activeTimers != null;\n let start: number;\n if (shouldTimeProgram) {\n start =
 util.now();\n }\n\n let texShape = texData.texShape;\n if (texShape == null) {\n texShape =
 webgl_util.getTextureShapeFromLogicalShape(shape, isPacked);\n texData.texShape = texShape;\n })\n\n if

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(values != null) {\n const shapeAs3D = webgl_util.getShapeAs3D(shape);\n\n let program;\n let width =\n texShape[1], height = texShape[0];\n const isByteArray = values instanceof Uint8Array;\n\n if (isPacked) {\n [width, height] = tex_util.getPackedMatrixTextureShapeWidthHeight(\n texShape[0], texShape[1]);\n program = new EncodeMatrixPackedProgram(\n shapeAs3D, [height,\n width], isByteArray);\n } else {\n program =\n new EncodeMatrixProgram(shapeAs3D, [height,\n width], isByteArray);\n }\n\n const tempDenseInputHandle = this.makeTensorInfo([height, width], dtype);\n if (isByteArray) {\n this.texData.get(tempDenseInputHandle.dataId).usage =\n TextureUsage.PIXELS;\n } else {\n this.texData.get(tempDenseInputHandle.dataId).usage =\n TextureUsage.UPLOAD;\n }\n this.gpgpu.uploadDenseMatrixToTexture(\n this.getTexture(tempDenseInputHandle.dataId), width,\n height,\n values as TypedArray);\n\n // We want the output to remain packed regardless of the value of\n // WEBGL_PACK.\n const preventEagerUnpacking = true;\n const encodedOutputTarget =\n this.runWebGLProgram(\n program, [tempDenseInputHandle], dtype, null, preventEagerUnpacking);\n\n // Have the original texture assume the identity of the encoded output.\n const\n outputTexData = this.texData.get(encodedOutputTarget.dataId);\n texData.texture = outputTexData.texture;\n texData.texShape = outputTexData.texShape;\n texData.isPacked = outputTexData.isPacked;\n texData.usage\n = outputTexData.usage;\n this.disposeIntermediateTensorInfo(tempDenseInputHandle);\n this.texData.delete(encodedOutputTarget.dataId);\n\n // Once uploaded, don't store the values on cpu.\n texData.values = null;\n if (shouldTimeProgram) {\n this.uploadWaitMs += util.now() - start;\n }\n } else {\n const newTexture = this.acquireTexture(texShape, usage, dtype, isPacked);\n texData.texture =\n newTexture;\n }\n\n private convertAndCacheOnCPU(dataId: DataId, float32Values?: Float32Array):\n TypedArray {\n const texData = this.texData.get(dataId);\n const {dtype} = texData;\n\n this.releaseGPUData(dataId);\n if (float32Values != null) {\n texData.values =\n float32ToTypedArray(float32Values,\n dtype as 'float32');\n }\n return texData.values as TypedArray;\n }\n\n private acquireTexture(\n texShape:\n [number, number], texType: TextureUsage, dtype: DataType,\n isPacked: boolean): WebGLTexture {\n this.numBytesInGPU += this.computeBytes(texShape, dtype);\n if (!this.warnedAboutMemory &&\n this.numBytesInGPU > this.numMBBeforeWarning * 1024 * 1024) {\n const mb = (this.numBytesInGPU / 1024\n / 1024).toFixed(2);\n this.warnedAboutMemory = true;\n console.warn(\n `High memory usage in GPU:\n ${mb} MB,`\n +`\n `most likely due to a memory leak`);\n }\n return\n this.textureManager.acquireTexture(texShape, texType, isPacked);\n }\n\n private computeBytes(shape: [number,\n number], dtype: DataType) {\n return shape[0] * shape[1] * util.bytesPerElement(dtype);\n }\n\n function\n float32ToTypedArray<D extends NumericDataType>(\n a: Float32Array, dtype: D): tf.DataTypeMap[D] {\n if\n (dtype === 'float32' ||\n dtype === 'complex64') {\n return a as tf.DataTypeMap[D];\n } else if (dtype === 'int32' || dtype === 'bool') {\n const result = (dtype === 'int32') ? new Int32Array(a.length) :\n new\n Uint8Array(a.length);\n for (let i = 0; i < result.length; ++i) {\n result[i] = Math.round(a[i]);\n }\n return\n result as tf.DataTypeMap[D];\n } else {\n throw new Error(`Unknown dtype ${dtype}`);\n }\n }\n\n /**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version\n * 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a\n * copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable\n * law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License\n * for the specific language governing permissions and\n * limitations under the License.\n */\n\n =====\n\n *\n *\n import {env} from '@tensorflow/tfjs-core';\n import * as gpgpu_util from './gpgpu_util';\n import * as\n webgl_util from './webgl_util';\n export {MathBackendWebGL, WebGLMemoryInfo, WebGLTimingInfo} from\n './backend_webgl';\n export {setWebGLContext} from './canvas_util';\n export {GPGPUContext} from\n './gpgpu_context';\n export {GPGPUProgram} from './gpgpu_math';\n // WebGL specific utils.\n export {gpgpu_util,

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webgl_util};\n\n/**\n * Enforce use of half precision textures if available on the platform.\n *\n * @doc {heading:
'Environment', namespace: 'webgl'}\n *\nexport function forceHalfFloat(): void {\n
env().set('WEBGL_FORCE_F16_TEXTURES', true);\n}\n\n"/**\n * @license\n * Copyright 2017 Google LLC.
All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use
this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *\n
=====
*\n\nimport {backend_util} from '@tensorflow/tfjs-core';\n\nimport {GPGPUProgram} from
'./gpgpu_math';\n\nexport const CHECK_NAN_SNIPPET = `\n if (isnan(a)) return a;\n if (isnan(b)) return
b;\n`;\n\nexport const SQUARED_DIFFERENCE = 'return (a - b) * (a - b);'\n\nexport class BinaryOpProgram
implements GPGPUProgram {\n variableNames = ['A', 'B'];\n outputShape: number[];\n userCode: string;\n\n constructor(op: string, aShape: number[],
bShape: number[]) {\n this.outputShape = backend_util.assertAndGetBroadcastShape(aShape, bShape);\n
this.userCode = `\n float binaryOperation(float a, float b) {\n ${op}\n }\n\n void main() {\n float a
= getAAtOutCoords();\n float b = getBAtOutCoords();\n setOutput(binaryOperation(a, b));\n }\n`;\n
}\n}\n\n"/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache
License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You
may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required
by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS"
BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the
License for the specific language governing permissions and\n * limitations under the
License.\n *\n
=====
*\n\nimport {backend_util, util} from '@tensorflow/tfjs-core';\n\nimport {GPGPUProgram} from
'./gpgpu_math';\n\nimport {getChannels} from './packing_util';\n\nimport {getCoordsDataType} from
'./shader_compiler';\n\nexport const CHECK_NAN_SNIPPET = `\n result.r = isNaN.r > 0. ? NAN : result.r;\n
result.g = isNaN.g > 0. ? NAN : result.g;\n result.b = isNaN.b > 0. ? NAN : result.b;\n result.a = isNaN.a > 0. ?
NAN : result.a;\n`;\n\nexport const ELU_DER = `\n vec4 bGTEZero = vec4(greaterThanEqual(b, vec4(0.)));\n
return (bGTEZero * a) + ((vec4(1.0) - bGTEZero) * (a * (b + vec4(1.0))));\n`;\n\nexport const NOT_EQUAL = `\n
return vec4(notEqual(a, b));\n`;\n\nexport class BinaryOpPackedProgram implements GPGPUProgram {\n
 variableNames = ['A', 'B'];\n outputShape: number[];\n userCode: string;\n supportsBroadcasting = true;\n
packedInputs = true;\n packedOutput = true;\n\n constructor(\n
 op: string, aShape: number[], bShape: number[],\n checkOutOfBounds = false) {\n this.outputShape =
backend_util.assertAndGetBroadcastShape(aShape, bShape);\n const rank = this.outputShape.length;\n let
checkOutOfBoundsString = ";\n if (checkOutOfBounds) {\n if (rank === 0 ||
util.sizeFromShape(this.outputShape) === 1) {\n checkOutOfBoundsString = `\n result.y = 0.;\n
result.z = 0.;\n result.w = 0.;\n `;\n } else {\n const dtype = getCoordsDataType(rank);\n
checkOutOfBoundsString = `\n ${dtype} coords = getOutputCoords();\n `;\n if (rank === 1) {\n
checkOutOfBoundsString += `\n result.y = (coords + 1) >= ${this.outputShape[0]} ? 0. : result.y;\n
result.z = 0.;\n result.w = 0.;\n `;\n } else {\n const channels = getChannels('coords', rank);\n
checkOutOfBoundsString += `\n bool nextRowOutOfBounds
= \n (${channels[rank - 2]} + 1) >= ${this.outputShape[rank - 2]};\n bool nextColOutOfBounds = \n
 (${channels[rank - 1]} + 1) >= ${this.outputShape[rank - 1]};\n result.y = nextColOutOfBounds ? 0. :
result.y;\n result.z = nextRowOutOfBounds ? 0. : result.z;\n result.w = nextColOutOfBounds ||
nextRowOutOfBounds ? 0. : result.w;\n `;\n }\n }\n }\n this.userCode = `\n vec4

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binaryOperation(vec4 a, vec4 b) {\n ${op}\n }\n\n void main() {\n vec4 a = getAAtOutCoords();\n vec4 b = getBAtOutCoords();\n vec4 result = binaryOperation(a, b);\n ${checkOutOfBoundsString}\n setOutput(result);\n }\n `;\n }\n}\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {env, KernelConfig, KernelFunc, LeakyRelu, LeakyReluAttrs, LeakyReluInputs, TensorInfo, util}
from '@tensorflow/tfjs-core';\nimport {MathBackendWebGL} from '../backend_webgl';\nimport
{BinaryOpProgram} from './binaryop_gpu';\nimport {BinaryOpPackedProgram} from
'./binaryop_packed_gpu';\n\nexport const LEAKYRELU = `return (a < 0.) ? b * a : a;`;
\nexport const LEAKYRELU_PACKED = `\n vec4 aLessThanZero = vec4(lessThan(a, vec4(0.)));
\n return (aLessThanZero * (b * a)) + ((vec4(1.0) - aLessThanZero)
* a);\n`;
\n\nexport function leakyRelu(args: {\n inputs: LeakyReluInputs,\n backend: MathBackendWebGL,\n attrs: LeakyReluAttrs\n}): TensorInfo {\n const {inputs, backend, attrs} = args;\n const {x} = inputs;\n const {alpha} = attrs;\n const $alpha = backend.makeTensorInfo([\n [], 'float32',\n util.createScalarValue(alpha as { } as 'float32', 'float32'));\n const program = env().getBool('WEBGL_PACK_BINARY_OPERATIONS') ?\n new BinaryOpPackedProgram(LEAKYRELU_PACKED, x.shape, $alpha.shape) :
 new BinaryOpProgram(LEAKYRELU, x.shape, $alpha.shape);\n const result = backend.runWebGLProgram(program,
[x, $alpha], x.dtype);\n backend.disposeIntermediateTensorInfo($alpha);\n return result;\n}\n\nexport const leakyReluConfig: KernelConfig = {\n kernelName: LeakyRelu,\n backendName: 'webgl',\n kernelFunc: leakyRelu as { } as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License,
Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {env, KernelConfig, KernelFunc, Prelu, PreluInputs, TensorInfo} from '@tensorflow/tfjs-
core';\nimport {MathBackendWebGL} from '../backend_webgl';\nimport {BinaryOpProgram} from
'./binaryop_gpu';\nimport {BinaryOpPackedProgram} from './binaryop_packed_gpu';\n\nexport const PRELU =
`return (a < 0.) ? b * a : a;`;
\nexport const PRELU_PACKED = `\n vec4 aLessThanZero = vec4(lessThan(a,
vec4(0.)));
\n return (aLessThanZero * (b * a)) + ((vec4(1.0) - aLessThanZero) * a);\n`;
\n\nexport function prelu(args: {\n inputs: PreluInputs, backend: MathBackendWebGL\n}): TensorInfo {\n const {inputs, backend} =
args;\n const {x, alpha} = inputs;\n const program = env().getBool('WEBGL_PACK_BINARY_OPERATIONS') ?\n new BinaryOpPackedProgram(PRELU_PACKED, x.shape, alpha.shape) :
 new BinaryOpProgram(PRELU, x.shape, alpha.shape);\n return backend.runWebGLProgram(program, [x, alpha],
x.dtype);\n}\n\nexport const preluConfig: KernelConfig = {\n kernelName: Prelu,\n backendName: 'webgl',\n kernelFunc: prelu as { } as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the

```





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: ";
if (addBias) {
 this.variableNames.push('bias');
}
if (hasPreluActivation) {
 this.variableNames.push('preluActivationWeights');
}
if (hasLeakyreluActivation) {
 this.variableNames.push('leakyreluAlpha');
}
let batchASnippet = 'rc.x';
let batchBSnippet = 'rc.x';
if (aShape[0] < bShape[0]) {
 batchASnippet = `int(min(float(rc.x), ${aShape[0] - 1}))`;
} else if (bShape[0] < aShape[0]) {
 batchBSnippet = `int(min(float(rc.x), ${bShape[0] - 1}))`;
}
this.userCode = `
 ${activationSnippet}
 const float sharedDimension = ${sharedDimensionPacked}.0;
 vec4 dot2x2ARowBCol(ivec3 rc) {
 vec4 result = vec4(0);
 for (int i = 0; i < ${sharedDimensionPacked}; i++) {
 int batchA = ${batchASnippet};
 int batchB = ${batchBSnippet};
 vec4 a = getMatrixA(batchA, ${aSample});
 vec4 b = getMatrixB(batchB, ${bSample});

 // These swizzled products need to be separately added. See:
 https://github.com/tensorflow/tfjs/issues/1735
 result += (${aSwizzle[0]} * ${bSwizzle[0]});
 result += (${aSwizzle[1]} * ${bSwizzle[1]});
 }
 return result;
 }
 void main() {
 ivec3 rc = getOutputCoords();
 vec4 result = dot2x2ARowBCol(rc);
 ${addBiasSnippet}
 ${applyActivationSnippet}
 setOutput(result);
 }
`;
}
}
"/**
 * @license
 * Copyright 2018 Google LLC. All Rights Reserved.
 * Licensed under the Apache License, Version 2.0 (the "License");
 * you may not use this file except in compliance with the License.
 * You may obtain a copy of the License at
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 * Unless required by applicable law or agreed to in writing,
 * software distributed under the License is distributed on an "AS IS"
 * BASIS, WITHOUT WARRANTIES OR CONDITIONS
 * OF ANY KIND, either express or implied.
 * See the License for the specific language governing permissions
 * and limitations under the License.
 */
=====
*/
import { backend_util } from '@tensorflow/tfjs-core';
import { GPGPUProgram } from './gpgpu_math';

(Ar + Ai)(Br + Bi) = ArBr + ArBi + AiBr + AiBi = ArBr - AB + ArBi + AiBr
Yr = ArBr - AB
Yi = ArBi + AiBr
export const COMPLEX_MULTIPLY = {
 REAL: 'return areal * breal - aimag * bimag;',
 IMAG: 'return areal * bimag + aimag * breal;',
};
export class BinaryOpComplexProgram implements GPGPUProgram {
 variableNames = ['AReal', 'AImag', 'BReal', 'BImag'];
 userCode: string;
 outputShape: number[];

 constructor(op: string, aShape: number[], bShape: number[]) {
 this.outputShape = backend_util.assertAndGetBroadcastShape(aShape, bShape);
 this.userCode = `
 float binaryOpComplex(
 float areal, float aimag, float breal, float bimag) {
 ${op}
 }
 void main() {
 float areal = getARealAtOutCoords();
 float aimag = getAImagAtOutCoords();
 float breal = getBRealAtOutCoords();
 float bimag = getBImagAtOutCoords();
 setOutput(binaryOpComplex(areal, aimag, breal, bimag));
 }
 `;
}
"/**
 * @license
 * Copyright 2020 Google LLC. All Rights Reserved.
 * Licensed under the Apache License, Version 2.0 (the "License");
 * you may not use this file except in compliance with the License.
 * You may obtain a copy of the License at
 * http://www.apache.org/licenses/LICENSE-2.0
 * Unless required by applicable law or agreed to in writing,
 * software distributed under the License is distributed on an "AS IS"
 * BASIS, WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.
 * See the License for the specific language governing permissions
 * and limitations under the License.
 */
=====
*/
import { TensorInfo } from '@tensorflow/tfjs-core';
import { MathBackendWebGL } from './backend_webgl';
import { ReshapePackedProgram } from './reshape_packed_gpu';
import { getBatchDim, getRowsCols } from './webgl_util';
export function packedReshape(input: TensorInfo, afterShape: number[], backend: MathBackendWebGL): TensorInfo {
 const input3DShape = [getBatchDim(input.shape), ...getRowsCols(input.shape)] as [number, number, number];
 const input3D: TensorInfo = {
 dtype: input.dtype,
 shape: input3DShape,
 dataId: input.dataId,
 };
 const afterShapeAs3D = [getBatchDim(afterShape), ...getRowsCols(afterShape)] as [number, number,

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number];\n\n const program = new ReshapePackedProgram(afterShapeAs3D, input3DShape);\n const
preventEagerUnpackingOfOutput = true;\n const output = backend.runWebGLProgram(\n program, [input3D],
input.dtype,
 null /* customSetup */,\n preventEagerUnpackingOfOutput);\n return {dataId: output.dataId, shape: afterShape,
dtype: output.dtype};\n}\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed
under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * \n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *

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*/\n\nimport { KernelConfig, KernelFunc, Reshape, ReshapeAttrs, ReshapeInputs, TensorInfo, util } from
'@tensorflow/tfjs-core';\n\nimport
{MathBackendWebGL} from '../backend_webgl';\nimport {packedReshape} from '../kernel_utils/reshape';\nimport
{isReshapeFree} from '../webgl_util';\n\nexport function reshape(args: {\n inputs: ReshapeInputs,\n backend:
MathBackendWebGL,\n attrs: ReshapeAttrs\n}): TensorInfo {\n const {inputs, backend, attrs} = args;\n const {x}
= inputs;\n const {shape} = attrs;\n const webglBackend = backend;\n const xSize =
util.sizeFromShape(x.shape);\n const $shape = util.inferFromImplicitShape(shape, xSize);\n const $xSize =
util.sizeFromShape($shape);\n util.assert(\n xSize === $xSize,\n () => `The new shape (${ $shape }) has
${ $xSize } elements and the old ` +\n `shape (${ x.shape }) has ${ xSize } elements. The new shape and old ` +\n
 `shape must have the same number of elements.`);\n const xTexData =
webglBackend.texData.get(x.dataId);\n if (xTexData.isPacked && !isReshapeFree(x.shape, $shape) &&\n
!(xTexData.texture !== null && isReshapeFree(xTexData.shape,
$shape))) {\n return packedReshape(x, $shape, webglBackend);\n }\n webglBackend.incRef(x.dataId);\n return {dataId: x.dataId, shape: $shape, dtype: x.dtype};\n}\n\nexport const reshapeConfig: KernelConfig = {\n
kernelName: Reshape,\n backendName: 'webgl',\n kernelFunc: reshape as {} as KernelFunc\n};\n"/**\n *
@license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version
2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *

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=====
*/\n\nimport { backend_util, util } from '@tensorflow/tfjs-core';\nimport {GPGPUProgram} from
'./gpgpu_math';\n\nexport class MeanProgram implements GPGPUProgram {\n variableNames = ['x'];\n outputShape: number[];\n userCode: string;\n\n constructor(reduceInfo: backend_util.ReduceInfo, divisor?:
number) {\n const {windowSize, batchSize, inSize, outSize} = reduceInfo;\n this.outputShape = [batchSize,
outSize];\n const windowSizeNearestVec4 = Math.floor(windowSize / 4) * 4;\n const
windowSizeVec4Remainder = windowSize % 4;\n let updateSnippet = `sumValue += dot(values, ones);`; \n if
(divisor !== null) {\n const denominator = 1 / divisor;\n updateSnippet = `sumValue += dot(values * ${\n
util.isInt(denominator) ? denominator.toPrecision(2) :\n denominator}, ones);`; \n }\n let
checkOutOfBounds = `;\n if (inSize % windowSize > 0) {\n checkOutOfBounds
= `\n if (inIdx < 0 || inIdx >= ${inSize}) {\n return 0.0;\n }\n `;\n }\n this.userCode = `\n
const vec4 ones = vec4(1.0, 1.0, 1.0, 1.0);\n float getValue(int batch, int inIdx) {\n
${checkOutOfBounds}\n return getX(batch, inIdx);\n }\n void main() {\n ivec2 coords =
getOutputCoords();\n int batch = coords[0];\n int outIdx = coords[1];\n int inOffset = outIdx *
${windowSize};\n float sumValue = 0.0;\n for (int i = 0; i < ${windowSizeNearestVec4}; i += 4) {\n

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 int inIdx = inOffset + i;\n vec4 values = vec4(\n getValue(batch, inIdx),\n getValue(batch, inIdx + 1),\n getValue(batch, inIdx + 2),\n getValue(batch, inIdx + 3)\n);\n\n ${updateSnippet}\n }\n\n int inIdx = inOffset + ${windowSizeNearestVec4};\n if\n (${windowSizeVec4Remainder === 1}) {\n vec4 values =\n vec4(getValue(batch, inIdx), 0.0, 0.0, 0.0);\n ${updateSnippet}\n } else if\n (${windowSizeVec4Remainder === 2}) {\n vec4 values = vec4(\n getValue(batch, inIdx),\n getValue(batch, inIdx + 1), 0.0, 0.0);\n ${updateSnippet}\n } else if (${windowSizeVec4Remainder\n === 3}) {\n vec4 values = vec4(\n getValue(batch, inIdx),\n getValue(batch, inIdx + 1),\n getValue(batch, inIdx + 2), 0.0);\n ${updateSnippet}\n }\n setOutput(sumValue);\n }\n `;\n }\n }\n ", "/*\n * @license\n * Copyright 2017 Google LLC. All Rights Reserved.\n * Licensed under the Apache\n License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You\n may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required\n by applicable law or agreed to in writing, software\n * distributed under the License\n is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either\n express or implied.\n * See the License for the specific language governing permissions and\n * limitations under\n the License.\n *\n =====\n *\n \n import {backend_util} from '@tensorflow/tfjs-core';\n import {GPGPUProgram} from\n './gpgpu_math';\n \n export class ReduceProgram implements GPGPUProgram {\n variableNames = ['x'];\n outputShape: number[];\n userCode: string;\n \n constructor(\n reduceInfo: backend_util.ReduceInfo,\n reduceType: 'all'|'any'|'max'|'min'|'sum'|'prod') {\n const {windowSize, batchSize, inSize, outSize} = reduceInfo;\n this.outputShape = [batchSize, outSize];\n \n let initializationValue = '0.0';\n let compareOp = ``;\n \n if\n (reduceType === 'prod') {\n initializationValue = '1.0';\n } else if (reduceType === 'min') {\n // WebGL on\n Firefox Linux can't compile\n 1/0 so we do 1/eps.\n initializationValue = '1.0 / 1e-20';\n compareOp = `min`;\n } else if (reduceType ===\n 'max') {\n // WebGL on Firefox Linux can't compile 1/0 so we do 1/eps.\n initializationValue = '-1.0 / 1e-\n 20';\n compareOp = `max`;\n }\n \n let returnValue = `${reduceType}(${reduceType}(${reduceType}(`\n +\n 'minMaxValue[0], minMaxValue[1], minMaxValue[2], minMaxValue[3]`);\n \n if (reduceType === 'sum') {\n returnValue = `sumValue`;\n } else if (reduceType === 'prod') {\n returnValue = `prodValue`;\n } else if\n (reduceType === 'all') {\n returnValue = `allValue`;\n } else if (reduceType === 'any') {\n returnValue =\n `anyValue`;\n }\n \n const windowSizeNearestVec4 = Math.floor(windowSize / 4) * 4;\n const\n windowSizeVec4Remainder = windowSize % 4;\n \n let updateSnippet = `\n if (${reduceType === 'sum'}) {\n sumValue += dot(values, ones);\n } else if (${reduceType === 'prod'}) {\n \n vec2 tmp = vec2(values[0], values[1]) * vec2(values[2], values[3]);\n prodValue *= tmp[0] * tmp[1];\n }\n \n else {\n minMaxValue = ${compareOp}(values, minMaxValue);\n }\n `;\n \n let vecType = `vec4`;\n \n if (reduceType === 'all') {\n initializationValue = '1.0';\n updateSnippet = `\n bool reducedAllValue =\n all(values);\n float floatedReducedAllValue = float(reducedAllValue);\n allValue = float(allValue >= 1.0\n && floatedReducedAllValue >= 1.0);\n `;\n vecType = `bvec4`;\n } else if (reduceType === 'any') {\n initializationValue = '0.0';\n updateSnippet = `\n bool reducedAnyValue = any(values);\n float\n floatedReducedAnyValue = float(reducedAnyValue);\n anyValue = float(anyValue >= 1.0 ||\n floatedReducedAnyValue >= 1.0);\n `;\n vecType = `bvec4`;\n }\n \n let checkOutOfBounds = ``;\n \n if\n (inSize % windowSize > 0) {\n checkOutOfBounds = `\n if (inIdx < 0\n || inIdx >= ${inSize}) {\n return initializationValue;\n }\n `;\n }\n \n this.userCode = `\n const\n float initializationValue = ${initializationValue};\n const vec4 ones = vec4(1.0, 1.0, 1.0, 1.0);\n \n float\n getValue(int batch, int inIdx) {\n ${checkOutOfBounds}\n return getX(batch, inIdx);\n }\n \n void\n main() {\n ivec2 coords = getOutputCoords();\n int batch = coords[0];\n int outIdx = coords[1];\n \n int inOffset = outIdx * ${windowSize};\n \n vec4 minMaxValue = vec4(${initializationValue});\n float\n prodValue = 1.0;\n float sumValue = 0.0;\n float allValue = 1.0;\n float anyValue = 0.0;\n \n for

```

```
(int i = 0; i < ${windowSizeNearestVec4}; i += 4) {\n int inIdx = inOffset + i;\n ${vecType} values =\n${vecType}(\n getValue(batch, inIdx),\n getValue(batch, inIdx + 1),\n getValue(batch, inIdx + 2),\n getValue(batch,\n inIdx + 3))\n);\n\n ${updateSnippet}\n}\n\n int inIdx = inOffset +\n${windowSizeNearestVec4};\n if (${windowSizeVec4Remainder} === 1) {\n ${vecType} values =\n${vecType}(\n getValue(batch, inIdx),\n initializationValue,\n initializationValue,\n initializationValue\n);\n\n ${updateSnippet}\n } else if (${windowSizeVec4Remainder} === 2) {\n ${vecType} values = ${vecType}(\n getValue(batch, inIdx),\n getValue(batch, inIdx + 1),\n initializationValue,\n initializationValue\n);\n\n ${updateSnippet}\n } else if\n(${windowSizeVec4Remainder} === 3) {\n ${vecType} values = ${vecType}(\n getValue(batch,\ninIdx),\n getValue(batch, inIdx + 1),\n getValue(batch, inIdx + 2),\n initializationValue\n);\n\n ${updateSnippet}\n }\n setOutput(${returnValue});\n}\n`;\n}\n}\n","**\n * @license\n * Copyright 2020 Google LLC.\nAll Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,\nsoftware\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n*\n=====\n\n*/\n\nimport {backend_util, DataType, TensorInfo} from '@tensorflow/tfjs-core';\nimport\n{MathBackendWebGL} from '../backend_webgl';\nimport {MeanProgram} from '../mean_gpu';\nimport\n{ReduceProgram} from '../reduce_gpu';\n\nntype\nReduceTypes = 'all'|'any'|'max'|'min'|'sum'|'prod'|'mean';\n\n// Returns an array of configuration objects that describe each stage of the\n// reduction.\nfunction getReductionStages(inShape: number[]):\n Array<{\n inSize: number,\n windowSize: number, outSize: number}> {\n const stages = [];\n\n while (stages.length === 0 ||\nstages[stages.length - 1].outSize !== 1) {\n const outSize: number =\n stages.length ? stages[stages.length - 1].outSize : inShape[1];\n const windowSize = backend_util.computeOptimalWindowSize(outSize);\n stages.push({\n inSize: outSize,\n windowSize,\n outSize: Math.ceil(outSize / windowSize)\n });\n }\n\n return stages;\n}\n\nexport function reduce(\n x: TensorInfo, dtype: DataType, reductionType: ReduceTypes,\n backend: MathBackendWebGL): TensorInfo {\n const reductionStages = getReductionStages(x.shape);\n\n let result = x;\n for (let i = 0; i < reductionStages.length; i++) {\n const {inSize,\n windowSize, outSize} = reductionStages[i];\n let program: ReduceProgram|MeanProgram;\n let previousResult: TensorInfo;\n if (reductionType === 'mean') {\n program = i === 0 ?\n new MeanProgram(\n {windowSize, inSize, batchSize: x.shape[0], outSize}, inSize):\n new MeanProgram({windowSize, inSize, batchSize: x.shape[0], outSize});\n } else {\n program = new ReduceProgram(\n {windowSize, inSize, batchSize: x.shape[0], outSize}, reductionType);\n }\n\n previousResult = result;\n result = backend.runWebGLProgram(program, [result], dtype);\n\n if\n(previousResult.dataId !== x.dataId) {\n backend.disposeIntermediateTensorInfo(previousResult);\n }\n }\n\n return result;\n}\n\n","**\n * @license\n * Copyright 2017 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy\nof the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n*\n=====\n\n*/\n\nimport {GPGPUProgram} from './gpgpu_math';\nimport {getCoordsDataType} from
```



```
./shader_compiler';\n\nexport class TransposeProgram implements GPGPUProgram {\n variableNames = ['A'];\n outputShape: number[];\n userCode: string;\n rank: number;\n\n constructor(aShape: number[], newDim: number[]) {\n const outputShape: number[] = new Array(aShape.length);\n for (let i = 0; i < outputShape.length; i++) {\n outputShape[i] = aShape[newDim[i]];\n }\n this.outputShape = outputShape;\n this.rank = outputShape.length;\n const dtype = getCoordsDataType(this.rank);\n const switched = getSwitchedCoords(newDim);\n\n this.userCode = `\n void main() {\n ${dtype} resRC = getOutputCoords();\n setOutput(getA(${switched}));\n }\n `;\n }\n\n function getSwitchedCoords(newDim: number[]): string {\n const rank = newDim.length;\n if (rank > 6) {\n throw Error(`Transpose for rank ${rank} is not yet supported`);\n }\n const originalOrder = [\n 'resRC.x', 'resRC.y', 'resRC.z', 'resRC.w', 'resRC.u', 'resRC.v'];\n const switchedCoords = new Array(rank);\n for (let i = 0; i < newDim.length; i++) {\n switchedCoords[newDim[i]] = originalOrder[i];\n }\n return switchedCoords.join();\n }\n}\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,\n * software distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n\nimport {GPGPUProgram} from './gpgpu_math';\nimport {getVecChannels} from './packing_util';\nimport {getCoordsDataType} from './shader_compiler';\n\nexport class TransposePackedProgram implements GPGPUProgram {\n variableNames = ['A'];\n outputShape: number[];\n userCode: string;\n rank: number;\n packedInputs = true;\n packedOutput = true;\n\n constructor(aShape: number[], newDim: number[]) {\n const outputShape: number[] = new Array(aShape.length);\n for (let i = 0; i < outputShape.length; i++) {\n outputShape[i]\n = aShape[newDim[i]];\n }\n this.outputShape = outputShape;\n this.rank = outputShape.length;\n if (this.rank > 6) {\n throw Error(\n `Packed transpose for rank ${this.rank} is not yet supported.`);\n }\n const dtype = getCoordsDataType(this.rank);\n const outputOrder = getVecChannels('rc', this.rank);\n const switchedOrder = new Array(this.rank);\n for (let i = 0; i < newDim.length; i++) {\n switchedOrder[newDim[i]] = outputOrder[i];\n }\n const innerDims = `vec2(${switchedOrder.slice(-2).join()})`; \n const nextColumn = `${++${outputOrder[this.rank - 1]}}`; \n const getc = `getChannel(getA(${switchedOrder.join()}), ${innerDims})`; \n this.userCode = `\n void main() {\n ${dtype} rc = getOutputCoords();\n vec4 result = vec4(0.); \n result[0] = ${getc}; \n if (${nextColumn}) {\n result[1] = ${getc}; \n } \n --${outputOrder[this.rank - 1]}; \n if (++${outputOrder[this.rank - 2]} < ${outputShape[this.rank - 2]}) {\n result[2] = ${getc}; \n if (${nextColumn}) {\n result[3] = ${getc}; \n } \n } \n setOutput(result);\n }\n `;\n }\n}\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,\n * software distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n\nimport {backend_util, sumOutType, TensorInfo, util} from '@tensorflow/tfjs-core';\nimport {MathBackendWebGL} from '../backend_webgl';\nimport {reduce} from '../kernel_utils/reduce';\nimport {reshape} from '../Reshape';\nimport {transposeImpl} from '../Transpose_impl';\n\nexport function sumImpl(\n x: TensorInfo, axis: number|number[], keepDims: boolean,\n backend: MathBackendWebGL): TensorInfo {\n const reductionIndices = axis;\n\n const xRank =
```



```

= null,\n leakyreluAlpha = 0,\n activation = null\n}: BatchMatMulConfig): TensorInfo {\n const aRank =
a.shape.length;\n const bRank = b.shape.length;\n\n const innerShapeA = transposeA ? a.shape[aRank - 2] :
a.shape[aRank - 1];\n const innerShapeB = transposeB ? b.shape[bRank - 1] : b.shape[bRank - 2];\n\n const
outerShapeA = transposeA ? a.shape[aRank - 1] : a.shape[aRank - 2];\n const outerShapeB = transposeB ?
b.shape[bRank - 2] : b.shape[bRank - 1];\n\n const outerDimsA = a.shape.slice(0, -2);\n const outerDimsB =
b.shape.slice(0, -2);\n\n const batchDimA = util.sizeFromShape(outerDimsA);\n const batchDimB =
util.sizeFromShape(outerDimsB);\n\n const batchDimsCompatible =\n batchDimA === batchDimB ||
batchDimA === 1 || batchDimB === 1;\n\n util.assert(\n aRank >= 2 && bRank >= 2 &&
batchDimsCompatible,\n () => `Error in matMul: the input batch dimensions must either be the ` +\n `same
or at least one input batch dimension must be 1. Got
input ` +\n `batch dimensions of (${outerDimsA}) and (${outerDimsB}).`);\n\n const outShapeOuterDims
=\n batchDimA > batchDimB ? a.shape.slice(0, -2) : b.shape.slice(0, -2);\n const outShape =
outShapeOuterDims.concat([outerShapeA, outerShapeB]);\n\n util.assert(\n innerShapeA === innerShapeB,\n () => `Error in matMul: inner shapes (${innerShapeA}) and ` +\n `${innerShapeB}) of Tensors with shapes
${a.shape} and ` +\n `${b.shape} and transposeA=${transposeA}` +\n ` and transposeB=${transposeB}
must match.`);\n\n const a3dShape: [number, number, number] = transposeA ?\n [batchDimA, innerShapeA,
outerShapeA] :\n [batchDimA, outerShapeA, innerShapeA];\n const b3dShape: [number, number, number] =
transposeB ?\n [batchDimB, outerShapeB, innerShapeB] :\n [batchDimB, innerShapeB, outerShapeB];\n\n //
The rest of the implementation is designed to operate on rank-3 tensors\n const a3d = reshape({inputs: {x: a},
backend,
 attrs: {shape: a3dShape}});\n const b3d = reshape({inputs: {x: b}, backend, attrs: {shape: b3dShape}});\n\n const
intermediates: TensorInfo[] = [a3d, b3d];\n\n const batchDim = Math.max(batchDimA, batchDimB);\n const
sharedDim = transposeA ? a3d.shape[1] : a3d.shape[2];\n\n const hasBias = bias != null;\n const
hasPreluActivationWeights = preluActivationWeights != null;\n const hasLeakyreluAlpha = activation ===
'leakyrelu';\n const fusedActivation = activation != null ?\n mapActivationToShaderProgram(activation, true) :\n null;\n const containsFusedOps = hasBias || hasPreluActivationWeights ||\n hasLeakyreluAlpha ||
fusedActivation != null;\n let out: TensorInfo;\n\n // Since the matrices are vectors, it is faster to call mul().sum()\n
// because sum() is O(sqrt(N)) due to divide-and-conquer.\n if ((outerShapeA === 1 || outerShapeB === 1) &&\n
sharedDim > MATMUL_SHARED_DIM_THRESHOLD && containsFusedOps === false) {\n let aVec = a3d;\n let bVec
= b3d;\n if (transposeA) {\n aVec = transpose({inputs: {x: a3d}, backend, attrs: {perm: [0, 2, 1]}});\n
intermediates.push(aVec);\n }\n if (transposeB) {\n bVec = transpose({inputs: {x: b3d}, backend, attrs:
{perm: [0, 2, 1]}});\n intermediates.push(bVec);\n }\n\n const shouldReshapeA = outerShapeB !== 1;\n
const shouldReshapeB = outerShapeB === 1;\n\n let aVec3d = aVec;\n if (shouldReshapeA) {\n aVec3d =
reshape({\n inputs: {x: aVec},\n backend,\n attrs: {shape: [batchDim, sharedDim, 1]}});\n }\n\n
intermediates.push(aVec3d);\n }\n\n const axis = outerShapeB === 1 ? 2 : 1;\n\n let bVec3d = bVec;\n if
(shouldReshapeB) {\n bVec3d = reshape({\n inputs: {x: bVec},\n backend,\n attrs: {shape:
[batchDim, 1, sharedDim]}});\n }\n\n intermediates.push(bVec3d);\n }\n\n const product =
multiply({inputs: {a: aVec3d, b: bVec3d}, backend});\n out = sum({inputs: {x:
product}, backend, attrs: {axis, keepDims: true}});\n intermediates.push(product);\n } else {\n const dtype =
upcastType(a.dtype, b.dtype);\n\n const program = new MatMulPackedProgram(\n a3dShape, b3dShape,
[batchDim, outerShapeA, outerShapeB], transposeA,\n transposeB, hasBias, fusedActivation,
hasPreluActivationWeights,\n hasLeakyreluAlpha);\n\n const inputs: TensorInfo[] = [a3d, b3d];\n if (bias !=
null) {\n inputs.push(bias);\n }\n if (hasPreluActivationWeights) {\n
inputs.push(preluActivationWeights);\n }\n if (hasLeakyreluAlpha) {\n const $leakyreluAlpha =
backend.makeTensorInfo(\n [], 'float32',\n util.createScalarValue(leakyreluAlpha as {} as 'float32',
'float32'));\n inputs.push($leakyreluAlpha);\n intermediates.push($leakyreluAlpha);\n }\n\n out =
backend.runWebGLProgram(program, inputs, dtype);\n }\n\n const outReshaped =\n reshape({inputs: {x: out},

```

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backend, attrs: { shape:
 outShape }));\n intermediates.push(out);\n for (const i of intermediates) {\n
backend.disposeIntermediateTensorInfo(i);\n }\n return outReshaped;\n}\n", "/*\n * @license\n * Copyright 2020
Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the License);\n * you may
not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an AS IS BASIS,\n * WITHOUT WARRANTIES OR
CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing
permissions and\n * limitations under the License.\n *
=====
*\n\nimport { _FusedMatMul, _FusedMatMulAttrs, _FusedMatMulInputs, KernelConfig, KernelFunc } from
'@tensorflow/tfjs-core';\n\nimport
{ MathBackendWebGL } from '../backend_webgl';\n\nimport { batchMatMulImpl } from
'./BatchMatMul_impl';\n\nexport function _fusedMatMul(args: { \n inputs: _FusedMatMulInputs,\n attrs:
_FusedMatMulAttrs,\n backend: MathBackendWebGL\n }) { \n const { inputs, backend, attrs } = args;\n const { a, b,
bias, preluActivationWeights } = inputs;\n const { transposeA, transposeB, activation, leakyreluAlpha } = attrs;\n\n
return batchMatMulImpl({\n a,\n b,\n transposeA,\n transposeB,\n backend,\n bias,\n
preluActivationWeights,\n leakyreluAlpha,\n activation\n });\n}\n\nexport const _fusedMatMulConfig:
KernelConfig = {\n kernelName: _FusedMatMul,\n backendName: 'webgl',\n kernelFunc: _fusedMatMul as { } as
KernelFunc,\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License
at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in
writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT
WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific
language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport { Acos, KernelConfig } from '@tensorflow/tfjs-core';\n\nimport { unaryKernelFunc } from
'../kernel_utils/kernel_funcs_utils';\n\nimport { CHECK_NAN_SNIPPET } from '../unaryop_gpu';\n\nconst ACOS =
CHECK_NAN_SNIPPET +`\n if (abs(x) > 1.)\n return NAN;\n }\n return acos(x);\n`;\n\nexport const acos =
unaryKernelFunc({ opSnippet: ACOS });\n\nexport const acosConfig: KernelConfig = {\n kernelName: Acos,\n
backendName: 'webgl',\n kernelFunc: acos,\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport { Acosh, KernelConfig } from '@tensorflow/tfjs-core';\n\nimport { unaryKernelFunc } from
'../kernel_utils/kernel_funcs_utils';\n\nimport { CHECK_NAN_SNIPPET } from '../unaryop_gpu';\n\nconst ACOSH =
CHECK_NAN_SNIPPET +`\n if (x < 1.0) return NAN;\n return log(x + sqrt(x * x - 1.0));\n`;\n\nexport const acosh =
unaryKernelFunc({ opSnippet:
ACOSH });\n\nexport const acoshConfig: KernelConfig = {\n kernelName: Acosh,\n backendName: 'webgl',\n
kernelFunc: acosh,\n};\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed
under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed

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on an \"AS IS\" BASIS,\n \* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*

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*\n\nimport {GPGPUProgram} from './gpgpu_math';\n\nexport class AddNProgram implements GPGPUProgram {\n variableNames: string[];\n outputShape: number[];\n number[] = [];\n userCode: string;\n\n constructor(outputShape: number[], shapes: number[][]) {\n this.outputShape = outputShape;\n this.variableNames = shapes.map((_, i) => `T${i}`);\n\n const snippets: string[] = [];\n // Get target elements from every input tensor.\n this.variableNames.forEach(variable => {\n snippets.push(`float v${variable} = get${variable}AtOutCoords();`);\n });\n\n // Calculate the sum of all elements.\n const operation = this.variableNames\n .map(variable => {\n return `v${variable}`;\n })\n .join(' + ');\n\n this.userCode = `\n void main() {\n ${snippets.join(`\n `)}\n float result = ${operation};\n setOutput(result);\n }\n `;\n }\n\n /**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n}
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=====
*\n\nimport {GPGPUProgram} from './gpgpu_math';\n\nexport class AddNPackedProgram implements GPGPUProgram {\n variableNames: string[];\n outputShape: number[] = [];\n userCode: string;\n packedInputs = true;\n packedOutput = true;\n\n constructor(outputShape: number[], shapes: number[][]) {\n this.outputShape = outputShape;\n this.variableNames = shapes.map((_, i) => `T${i}`);\n\n const snippets: string[] = [];\n // Get target elements from every input tensor.\n this.variableNames.forEach(variable => {\n snippets.push(`vec4 v${variable} = get${variable}AtOutCoords();`);\n });\n\n // Calculate the sum of all elements.\n const operation = this.variableNames\n .map(variable => {\n return `v${variable}`;\n })\n .join(' + ');\n\n this.userCode = `\n void main() {\n ${snippets.join(`\n `)}\n vec4 result = ${operation};\n setOutput(result);\n }\n `;\n }\n\n /**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n}
```

```
=====
*\n\nimport {AddN, AddNInputs, env, KernelConfig, KernelFunc, TensorInfo, upcastType} from '@tensorflow/tfjs-core';\n\nimport {AddNProgram} from './addn_gpu';\nimport {AddNPackedProgram} from './addn_packed_gpu';\nimport {MathBackendWebGL} from './backend_webgl';\nimport {identity} from './Identity';\n\nexport function addN(args: {inputs: AddNInputs, backend: MathBackendWebGL}): TensorInfo {\n const {inputs, backend} = args;\n const tensors = inputs;\n if (tensors.length === 1) {\n return identity({inputs: {x: tensors[0]}, backend});\n }\n\n // Limit the number of uploaded textures for optimization.\n if (tensors.length > env().get('WEBGL_MAX_TEXTURES_IN_SHADER')) {\n const midIndex = Math.floor(tensors.length / 2);\n const leftSide = addN({inputs: tensors.slice(0, midIndex), backend});\n const rightSide = addN({inputs: tensors.slice(midIndex), backend});\n return addN({inputs: [leftSide, rightSide], backend});\n }\n\n const dtype = tensors.map(t => t.dtype).reduce((d1,
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d2) => upcastType(d1, d2));\n const shapes = tensors.map(t => t.shape);\n // We can make sure shapes are identical
in op level.\n const usePackedOp = env().getBool('WEBGL_PACK');\n const program = usePackedOp ?\n new
AddNPackedProgram(tensors[0].shape, shapes) :\n new AddNProgram(tensors[0].shape, shapes);\n return
backend.runWebGLProgram(program, tensors, dtype);\n}\n\n\nexport const addNConfig: KernelConfig = {\n
 kernelName: AddN,\n backendName: 'webgl',\n kernelFunc: addN as {} as KernelFunc\n};\n\n"/**\n * @license\n
* Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License,
Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may
obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by
applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS"
BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the
License for the specific language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport { All, AllAttrs, AllInputs, backend_util, KernelConfig, KernelFunc, TensorInfo, util } from
'@tensorflow/tfjs-core';\n\nimport { MathBackendWebGL } from '../backend_webgl';\nimport { reduce } from
'../kernel_utils/reduce';\nimport { reshape } from '../Reshape';\nimport { transpose } from '../Transpose';\n\nexport
function all(\n args: { inputs: AllInputs, backend: MathBackendWebGL,\n attrs: AllAttrs }):\n TensorInfo {\n const { inputs, backend, attrs } = args;\n const { x } = inputs;\n const { axis,
keepDims } = attrs;\n\n const xRank = x.shape.length;\n\n const origAxes = util.parseAxisParam(axis, x.shape);\n let axes = origAxes;\n const permutedAxes = backend_util.getAxesPermutation(axes, xRank);\n let permutedX =
x;\n if (permutedAxes !== null) {\n permutedX = transpose({ inputs: { x }, backend, attrs: { perm:
permutedAxes } });\n axes = backend_util.getInnerMostAxes(axes.length, xRank);\n }\n\n backend_util.assertAxesAreInnerMostDims('all', axes, xRank);\n const [outShape, reduceShape] =\n backend_util.computeOutAndReduceShapes(permutedX.shape, axes);\n const inSize =
 util.sizeFromShape(reduceShape);\n\n const a2D =\n reshape({ inputs: { x: permutedX }, backend, attrs: { shape:
[-1, inSize] } });\n const reduced = reduce(a2D, a2D.dtype, 'all', backend);\n\n let res;\n if (keepDims) {\n const
newShape = backend_util.expandShapeToKeepDim(outShape,\n origAxes);\n res = reshape({ inputs: { x: reduced }, backend, attrs: { shape: newShape } });\n } else {\n res =
 reshape({ inputs: { x: reduced }, backend, attrs: { shape: outShape } });\n }\n\n backend.disposeIntermediateTensorInfo(a2D);\n backend.disposeIntermediateTensorInfo(reduced);\n\n if
(permutedAxes !== null) {\n backend.disposeIntermediateTensorInfo(permutedX);\n }\n\n return res;\n }\n\n\nexport
const allConfig: KernelConfig = {\n kernelName: All,\n backendName: 'webgl',\n kernelFunc: all as {} as
KernelFunc\n};\n\n"/**\n * @license\n
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* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License
for the specific language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport { Any, AnyAttrs, AnyInputs, backend_util, KernelConfig, KernelFunc, TensorInfo, util } from
'@tensorflow/tfjs-core';\n\nimport { MathBackendWebGL } from '../backend_webgl';\nimport { reduce } from
'../kernel_utils/reduce';\nimport { reshape } from '../Reshape';\nimport { transpose } from '../Transpose';\n\nexport
function any(\n args: { inputs: AnyInputs, backend: MathBackendWebGL, attrs: AnyAttrs }):\n TensorInfo {\n const { inputs, backend, attrs } = args;\n const { x } = inputs;\n const { axis, keepDims } = attrs;\n\n const xRank =
x.shape.length;\n\n const origAxes = util.parseAxisParam(axis, x.shape);\n let axes = origAxes;\n const
permutedAxes = backend_util.getAxesPermutation(axes, xRank);\n let permutedX = x;\n if (permutedAxes !== null) {\n permutedX = transpose({ inputs: { x }, backend, attrs: { perm: permutedAxes } });\n axes = backend_util.getInnerMostAxes(axes.length, xRank);\n }\n\n axes = backend_util.getInnerMostAxes(axes.length, xRank);\n }\n\n

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backend_util.assertAxesAreInnerMostDims('any', axes, xRank);\n const [outShape, reduceShape] =\n
backend_util.computeOutAndReduceShapes(permutedX.shape, axes);\n const inSize =\n
util.sizeFromShape(reduceShape);\n\n const a2D =\n reshape({inputs: {x: permutedX}, backend, attrs: {shape:\n
[-1, inSize]}));\n const reduced = reduce(a2D, a2D.dtype, 'any', backend);\n let res;\n if (keepDims) {\n const\n
newShape = backend_util.expandShapeToKeepDim(outShape, origAxes);\n res = reshape({inputs: {x: reduced},\n
backend, attrs: {shape: newShape}});\n } else {\n res = reshape({inputs: {x: reduced}, backend, attrs: {shape:\n
outShape}});\n }\n\n backend.disposeIntermediateTensorInfo(a2D);\n
backend.disposeIntermediateTensorInfo(reduced);\n\n if (permutedAxes != null) {\n
backend.disposeIntermediateTensorInfo(permutedX);\n
 }\n\n return res;\n}\n\n\nexport const anyConfig: KernelConfig = {\n kernelName: Any,\n backendName:\n
'webgl',\n kernelFunc: any as {} as KernelFunc\n};\n\n", "/*\n * @license\n * Copyright 2017 Google LLC. All\n
Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this\n
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n
governing permissions and\n * limitations under the License.\n *\n
===== \n
*\n\nimport {backend_util} from '@tensorflow/tfjs-core';\nimport {GPGPUProgram} from\n
'./gpgpu_math';\n\nexport\n
class ArgMinMaxProgram implements GPGPUProgram {\n variableNames = ['A'];\n outputShape: number[];\n userCode: string;\n\n constructor(\n reduceInfo: backend_util.ReduceInfo, op: 'max'|'min',\n firstPass:\n
boolean) {\n const {windowSize, batchSize, outSize} = reduceInfo;\n if (!firstPass) {\n\n
this.variableNames.push('bestIndicesA');\n }\n this.outputShape = [batchSize, outSize];\n const compOp = (op\n
=== 'max') ? '>' : '<';\n const indexSnippet = firstPass ?\n 'inOffset + i;' :\n 'round(getBestIndicesA(batch,\n
inOffset + i));'\n this.userCode = `\n void main() {\n ivec2 coords = getOutputCoords();\n int batch\n
= coords[0];\n int outIdx = coords[1];\n int inOffset = outIdx * ${windowSize};\n\n int bestIndex =\n
inOffset;\n float bestValue = getA(batch, bestIndex);\n for (int i = 0; i < ${windowSize}; i++) {\n\n
int inIdx = ${indexSnippet};\n\n float candidate = getA(batch, inIdx);\n if (candidate ${compOp} bestValue) {\n bestValue =\n
candidate;\n bestIndex = inIdx;\n }\n }\n setOutput(float(bestIndex));\n }\n `;\n\n
}\n\n", "/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache\n
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may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required\n
by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS"\n
BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the\n
License for the specific language governing permissions and\n * limitations under the License.\n *\n
===== \n
*\n\nimport {util} from '@tensorflow/tfjs-core';\n\nimport\n
{GPGPUProgram} from './gpgpu_math';\nimport {getChannels} from './packing_util';\nimport\n
{getCoordsDataType} from './shader_compiler';\n\nexport class ArgMinMaxPackedProgram implements\n
GPGPUProgram {\n variableNames = ['A'];\n outputShape: number[];\n userCode: string;\n packedInputs =\n
true;\n packedOutput = true;\n\n constructor(\n shape: number[], windowSize: number, op: 'max'|'min',\n firstPass: boolean) {\n util.assert(\n shape.length > 2,\n () => `Packed arg${\n
op.charAt(0).toUpperCase() +\n op.slice(1)} supports only inputs with rank above 2.`);\n const inSize =\n
shape[shape.length - 1];\n const outSize = Math.ceil(inSize / windowSize);\n this.outputShape = shape.slice(0, -\n
1);\n if (outSize > 1) {\n this.outputShape.push(outSize);\n }\n if (!firstPass) {\n\n
this.variableNames.push('bestIndicesA');\n }\n const outShape = this.outputShape;\n const rank =

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outShape.length;\n
const dtype = getCoordsDataType(rank);\n const coords = getChannels('coords', rank);\n let
sourceLocSetup;\n let sourceRank;\n if (outSize === 1) {\n sourceRank = rank + 1;\n const
sourceLocDType = getCoordsDataType(sourceRank);\n sourceLocSetup = `\n ${sourceLocDType}
sourceLocR = ${sourceLocDType}(${coords.join()}, 0);\n ++${coords[rank - 1]};\n ${sourceLocDType}
sourceLocG = ${sourceLocDType}(${coords.join()}, 0);\n ++${coords[rank - 2]};\n ${sourceLocDType}
sourceLocA = ${sourceLocDType}(${coords.join()}, 0);\n --${coords[rank - 1]};\n ${sourceLocDType}
sourceLocB = ${sourceLocDType}(${coords.join()}, 0);\n --${coords[rank - 2]};`; \n } else {\n
sourceRank = rank;\n sourceLocSetup = `\n ${dtype} sourceLocR = coords;\n ++${coords[rank - 1]};\n
${dtype} sourceLocG = coords;\n ++${coords[rank - 2]};\n ${dtype} sourceLocA = coords;\n --
${coords[rank
- 1]};\n ${dtype} sourceLocB = coords;\n --${coords[rank - 2]};`; \n } \n const channels = ['x', 'y', 'z',
'w', 'u', 'v'].slice(0, sourceRank);\n const inChannel = '.' + channels[sourceRank - 1]; // e.g. ".b" for rank 3.\n
const intChannels = channels.map(x => 'int ' + x);\n const srcRCoords =\n getChannels('sourceLocR',
sourceRank - 1).concat('inIdx.r');\n const srcGCoords =\n getChannels('sourceLocG', sourceRank -
1).concat('inIdx.g');\n const srcBCoords =\n getChannels('sourceLocB', sourceRank - 1).concat('inIdx.b');\n
const srcACoords =\n getChannels('sourceLocA', sourceRank - 1).concat('inIdx.a');\n\n const compOp = (op
=== 'max') ? 'greaterThan' : 'lessThan';\n const fetchCandidateIdx = firstPass ? " : "\n inIdx =
round(vec4(getBestIndicesAChannel(${srcRCoords.join()}),\n
getBestIndicesAChannel(${srcGCoords.join()}),\n
getBestIndicesAChannel(${srcBCoords.join()}),\n
getBestIndicesAChannel(${srcACoords.join()})));\n\n const fetchValue = `vec4(\n
getAChannel(${srcRCoords.join()}),\n hasNextCol ? getAChannel(${srcGCoords.join()}): 0.,\n
hasNextRow ? getAChannel(${srcBCoords.join()}): 0.,\n hasNextRow && hasNextCol ?
getAChannel(${srcACoords.join()}): 0.)`; \n\n const getBestIndicesAChannelSnippet = firstPass ? " : "\n float
getBestIndicesAChannel(${intChannels.join()}) {\n return getChannel(getBestIndicesA(${channels.join()}),\n
vec2(${channels.slice(-2).join()})); \n }`; \n\n this.userCode = `\n float
getAChannel(${intChannels.join()}) {\n return getChannel(getA(${channels.join()}),\n
vec2(${channels.slice(-2).join()})); \n } \n ${getBestIndicesAChannelSnippet} \n void main() {\n
${dtype} coords = getOutputCoords();\n
bool hasNextCol = ${coords[rank - 1]} < ${outShape[rank - 1] - 1};\n bool hasNextRow = ${coords[rank -
2]} < ${outShape[rank - 2] - 1};\n ${sourceLocSetup}\n ivec4 srcIdx = ivec4(sourceLocR${inChannel},
sourceLocG${inChannel},\n sourceLocB${inChannel}, sourceLocA${inChannel}) * ${windowSize};\n
ivec4 inIdx = srcIdx;\n ivec4 bestIndex = vec4(inIdx);\n ivec4 bestValue = ${fetchValue};\n\n for (int i
= 0; i < ${windowSize}; i++) {\n inIdx = srcIdx;\n ${fetchCandidateIdx}\n ivec4 candidate =
${fetchValue};\n bvec4 nan = isnan(candidate);\n bvec4 replace = bvec4(\n
vec4(${compOp}(candidate, bestValue)) * (vec4(1.0) - vec4(nan));\n\n bestValue = vec4(replace.x ?
candidate.x : bestValue.x,\n replace.y ? candidate.y : bestValue.y,\n replace.z ?
candidate.z : bestValue.z,\n replace.w ? candidate.w
: bestValue.w);\n bestIndex = mix(bestIndex, vec4(inIdx), vec4(replace));\n srcIdx++; \n } \n
setOutput(bestIndex);\n } \n `;\n }\n }\n\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights
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except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
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===== \n

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*/\n\nimport { backend_util, env, TensorInfo, util } from '@tensorflow/tfjs-core';\n\nimport { ArgMinMaxProgram }
from './argminmax_gpu';\nimport { ArgMinMaxPackedProgram } from './argminmax_packed_gpu';\nimport
{ MathBackendWebGL } from './backend_webgl';\nimport { reshape } from './kernels/Reshape';\n\nfunction
argReduce(\n backend: MathBackendWebGL, x: TensorInfo, reduceType: 'max'|'min',\n bestIndicesA:
TensorInfo = null): TensorInfo {\n let batchSize = x.shape[0];\n let inSize = x.shape[1];\n if (bestIndicesA != null)
{\n batchSize = bestIndicesA.shape[0];\n inSize = bestIndicesA.shape[1];\n }\n const windowSize =
backend_util.computeOptimalWindowSize(inSize);\n const reduceInfo =\n { windowSize, inSize, batchSize,
outSize: Math.ceil(inSize / windowSize)};\n const program =\n new ArgMinMaxProgram(reduceInfo,
reduceType, bestIndicesA == null);\n const inputs = [x];\n if (bestIndicesA != null) {\n
inputs.push(bestIndicesA);\n }\n const output = backend.runWebGLProgram(program, inputs, 'int32');\n // No
need to run another GPGPU program.\n if (output.shape[1]
=== 1) {\n return output;\n }\n const result = argReduce(backend, x, reduceType, output);\n
backend.disposeIntermediateTensorInfo(output);\n return result;\n}\n\nfunction argReducePacked(\n backend:
MathBackendWebGL, x: TensorInfo, reduceType: 'max'|'min',\n bestIndicesA: TensorInfo = null): TensorInfo {\n
const inShape = bestIndicesA != null ? bestIndicesA.shape : x.shape;\n const inSize = inShape[inShape.length -
1];\n const windowSize = backend_util.computeOptimalWindowSize(inSize);\n const program = new
ArgMinMaxPackedProgram(\n inShape, windowSize, reduceType, bestIndicesA == null);\n const inputs =
bestIndicesA == null ? [x] : [x, bestIndicesA];\n const output = backend.runWebGLProgram(program, inputs,
'int32');\n if (output.shape.length === x.shape.length) {\n const result = argReducePacked(backend, x,
reduceType, output);\n backend.disposeIntermediateTensorInfo(output);\n return result;\n }\n return
output;\n}\n\nexport function
argMinMaxReduce(\n backend: MathBackendWebGL, x: TensorInfo, axis: number,\n reduceType: 'min'|'max'):
TensorInfo {\n const axes = [axis];\n backend_util.assertAxesAreInnerMostDims(\n 'arg' +
reduceType.charAt(0).toUpperCase() + reduceType.slice(1), axes,\n x.shape.length);\n if
(!env().getBool('WEBGL_PACK_REDUCE') || x.shape.length <= 2) {\n const intermediateTensorInfos = [];\n
const [outShape, reduceShape] =\n backend_util.computeOutAndReduceShapes(x.shape, axes);\n const inSize
= util.sizeFromShape(reduceShape);\n const a2D = reshape({inputs: {x}, backend, attrs: {shape: [-1, inSize]}});\n
intermediateTensorInfos.push(a2D);\n\n const reduced = argReduce(backend, a2D, reduceType);\n
intermediateTensorInfos.push(reduced);\n const reshaped =\n reshape({inputs: {x: reduced}, backend, attrs:
{shape: outShape}});\n\n intermediateTensorInfos.forEach(\n t =>
backend.disposeIntermediateTensorInfo(t);\n return reshaped;\n }\n return argReducePacked(backend, x, reduceType);\n}\n\n", "/*\n * @license\n * Copyright 2020 Google LLC.
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http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
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=====
*/\n\nimport { ArgMax, ArgMaxAttrs, ArgMaxInputs, backend_util, KernelConfig, KernelFunc, TensorInfo, util }
from '@tensorflow/tfjs-core';\n\nimport { MathBackendWebGL } from './backend_webgl';\nimport
{ argMinMaxReduce } from
'./kernel_utils/arg_min_max';\n\nimport { transpose } from './Transpose';\n\nexport function argMax(\n args:\n
{inputs: ArgMaxInputs, backend: MathBackendWebGL, attrs: ArgMaxAttrs});\n TensorInfo {\n const {inputs,
backend, attrs} = args;\n const {x} = inputs;\n const {axis} = attrs;\n\n let axes = util.parseAxisParam(axis,
x.shape);\n const permutedAxes = backend_util.getAxesPermutation(axes, x.shape.length);\n let $x = x;\n const
intermediateTensorInfos = [];\n if (permutedAxes != null) {\n $x = transpose({inputs: {x}, backend, attrs: {perm:
permutedAxes}});\n intermediateTensorInfos.push($x);\n axes = backend_util.getInnerMostAxes(axes.length,

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$x.shape.length);\n }\n\n backend_util.assertAxesAreInnerMostDims('argMax', [axes[0]], $x.shape.length);\n
const out = argMinMaxReduce(backend, $x, axes[0], 'max');\n\n intermediateTensorInfos.forEach(\n t =>
backend.disposeIntermediateTensorInfo(t));\n\n return out;\n}\n\n\nexport const argMaxConfig: KernelConfig
= {\n kernelName: ArgMax,\n backendName: 'webgl',\n kernelFunc: argMax as { } as KernelFunc\n};\n\n", "/*\n *
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the specific language governing permissions and\n * limitations under the License.\n *

=====
\n
*/\n\nimport { ArgMin, ArgMinAttrs, ArgMinInputs, backend_util, KernelConfig, KernelFunc, TensorInfo, util }
from '@tensorflow/tfjs-core';\n\nimport { MathBackendWebGL } from
'../backend_webgl';\n\nimport { argMinMaxReduce } from '../kernel_utils/arg_min_max';\n\nimport { transpose } from
'./Transpose';\n\n\nexport function argMin(\n args: {\n inputs: ArgMinInputs, backend: MathBackendWebGL,\n attrs: ArgMinAttrs\n }): {\n TensorInfo {\n const { inputs, backend, attrs } = args;\n const { x } = inputs;\n const { axis }
= attrs;\n\n let axes = util.parseAxisParam(axis, x.shape);\n const permutedAxes =
backend_util.getAxesPermutation(axes, x.shape.length);\n let $x = x;\n const intermediateTensorInfos = [];\n if
(permutedAxes != null) {\n $x = transpose({ inputs: { x }, backend, attrs: { perm: permutedAxes } });\n }\n intermediateTensorInfos.push($x);\n axes = backend_util.getInnerMostAxes(axes.length, $x.shape.length);\n }\n\n backend_util.assertAxesAreInnerMostDims('argMin', [axes[0]], $x.shape.length);\n\n const out =
argMinMaxReduce(backend, $x, axes[0], 'min');\n\n intermediateTensorInfos.forEach(\n t =>
backend.disposeIntermediateTensorInfo(t));\n\n return out;\n }\n\n\nexport const argMinConfig: KernelConfig = {\n kernelName: ArgMin,\n backendName:
'webgl',\n kernelFunc: argMin as { } as KernelFunc\n};\n\n", "/*\n *
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *

=====
\n
*/\n\nimport { Asin, KernelConfig } from '@tensorflow/tfjs-core';\n\nimport { unaryKernelFunc } from
'../kernel_utils/kernel_funcs_utils';\n\nimport
{ CHECK_NAN_SNIPPET } from '../unaryop_gpu';\n\n\nconst ASIN = CHECK_NAN_SNIPPET +`\n if (abs(x) >
1.) {\n return NaN;\n }\n return asin(x);\n`;\n\n\nexport const asin = unaryKernelFunc({ opSnippet:
ASIN });\n\n\nexport const asinConfig: KernelConfig = {\n kernelName: Asin,\n backendName: 'webgl',\n kernelFunc: asin,\n};\n\n", "/*\n *
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on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *

=====
\n
*/\n\nimport { Asinh, KernelConfig } from '@tensorflow/tfjs-core';\n\nimport { unaryKernelFunc } from
'../kernel_utils/kernel_funcs_utils';\n\nimport { CHECK_NAN_SNIPPET } from '../unaryop_gpu';\n\n\nconst ASINH =
CHECK_NAN_SNIPPET +`return log(x + sqrt(x * x + 1.0));`\n\n\nexport const asinh =

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unaryKernelFunc({opSnippet: ASINH});\n\nexport const asinhConfig: KernelConfig = {\n kernelName: Asinh,\n backendName: 'webgl',\n kernelFunc: asinh,\n};\n", "/\*\n \* @license\n \* Copyright 2020 Google LLC. All Rights Reserved.\n \* Licensed under the Apache License, Version 2.0 (the "License");\n \* you may not use this file except in compliance with the License.\n \* You may obtain a copy of the License at\n \* \n \* http://www.apache.org/licenses/LICENSE-2.0\n \* \n \* Unless required by applicable law or agreed to in writing, software\n \* distributed under the License is distributed on an "AS IS" BASIS,\n \* WITHOUT WARRANTIES OR CONDITIONS

OF ANY KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*/

=====\n\n/\*\n\nimport {Atan, KernelConfig} from '@tensorflow/tfjs-core';\nimport {unaryKernelFunc} from\n '../kernel\_utils/kernel\_funcs\_utils';\nimport {CHECK\_NAN\_SNIPPET} from '../unaryop\_gpu';\nconst ATAN =\n CHECK\_NAN\_SNIPPET +`\n return atan(x);\n`;\n\nexport const atan = unaryKernelFunc({opSnippet:\n ATAN});\n\nexport const atanConfig: KernelConfig = {\n kernelName: Atan,\n backendName: 'webgl',\n kernelFunc: atan,\n};\n", "/\*\n \* @license\n \* Copyright 2020 Google LLC. All Rights Reserved.\n \* Licensed under the Apache License, Version 2.0 (the "License");\n \* you may not use this file except in compliance with the License.\n \* You may obtain a copy of the License at\n \* \n \* http://www.apache.org/licenses/LICENSE-2.0\n \* \n \* Unless required by applicable

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=====\n\n/\*\n\nimport {Atan2} from '@tensorflow/tfjs-core';\nimport {KernelConfig} from '@tensorflow/tfjs-core';\nimport {binaryKernelFunc, CHECK\_NAN\_SNIPPET\_BINARY,\n CHECK\_NAN\_SNIPPET\_BINARY\_PACKED} from '../kernel\_utils/kernel\_funcs\_utils';\nconst ATAN2 =\n CHECK\_NAN\_SNIPPET\_BINARY +`\n return atan(a, b);\n`;\n\nconst ATAN2\_PACKED =`\n vec4 result =\n atan(a, b);\n vec4 isNaN = min(vec4(isnan(a)) + vec4(isnan(b)), vec4(1.0));\n ` +`\n CHECK\_NAN\_SNIPPET\_BINARY\_PACKED +`\n return result;\n`;\n\nexport const atan2 =\n binaryKernelFunc({opSnippet: ATAN2, packedOpSnippet: ATAN2\_PACKED});\n\nexport const atan2Config:\n KernelConfig = {\n kernelName: Atan2,\n backendName: 'webgl',\n kernelFunc: atan2,\n};\n", "/\*\n \* @license\n \* Copyright 2020 Google LLC. All Rights Reserved.\n \* Licensed under the Apache License, Version 2.0 (the "License");\n \* you may not use this file except in compliance with the License.\n \* You may obtain a copy of the License at\n \* \n \* http://www.apache.org/licenses/LICENSE-2.0\n \* \n \* Unless required by applicable law or agreed to in writing, software\n \* distributed under the License is distributed on an "AS IS" BASIS,\n \* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*/

=====\n\n/\*\n\nimport {Atanh, KernelConfig} from '@tensorflow/tfjs-core';\nimport {unaryKernelFunc} from\n '../kernel\_utils/kernel\_funcs\_utils';\nimport {CHECK\_NAN\_SNIPPET} from '../unaryop\_gpu';\nconst ATANH =\n CHECK\_NAN\_SNIPPET +`\n if ((x < -1.0) || (x > 1.0)) return NaN;\n return (log(1.0 + x) - log(1.0 -\n x)) / 2.0;\n`;\n\nexport const atanh = unaryKernelFunc({opSnippet: ATANH});\n\nexport const atanhConfig:\n KernelConfig = {\n kernelName: Atanh,\n backendName: 'webgl',\n kernelFunc: atanh,\n};\n", "/\*\n \* @license\n \* Copyright 2017 Google LLC. All Rights Reserved.\n \* Licensed under the Apache License, Version 2.0 (the\n \* "License");\n \* you may not use this file except in compliance with the License.\n \* You may obtain a copy of the License at\n \* \n \* http://www.apache.org/licenses/LICENSE-2.0\n \* \n \* Unless required by applicable law or\n \* agreed to in writing, software\n \* distributed under the License is distributed on an "AS IS" BASIS,\n \* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*/

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*/\\n\\nimport {backend_util} from '@tensorflow/tfjs-core';\\nimport {GPGPUProgram} from
'./gpgpu_math';\\n\\nexport class Pool2DProgram implements GPGPUProgram {\\n variableNames = ['x'];\\n
outputShape: number[];\\n userCode: string;\\n\\n constructor(\\n convInfo: backend_util.Conv2DInfo, poolType:
'max'|'avg',\\n computePositions: boolean, flattenPositions = false,\\n includeBatchInIndex = false) {\\n if
(poolType === 'avg' && computePositions) {\\n throw new Error('Cannot compute positions for average
pool.');

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int xR = xRCorner + wR;\n\n if (xR < 0 || xR >= ${convInfo.inHeight}) {\n continue;\n }\n\n for (int wC = 0; wC < ${filterWidthNearestVec4}; wC += 4) {\n int xC = xCCorner + wC *
${dilationWidth};\n vec4 values = vec4(\n getValue(batch, xR, xC, d),\n getValue(batch,
xR, xC + ${dilationWidth}, d),\n getValue(batch, xR, xC + 2 * ${dilationWidth}, d),\n getValue(batch, xR, xC + 3 * ${dilationWidth}, d)\n);\n\n ${updateSnippet}\n }\n\n int xC
= xCCorner + ${filterWidthNearestVec4};\n if (${filterWidthVec4Remainder} === 1) {\n vec4 values
= vec4(\n getValue(batch,
xR, xC, d),\n initializationValue,\n initializationValue,\n initializationValue\n);\n\n ${updateSnippet}\n } else if (${filterWidthVec4Remainder} === 2) {\n vec4 values = vec4(\n getValue(batch, xR, xC, d),\n getValue(batch, xR, xC + ${dilationWidth}, d),\n initializationValue,\n initializationValue\n);\n\n ${updateSnippet}\n } else if
(${filterWidthVec4Remainder} === 3) {\n vec4 values = vec4(\n getValue(batch, xR, xC, d),\n getValue(batch, xR, xC + ${dilationWidth}, d),\n getValue(batch, xR, xC + 2 * ${dilationWidth}, d),\n initializationValue\n);\n\n ${updateSnippet}\n }\n }\n\n setOutput(${returnValue});\n }\n }\n }\n\nexport class Pool3DProgram implements GPGPUProgram {\n
variableNames = ['x'];\n
outputShape: number[];\n
userCode: string;\n
constructor(\n convInfo: backend_util.Conv3DInfo, poolType:
'max'|'avg',\n computePositions: boolean, flattenPositions = false,\n includeBatchInIndex = false) {\n if
(poolType === 'avg' && computePositions) {\n throw new Error('Cannot compute positions for average
pool.);\n }\n\n const filterWidth = convInfo.filterWidth;\n const strideDepth = convInfo.strideDepth;\n const
strideHeight = convInfo.strideHeight;\n const strideWidth = convInfo.strideWidth;\n const dilationDepth =
convInfo.dilationDepth;\n const dilationHeight = convInfo.dilationHeight;\n const dilationWidth =
convInfo.dilationWidth;\n const effectiveFilterDepth = convInfo.effectiveFilterDepth;\n const
effectiveFilterHeight = convInfo.effectiveFilterHeight;\n const effectiveFilterWidth =
convInfo.effectiveFilterWidth;\n\n const padFront = convInfo.padInfo.front;\n const padTop =
convInfo.padInfo.top;\n const padLeft
= convInfo.padInfo.left;\n this.outputShape = convInfo.outShape;\n\n const isAvgPool = poolType ===
'avg';\n\n let initializationValue = '0.0';\n if (!isAvgPool) {\n // WebGL on Firefox Linux can't compile 1/0 so
we do 1/eps.\n initializationValue = '-1.0 / 1e-20';\n }\n\n if (computePositions) {\n const compareOp =
'>=';\n\n this.userCode = `\n const ivec3 strides =\n ivec3(${strideDepth}, ${strideHeight},
${strideWidth});\n const ivec3 pads = ivec3(${padFront}, ${padTop}, ${padLeft});\n\n void main() {\n
 ivec5 coords = getOutputCoords();\n int batch = coords.x;\n int ch = coords.u;\n ivec3 xCorner
= ivec3(coords.y, coords.z, coords.w) * strides - pads;\n int xDCorner = xCorner.x;\n int xRCorner =
xCorner.y;\n int xCCorner = xCorner.z;\n\n // max/min x(?, ?, ch) to get y(yD, yR, yC, ch).\n // ?
= to be determined\n float
minMaxValue = 0.0;\n float minMaxValueFound = 0.0;\n int minMaxPosition = 0;\n\n for (int wD = 0; wD < ${effectiveFilterDepth};\n wD += ${dilationDepth}) {\n int xD = xDCorner + wD;\n\n if (xD < 0 || xD >= ${convInfo.inDepth}) {\n continue;\n }\n\n for (int wR = 0; wR <
${effectiveFilterHeight};\n wR += ${dilationHeight}) {\n int xR = xRCorner + wR;\n\n if
(xR < 0 || xR >= ${convInfo.inHeight}) {\n continue;\n }\n\n for (int wC = 0; wC <
${effectiveFilterWidth};\n wC += ${dilationWidth}) {\n int xC = xCCorner + wC;\n\n if
(xC < 0 || xC >= ${convInfo.inWidth}) {\n continue;\n }\n\n float value =
getX(batch, xD, xR, xC, ch);\n\n // If a min / max value has already been found, use it. If not,\n
 // use the current value.\n float currMinMaxValue = mix(\n value, minMaxValue,
minMaxValueFound);\n if (value ${compareOp} currMinMaxValue) {\n minMaxValue =
value;\n minMaxValueFound = 1.0;\n minMaxPosition = ${\n flattenPositions ?\n
(includeBatchInIndex ?\n (((batch * ${convInfo.inDepth} + xD) * ${\n
convInfo.inHeight} + xR) * ${convInfo.inWidth} + xC) * ${\n
convInfo.inChannels} + ch` :\n

```

```
(xD * ${convInfo.inWidth} + xR) * ${n convInfo.inChannels} +
ch`):\n `wD * ${effectiveFilterHeight} * ${effectiveFilterWidth} +\n\n wR *\n${effectiveFilterWidth} + wC`));\n }\n }\n}\n}\n}\nsetOutput(float(minMaxPosition));\n }\n`; \n
return;\n } \n\n const compareOp = 'max';\n let returnValue = `${poolType}(${poolType})($ {poolType})(`\n+\n 'minMaxValue[0], minMaxValue[1]), minMaxValue[2]), minMaxValue[3])';\n if (poolType === 'avg')\n {\n returnValue = `avgValue / count`;\n } \n\n const filterWidthNearestVec4 = Math.floor(filterWidth / 4) *\n4;\n const filterWidthVec4Remainder = filterWidth % 4;\n\n const updateSnippet = `\n if (${isAvgPool}) {\n avgValue += dot(values, ones);\n } else {\n minMaxValue = ${compareOp}(values, minMaxValue);\n }\n}`;\n\n this.userCode = `\nconst ivec3 strides =\nivec3(${strideDepth}, ${strideHeight},\n${strideWidth});\nconst ivec3 pads = ivec3(`${padFront}`, `${padTop}`, `${padLeft});\nconst float initializationValue = ${initializationValue};\nconst vec4 ones = vec4(1.0, 1.0, 1.0, 1.0);\nfloat count = 0.0;\nfloat getValue(int batch, int xD, int xR, int xC, int ch) {\nif (xC < 0 || xC >= ${convInfo.inWidth}) {\nreturn initializationValue;\n}\ncount += 1.0;\nreturn getX(batch, xD, xR, xC, ch);\n}\nvoid main() {\nivec5 coords = getOutputCoords();\nint batch = coords.x;\nint ch = coords.u;\nivec3 xCorner = ivec3(coords.y, coords.z, coords.w) * strides - pads;\nint xDCorner = xCorner.x;\nint xRCorner = xCorner.y;\nint xCCorner = xCorner.z;\n// max/min x(? , ? , d) to get y(yD, yR, yC, ch).\n// ? = to be determined\nvec4 minMaxValue = vec4(${initializationValue});\nfloat avgValue = 0.0;\ncount = 0.0;\nfor (int wD = 0; wD < ${effectiveFilterDepth};\nwD += ${dilationDepth}) {\nint xD = xDCorner + wD;\nif (xD < 0 || xD >= ${convInfo.inDepth}) {\ncontinue;\n}\nfor (int wR = 0; wR < ${effectiveFilterHeight};\nwR += ${dilationHeight}) {\nint xR = xRCorner + wR;\nif (xR < 0 || xR >= ${convInfo.inHeight}) {\ncontinue;\n}\nfor (int wC = 0; wC < ${filterWidthNearestVec4}; wC += 4) {\nint xC = xCCorner + wC * ${dilationWidth};\nvec4 values = vec4(\ngetValue(batch, xD, xR, xC, ch),\ngetValue(batch, xD, xR, xC + ${dilationWidth}, ch),\ngetValue(batch, xD, xR, xC + 2 * ${dilationWidth}, ch),\ngetValue(batch, xD, xR, xC + 3 * ${dilationWidth}, ch)));\n${updateSnippet}\nint xC = xCCorner + ${filterWidthNearestVec4};\nif ($ {filterWidthVec4Remainder} === 1) {\nvec4 values = vec4(\ngetValue(batch, xD, xR, xC, ch),\ninitializationValue,\ninitializationValue,\ninitializationValue)\n); \nupdateSnippet)\n}\nelse if ($ {filterWidthVec4Remainder} === 2) {\nvec4 values = vec4(\ngetValue(batch, xD, xR, xC, ch),\ngetValue(batch, xD, xR, xC + ${dilationWidth}, ch),\ninitializationValue,\ninitializationValue)\n); \nupdateSnippet)\n}\nelse if ($ {filterWidthVec4Remainder} === 3) {\nvec4 values = vec4(\ngetValue(batch, xD, xR, xC, ch),\ngetValue(batch, xD, xR, xC + ${dilationWidth}, ch),\ngetValue(batch, xD, xR, xC + 2 * ${dilationWidth}, ch),\ninitializationValue)\n); \nupdateSnippet)\n}\n}\n}\n}\n}\nsetOutput(returnValue);\n}\n}\n};\n}\n}\n*/ **\n@license\nCopyright 2020 Google LLC. All Rights Reserved.\nLicensed under the Apache License, Version 2.0 (the "License"); you may not use this file except in compliance with the License.\nYou may obtain a copy of the License at\n*\nhttp://www.apache.org/licenses/LICENSE-2.0\n*\nUnless required by applicable law or agreed to in writing, software distributed under the License is distributed on an "AS IS" BASIS, WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied. See the License for the specific language governing permissions and limitations under the License.\n*\n===== \n*\nnimport { AvgPool, AvgPoolAttrs, AvgPoolInputs, backend_util, KernelConfig, KernelFunc, TensorInfo, util } from '@tensorflow/tfjs-core';\nnimport { MathBackendWebGL } from '../backend_webgl';\nnimport { Pool2DProgram } from './pool_gpu';\nnimport { assertNotComplex } from './webgl_util';\nnimport { identity } from
```

```

'/Identity';\n\nexport function avgPool(args: {\n inputs: AvgPoolInputs,\n backend: MathBackendWebGL,\n attrs: AvgPoolAttrs\n}): TensorInfo
{\n const {inputs, backend, attrs} = args;\n const {x} = inputs;\n assertNotComplex(x, 'avgPool');\n const
{filterSize, strides, pad, dimRoundingMode} = attrs;\n const dilations = 1;\n\n util.assert(\n
backend_util.eitherStridesOrDilationsAreOne(strides, dilations),\n () => 'Error in avgPool: Either strides or
dilations must be 1.' +\n `Got strides ${strides} and dilations '${dilations}'`);\n\n const convInfo =
backend_util.computePool2DInfo(\n x.shape as [number, number, number, number], filterSize, strides,\n
dilations, pad, dimRoundingMode);\n if (convInfo.filterWidth === 1 && convInfo.filterHeight === 1 &&\n
util.arraysEqual(convInfo.inShape, convInfo.outShape)) {\n return identity({inputs: {x}, backend});\n }\n const
avgPoolProgram = new Pool2DProgram(convInfo, 'avg', false);\n return
backend.runWebGLProgram(avgPoolProgram, [x], 'float32');\n}\n\nexport const avgPoolConfig: KernelConfig =
{\n kernelName: AvgPool,\n backendName:
'webgl',\n kernelFunc: avgPool as { } as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All
Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
===== \n
*/\n\nimport {AvgPool3D, AvgPool3DAttrs, AvgPool3DInputs, backend_util, KernelConfig, KernelFunc,
TensorInfo} from '@tensorflow/tfjs-core';\n\nimport {MathBackendWebGL} from '../backend_webgl';\n\nimport
{Pool3DProgram}
from '../pool_gpu';\n\nexport function avgPool3D(args: {\n inputs: AvgPool3DInputs,\n backend:
MathBackendWebGL,\n attrs: AvgPool3DAttrs\n}): TensorInfo {\n const {inputs, backend, attrs} = args;\n const
{x} = inputs;\n const {filterSize, strides, pad, dimRoundingMode, dataFormat} = attrs;\n const dilations: [number,
number, number] = [1, 1, 1];\n\n const convInfo = backend_util.computePool3DInfo(\n x.shape as [number,
number, number, number, number], filterSize, strides,\n dilations, pad, dimRoundingMode, dataFormat);\n const
avgPoolProgram = new Pool3DProgram(convInfo, 'avg', false);\n return
backend.runWebGLProgram(avgPoolProgram, [x], 'float32');\n}\n\nexport const avgPool3DConfig: KernelConfig =
{\n kernelName: AvgPool3D,\n backendName: 'webgl',\n kernelFunc: avgPool3D as { } as
KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2017 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the "License");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
===== \n
*/\n\nimport {backend_util} from '@tensorflow/tfjs-core';\n\nimport {GPUPProgram} from
'./gpgpu_math';\n\nexport class AvgPool2DBackpropProgram implements GPUPProgram {\n variableNames =
['dy'];\n outputShape: number[];\n userCode: string;\n\n constructor(convInfo: backend_util.Conv2DInfo) {\n
this.outputShape = convInfo.inShape;\n const filterHeight = convInfo.filterHeight;\n const filterWidth =
convInfo.filterWidth;\n const
strideHeight = convInfo.strideHeight;\n const strideWidth = convInfo.strideWidth;\n const dilationHeight =
convInfo.dilationHeight;\n const dilationWidth = convInfo.dilationWidth;\n const effectiveFilterHeight =
convInfo.effectiveFilterHeight;\n const effectiveFilterWidth = convInfo.effectiveFilterWidth;\n\n const padTop
= effectiveFilterHeight - 1 - convInfo.padInfo.top;\n const padLeft = effectiveFilterWidth - 1 -

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convInfo.padInfo.left;\n\n const avgMultiplier = 1 / (filterHeight * filterWidth);\n\n this.userCode = `\n const
ivec2 pads = ivec2(${padTop}, ${padLeft});\n const float avgMultiplier = float(${avgMultiplier});\n\n void
main() {\n ivec4 coords = getOutputCoords();\n int b = coords[0];\n int d = coords[3];\n\n ivec2
dyRCCorner = coords.yz - pads;\n int dyRCorner = dyRCCorner.x;\n int dyCCorner = dyRCCorner.y;\n\n // Convolve dy(?, ?, d) with pos mask(:, :, d) to get dx(xR, xC, d).\n
 // ? = to be determined. : = across all values in that axis.\n float dotProd = 0.0;\n for (int wR = 0; wR <
${effectiveFilterHeight};\n wR += ${dilationHeight}) {\n float dyR = float(dyRCorner + wR) /
${strideHeight}.0;\n\n if (dyR < 0.0 || dyR >= ${convInfo.outHeight}.0 || fract(dyR) > 0.0) {\n
continue;\n }\n int idyR = int(dyR);\n\n for (int wC = 0; wC < ${effectiveFilterWidth};\n wC += ${dilationWidth}) {\n float dyC = float(dyCCorner + wC) / ${strideWidth}.0;\n\n if (dyC < 0.0
|| dyC >= ${convInfo.outWidth}.0 ||\n fract(dyC) > 0.0) {\n continue;\n }\n int idyC
= int(dyC);\n\n float dyValue = getDy(b, idyR, idyC, d);\n\n dotProd += dyValue * avgMultiplier;\n
 }\n }\n setOutput(dotProd);\n }\n `;\n\n}\n\n\nexport class AvgPool3DBackpropProgram
implements GPGPUProgram
{\n variableNames = ['dy'];\n outputShape: number[];\n userCode: string;\n\n constructor(convInfo:
backend_util.Conv3DInfo) {\n this.outputShape = convInfo.inShape;\n const filterDepth =
convInfo.filterDepth;\n const filterHeight = convInfo.filterHeight;\n const filterWidth = convInfo.filterWidth;\n
const strideDepth = convInfo.strideDepth;\n const strideHeight = convInfo.strideHeight;\n const strideWidth =
convInfo.strideWidth;\n const dilationDepth = convInfo.dilationDepth;\n const dilationHeight =
convInfo.dilationHeight;\n const dilationWidth = convInfo.dilationWidth;\n const effectiveFilterDepth =
convInfo.effectiveFilterDepth;\n const effectiveFilterHeight = convInfo.effectiveFilterHeight;\n const
effectiveFilterWidth = convInfo.effectiveFilterWidth;\n\n const padFront = effectiveFilterDepth - 1 -
convInfo.padInfo.front;\n const padTop = effectiveFilterHeight - 1 - convInfo.padInfo.top;\n const padLeft =
effectiveFilterWidth
- 1 - convInfo.padInfo.left;\n\n const avgMultiplier = 1 / (filterDepth * filterHeight * filterWidth);\n\n this.userCode = `\n const ivec3 pads = ivec3(${padFront}, ${padTop}, ${padLeft});\n const float
avgMultiplier = float(${avgMultiplier});\n\n void main() {\n ivec5 coords = getOutputCoords();\n int
batch = coords.x;\n int ch = coords.u;\n\n ivec3 dyCorner = ivec3(coords.y, coords.z, coords.w) - pads;\n
 int dyDCorner = dyCorner.x;\n int dyRCorner = dyCorner.y;\n int dyCCorner = dyCorner.z;\n\n //
Convolve dy(?, ?, d) with pos mask(:, :, :, ch) to get\n // dx(xD, xR, xC, ch).\n // ? = to be determined. : =
across all values in that axis.\n float dotProd = 0.0;\n\n for (int wD = 0; wD < ${effectiveFilterDepth};\n wD += ${dilationDepth}) {\n float dyD = float(dyDCorner + wD) / ${strideDepth}.0;\n\n if (dyD <
0.0 || dyD >= ${convInfo.outDepth}.0 || fract(dyD)
> 0.0) {\n continue;\n }\n int idyD = int(dyD);\n\n for (int wR = 0; wR <
${effectiveFilterHeight};\n wR += ${dilationHeight}) {\n float dyR = float(dyRCorner + wR) /
${strideHeight}.0;\n\n if (dyR < 0.0 || dyR >= ${convInfo.outHeight}.0 ||\n fract(dyR) > 0.0) {\n
continue;\n }\n int idyR = int(dyR);\n\n for (int wC = 0; wC < ${effectiveFilterWidth};\n wC += ${dilationWidth}) {\n float dyC = float(dyCCorner + wC) / ${strideWidth}.0;\n\n if
(dyC < 0.0 || dyC >= ${convInfo.outWidth}.0 ||\n fract(dyC) > 0.0) {\n continue;\n }\n int idyC
= int(dyC);\n\n float dyValue = getDy(batch, idyD, idyR, idyC, ch);\n\n dotProd +=
dyValue * avgMultiplier;\n }\n }\n }\n setOutput(dotProd);\n }\n }\n }\n `;\n
 }\n\n /**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache
License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You
may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required
by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS"
BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the
License for the specific language governing permissions and\n * limitations under the License.\n */
\n =====\n

```



```

*\\nimport { AvgPool3DGrad, AvgPool3DGradAttrs, AvgPool3DGradInputs, backend_util, KernelConfig,
KernelFunc, TensorInfo } from '@tensorflow/tfjs-core';\\n\\nimport { AvgPool3DBackpropProgram } from
'./avg_pool_backprop_gpu';\\nimport { MathBackendWebGL } from './backend_webgl';\\n\\nexport
function avgPool3DGrad(args: {\\n inputs: AvgPool3DGradInputs,\\n backend: MathBackendWebGL,\\n attrs:
AvgPool3DGradAttrs\\n}): TensorInfo {\\n const { inputs, backend, attrs } = args;\\n const { dy, input } = inputs;\\n
const x = input;\\n const { filterSize, strides, pad, dimRoundingMode } = attrs;\\n const dilations: [number, number,
number] = [1, 1, 1];\\n\\n const convInfo = backend_util.computePool3DInfo(\\n x.shape as [number, number,
number, number, number], filterSize, strides,\\n dilations, pad, dimRoundingMode);\\n const
avgPoolBackpropProgram = new AvgPool3DBackpropProgram(convInfo);\\n return
backend.runWebGLProgram(avgPoolBackpropProgram, [dy], x.dtype);\\n}\\n\\nexport const avgPoolGrad3DConfig:
KernelConfig = {\\n kernelName: AvgPool3DGrad,\\n backendName: 'webgl',\\n kernelFunc: avgPool3DGrad as { }
as KernelFunc\\n};\\n", "/*\\n * @license\\n * Copyright 2020 Google LLC. All Rights Reserved.\\n * Licensed under
the Apache License, Version 2.0 (the 'License');\\n
* you may not use this file except in compliance with the License.\\n * You may obtain a copy of the License at\\n
*\\n * http://www.apache.org/licenses/LICENSE-2.0\\n *\\n * Unless required by applicable law or agreed to in
writing, software\\n * distributed under the License is distributed on an 'AS IS' BASIS,\\n * WITHOUT
WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\\n * See the License for the specific
language governing permissions and\\n * limitations under the License.\\n *
=====\\n
*\\nimport { AvgPoolGrad, AvgPoolGradAttrs, AvgPoolGradInputs, backend_util, KernelConfig, KernelFunc,
TensorInfo } from '@tensorflow/tfjs-core';\\n\\nimport { AvgPool2DBackpropProgram } from
'./avg_pool_backprop_gpu';\\nimport { MathBackendWebGL } from './backend_webgl';\\nimport
{ assertNotComplex } from './webgl_util';\\n\\nexport function avgPoolGrad(args: {\\n inputs: AvgPoolGradInputs,\\n
backend: MathBackendWebGL,\\n attrs:
AvgPoolGradAttrs\\n}): TensorInfo {\\n const { inputs, backend, attrs } = args;\\n const { dy, input } = inputs;\\n const
x = input;\\n assertNotComplex([dy, input], 'avgPoolGrad');\\n const { filterSize, strides, pad } = attrs;\\n\\n const
convInfo = backend_util.computePool2DInfo(\\n x.shape as [number, number, number, number], filterSize,
strides,\\n 1 /* dilations */, pad);\\n const avgPoolBackpropProgram = new
AvgPool2DBackpropProgram(convInfo);\\n return backend.runWebGLProgram(avgPoolBackpropProgram, [dy],
x.dtype);\\n}\\n\\nexport const avgPoolGradConfig: KernelConfig = {\\n kernelName: AvgPoolGrad,\\n
backendName: 'webgl',\\n kernelFunc: avgPoolGrad as { } as KernelFunc\\n};\\n", "/*\\n * @license\\n * Copyright
2020 Google LLC. All Rights Reserved.\\n * Licensed under the Apache License, Version 2.0 (the 'License');\\n
* you may not use this file except in compliance with the License.\\n * You may obtain a copy of the License at\\n
*\\n * http://www.apache.org/licenses/LICENSE-2.0\\n
*\\n * Unless required by applicable law or agreed to in writing, software\\n * distributed under the License is
distributed on an 'AS IS' BASIS,\\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
express or implied.\\n * See the License for the specific language governing permissions and\\n * limitations under
the License.\\n *
=====\\n
*\\n\\nimport { BatchMatMul, BatchMatMulAttrs, BatchMatMulInputs, KernelConfig, KernelFunc } from
'@tensorflow/tfjs-core';\\n\\nimport { MathBackendWebGL } from './backend_webgl';\\nimport { batchMatMulImpl }
from './BatchMatMul_impl';\\n\\nexport function batchMatMul(args: {\\n inputs: BatchMatMulInputs,\\n attrs:
BatchMatMulAttrs,\\n backend: MathBackendWebGL\\n}) {\\n const { inputs, backend, attrs } = args;\\n const { a, b }
= inputs;\\n const { transposeA, transposeB } = attrs;\\n\\n return batchMatMulImpl({ a, b, transposeA, transposeB,
backend });\\n}\\n\\nexport const batchMatMulConfig: KernelConfig
= {\\n kernelName: BatchMatMul,\\n backendName: 'webgl',\\n kernelFunc: batchMatMul as { } as
KernelFunc,\\n};\\n", "/*\\n * @license\\n * Copyright 2017 Google LLC. All Rights Reserved.\\n * Licensed under the
Apache License, Version 2.0 (the 'License');\\n * you may not use this file except in compliance with the

```

License.\n \* You may obtain a copy of the License at\n \* <http://www.apache.org/licenses/LICENSE-2.0>\n \* Unless required by applicable law or agreed to in writing, software\n \* distributed under the License is distributed on an \"AS IS\" BASIS,\n \* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*

```
=====\n\n*\n\nimport {backend_util} from '@tensorflow/tfjs-core';\nimport {GPGPUProgram} from\n'./gpgpu_math';\n\nexport class BatchNormProgram implements GPGPUProgram {\n variableNames: string[];\n outputShape: number[] = [];\n userCode: string;\n\n constructor(\n xShape:\nnumber[], meanShape: number[], varianceShape: number[],\n offsetShape: number[]|null, scaleShape:\nnumber[]|null,\n varianceEpsilon: number) {\n this.variableNames = ['x', 'mean', 'variance'];\n backend_util.assertAndGetBroadcastShape(xShape, meanShape);\n backend_util.assertAndGetBroadcastShape(xShape, varianceShape);\n\n let offsetSnippet = '0.0';\n if\n(offsetShape != null) {\n backend_util.assertAndGetBroadcastShape(xShape, offsetShape);\n this.variableNames.push('offset');\n offsetSnippet = 'getOffsetAtOutCoords()';\n }\n\n let scaleSnippet =\n'1.0';\n if (scaleShape != null) {\n backend_util.assertAndGetBroadcastShape(xShape, scaleShape);\n this.variableNames.push('scale');\n scaleSnippet = 'getScaleAtOutCoords()';\n }\n\n this.outputShape =\nxShape;\n this.userCode = `\n void main() {\n float\nx = getXAtOutCoords();\n float mean = getMeanAtOutCoords();\n float variance =\ngetVarianceAtOutCoords();\n float offset = ${offsetSnippet};\n float scale = ${scaleSnippet};\n float\ninv = scale * inversesqrt(variance + float(${varianceEpsilon}));\n setOutput(dot(vec3(x, -mean, offset),\nvec3(inv, inv, 1)));\n }\n `;\n}\n\n"/**\n * @license\n * Copyright 2018 Google LLC. All Rights\nReserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file\nexcept in compliance with the License.\n * You may obtain a copy of the License at\n *\nhttp://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,\nsoftware\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\nOR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\ngoverning permissions and\n * limitations under\nthe License.\n */\n\n
```

```
=====\n\n*\n\nimport {backend_util} from '@tensorflow/tfjs-core';\nimport {GPGPUProgram} from\n'./gpgpu_math';\n\nexport class BatchNormPackedProgram implements GPGPUProgram {\n variableNames:\nstring[];\n outputShape: number[];\n userCode: string;\n packedInputs = true;\n packedOutput = true;\n\n constructor(\n xShape: number[], meanShape: number[], varianceShape: number[],\n offsetShape:\nnumber[]|null, scaleShape: number[]|null,\n varianceEpsilon: number) {\n this.variableNames = ['x', 'mean',\n'variance'];\n backend_util.assertAndGetBroadcastShape(xShape, meanShape);\n backend_util.assertAndGetBroadcastShape(xShape, varianceShape);\n\n let offsetSnippet = 'vec4(0.0)';\n if\n(offsetShape != null) {\n backend_util.assertAndGetBroadcastShape(xShape, offsetShape);\n this.variableNames.push('offset');\n offsetSnippet = 'getOffsetAtOutCoords()';\n }\n\n let scaleSnippet = 'vec4(1.0)';\n if (scaleShape != null) {\n backend_util.assertAndGetBroadcastShape(xShape, scaleShape);\n this.variableNames.push('scale');\n scaleSnippet = 'getScaleAtOutCoords()';\n }\n\n this.outputShape = xShape;\n this.userCode = `\n void\nmain() {\n vec4 offset = ${offsetSnippet};\n vec4 scale = ${scaleSnippet};\n vec4 x =\ngetXAtOutCoords();\n vec4 mean = getMeanAtOutCoords();\n vec4 variance =\ngetVarianceAtOutCoords();\n vec4 inv = scale * inversesqrt(variance + vec4(${varianceEpsilon}));\n setOutput((x - mean) * inv + offset);\n }\n `;\n}\n\n"/**\n * @license\n * Copyright 2020 Google LLC.\nAll Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this\nfile except in compliance with the License.\n * You may obtain a copy of the License at\n *\n
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\"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n
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=====
*\n\nimport {env, FusedBatchNorm, FusedBatchNormAttrs, FusedBatchNormInputs, KernelConfig, KernelFunc,
TensorInfo, util} from '@tensorflow/tfjs-core';\n\nimport {MathBackendWebGL} from '../backend_webgl';\n\nimport
{BatchNormProgram} from '../batchnorm_gpu';\n\nimport {BatchNormPackedProgram} from
'../batchnorm_packed_gpu';\n\n\nexport const batchNorm: (params: {\n inputs: FusedBatchNormInputs,\n backend:
MathBackendWebGL,\n attrs: FusedBatchNormAttrs\n}) => TensorInfo = ({inputs, backend, attrs}) => {\n const
{x, mean, variance, offset, scale} = inputs;\n\n util.assert(\n mean.shape.length
=== variance.shape.length,\n () => 'Batch normalization gradient requires mean and variance to have ' +\n
'equal ranks.);\n util.assert(\n offset == null || mean.shape.length === offset.shape.length,\n () => 'Batch
normalization gradient requires mean and offset to have ' +\n 'equal ranks.);\n util.assert(\n scale == null ||
mean.shape.length === scale.shape.length,\n () => 'Batch normalization gradient requires mean and scale to have
' +\n 'equal ranks.);\n\n let {varianceEpsilon} = attrs;\n if (varianceEpsilon == null) {\n varianceEpsilon =
0.001;\n }\n\n const finalInputs = [x, mean, variance];\n\n let offsetShape = null;\n if (offset != null) {\n
offsetShape = offset.shape;\n finalInputs.push(offset);\n }\n\n let scaleShape = null;\n if (scale != null) {\n
scaleShape = scale.shape;\n finalInputs.push(scale);\n }\n\n const program =
env().getBool('WEBGL_PACK_NORMALIZATION') ?\n new BatchNormPackedProgram(\n
 x.shape, mean.shape, variance.shape, offsetShape, scaleShape,\n varianceEpsilon)\n : new
BatchNormProgram(\n x.shape, mean.shape, variance.shape, offsetShape, scaleShape,\n varianceEpsilon);\n
 const output =\n backend.runWebGLProgram(program, finalInputs,\n finalInputs[0].dtype);\n\n return output;\n};\n\n\nexport const batchNormConfig: KernelConfig = {\n kernelName:
FusedBatchNorm,\n backendName: 'webgl',\n kernelFunc: batchNorm as {\n as KernelFunc,\n };,\n /**\n *
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2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable
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WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n */
 };\n
 =====
*\n\nimport {GPGPUContext} from './gpgpu_context';\n\nimport {GPGPUProgram} from './gpgpu_math';\n\nimport
{getCoordsDataType} from './shader_compiler';\n\n\nexport class SliceProgram implements GPGPUProgram {\n variableNames = ['source'];\n outputShape: number[];\n userCode: string;\n rank: number;\n\n // Caching uniform
location for speed.\n startLoc: WebGLUniformLocation;\n\n constructor(destSize: number[]) {\n
this.outputShape = destSize;\n this.rank = destSize.length;\n\n const dtype = getCoordsDataType(this.rank);\n
const uniformPart = `uniform int start[${this.rank}];`;\n const sourceCoords = getCoords(this.rank);\n\n let
body: string;\n const coordSum = destSize.map((_, i) => {\n return `sourceLoc.${coords[i]}
= start[${i}] + coords.${coords[i]};`;\n });\n body = `\n ${dtype} sourceLoc;\n ${dtype} coords =
getOutputCoords();\n ${coordSum.join("\\n")}\n `;\n this.userCode = `\n ${uniformPart}\n void
main() {\n ${body}\n setOutput(getSource(${sourceCoords}));\n }\n `;\n }\n\n getCustomSetupFunc(start: number[]) {\n if (start.length !== this.rank) {\n throw Error(\n `The rank
(${this.rank}) of the program must match the ` +\n `length of start (${start.length})`);\n }\n return (gpgpu:
GPGPUContext, webGLProgram: WebGLProgram) => {\n if (this.startLoc == null) {\n this.startLoc =
gpgpu.getUniformLocationNoThrow(webGLProgram, 'start');\n }\n if (this.startLoc == null) {\n // This means
the compiler has optimized and realized it doesn't need\n // the uniform.\n return;\n }\n }\n }\n}

```

```

gpgpu.gl.uniform1iv(this.startLoc, start);\n };\n }\n\nconst
coords = ['x', 'y', 'z', 'w', 'u', 'v'];\n\nfunction getCoords(rank: number): string {\n if (rank === 1) {\n return
'sourceLoc';\n } else if (rank <= 6) {\n return coords.slice(0, rank).map(x => 'sourceLoc.' + x).join(',');\n } else
{\n throw Error('Slicing for rank ${rank} is not yet supported');\n }\n}\n\n"/**\n * @license\n * Copyright 2019
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http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an 'AS IS' BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*/\n\nimport { GPGPUContext } from './gpgpu_context';\nimport { GPGPUProgram } from './gpgpu_math';\nimport
{ getChannels } from './packing_util';\nimport { getCoordsDataType } from './shader_compiler';\n\nexport class
SlicePackedProgram implements GPGPUProgram {\n variableNames = ['source'];\n packedInputs = true;\n packedOutput = true;\n outputShape: number[];\n userCode: string;\n rank: number;\n\n // Caching uniform
location for speed.\n startLoc: WebGLUniformLocation;\n\n constructor(destSize: number[]) {\n this.outputShape = destSize;\n this.rank = destSize.length;\n\n const dtype = getCoordsDataType(this.rank);\n const coords = getChannels('coords', this.rank);\n const sourceLoc = getChannels('sourceLoc', this.rank);\n\n const innerDims =\n this.rank === 1 ? 'sourceLoc' : `vec2(${sourceLoc.slice(-2).join()})`;\n const getChannel
=\n `getChannel(getSource(${sourceLoc.join()}), ${innerDims})`;\n\n const upperRow =\n result.x = ${getChannel};\n if (++${coords[this.rank - 1]} < ${destSize[this.rank -
1]}) {\n ++${sourceLoc[this.rank - 1]};\n result.y = ${getChannel};\n --${sourceLoc[this.rank - 1]};\n }
\n const lowerRow = this.rank === 1 ? `--${coords[this.rank - 1]}` :\n if (++${coords[this.rank
- 2]} < ${destSize[this.rank - 2]}) {\n ++${sourceLoc[this.rank - 2]};\n result.z = ${getChannel};\n if
(++${coords[this.rank - 1]} < ${destSize[this.rank - 1]}) {\n ++${sourceLoc[this.rank - 1]};\n result.w =
${getChannel};\n }\n }\n\n const sourceLocSetup = this.rank <= 4 ?\n `sourceLoc = coords +\n
${dtype}(${destSize.map((_, i) => `start[${i}]`).join()})` :\n destSize.map((_, i) => `${sourceLoc[i]} =
${coords[i]} + start[${i}];`)\n .join('\\n');\n this.userCode =\n `uniform int start[${this.rank}];\n void
main() {\n ${dtype} coords = getOutputCoords();\n ${dtype} sourceLoc;\n ${sourceLocSetup}\n
vec4 result = vec4(0.); \n ${upperRow}\n ${lowerRow}\n setOutput(result);\n }\n }\n\n
getCustomSetupFunc(start: number[]) {\n if (start.length !== this.rank) {\n throw Error(`The rank
(${this.rank}) of the program must match the ` +\n `length of start (${start.length})`);\n }\n return (gpgpu:
GPGPUContext, webGLProgram: WebGLProgram) => {\n if (this.startLoc == null) {\n this.startLoc =
gpgpu.getUniformLocationNoThrow(webGLProgram, 'start');\n }\n if (this.startLoc == null) {\n // This means
the compiler has optimized and realized it doesn't need\n // the uniform.\n return;\n }\n }\n gpgpu.gl.uniform1iv(this.startLoc, start);\n };\n }\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All
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BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the
License for the specific language governing permissions and\n * limitations under the License.\n *
=====
*/\n\nimport { backend_util, BatchToSpaceND, BatchToSpaceNDAttrs, BatchToSpaceNDInputs, KernelConfig,
KernelFunc, TensorInfo, util } from '@tensorflow/tfjs-core';\nimport { MathBackendWebGL } from
'./backend_webgl';\nimport { reshape } from './Reshape';\nimport { slice } from './Slice';\nimport { transpose } from
'./Transpose';\n\nexport const batchToSpaceND = (args: {\n inputs:

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BatchToSpaceNDInputs,\n backend: MathBackendWebGL,\n attrs: BatchToSpaceNDAttrs\n)): TensorInfo => {\n
const {inputs, backend, attrs} = args;\n const {x} = inputs;\n const {blockShape, crops} = attrs;\n\n util.assert(\n
x.shape.length <= 4,\n () => 'batchToSpaceND for rank > 4 with a WebGL backend not ' +\n 'implemented\n
yet');\n const prod = blockShape.reduce((a, b) => a * b);\n\n const reshaped = backend_util.getReshaped(x.shape,\n
blockShape, prod);\n const permuted = backend_util.getPermuted(reshaped.length, blockShape.length);\n const\n
reshapedPermuted =\n backend_util.getReshapedPermuted(x.shape, blockShape, prod);\n const\n
sliceBeginCoords =\n backend_util.getSliceBeginCoords(crops, blockShape.length);\n const sliceSize =\n
backend_util.getSliceSize(reshapedPermuted, crops, blockShape.length);\n\n const toDispose = [];\n\n const\n
reshapedIntermediate =\n reshape({inputs: {x}, backend, attrs: {shape: reshaped}});\n const\n
transposedIntermediate\n
= transpose(\n {inputs: {x: reshapedIntermediate}, backend, attrs: {perm: permuted}});\n const\n
reshapedIntermediate2 = reshape({\n inputs: {x: transposedIntermediate},\n backend,\n attrs: {shape:\n
reshapedPermuted}\n });\n const sliced = slice({\n inputs: {x: reshapedIntermediate2},\n backend,\n attrs:\n
{begin: sliceBeginCoords, size: sliceSize}\n });\n\n toDispose.push(reshapedIntermediate);\n
toDispose.push(transposedIntermediate);\n toDispose.push(reshapedIntermediate2);\n\n toDispose.forEach(t =>\n
backend.disposeIntermediateTensorInfo(t));\n\n return sliced;\n};\n\nexport const batchToSpaceNDConfig:\n
KernelConfig = {\n kernelName: BatchToSpaceND,\n backendName: 'webgl',\n kernelFunc: batchToSpaceND as\n
{ } as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed\n
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BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the\n
License for the specific language governing permissions and\n * limitations under the License.\n *\n
=====
*/\n\nimport {Bincount, BincountAttrs, BincountInputs, KernelConfig, KernelFunc, TensorInfo, TypedArray} from\n
'@tensorflow/tfjs-core';\n\nimport {MathBackendWebGL} from '../backend_webgl';\nimport {bincountImplCPU}\n
from '../kernel_utils/shared';\n\nexport function bincount(args: {\n inputs: BincountInputs,\n backend:\n
MathBackendWebGL,\n attrs: BincountAttrs\n}): TensorInfo {\n const {inputs, backend, attrs} = args;\n const {x,\n
weights} = inputs;\n const {size} = attrs;\n\n const xVals =\n
backend.readSync(x.dataId) as TypedArray;\n const weightsVals = backend.readSync(weights.dataId) as\n
TypedArray;\n\n const outVals =\n bincountImplCPU(xVals, weightsVals, weights.dtype, weights.shape,\n
size);\n\n return backend.makeTensorInfo([size], weights.dtype, outVals);\n}\n\nexport const bincountConfig:\n
KernelConfig = {\n kernelName: Bincount,\n backendName: 'webgl',\n kernelFunc: bincount as { } as\n
KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the\n
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on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or\n
implied.\n * See the License for the specific\n
language governing permissions and\n * limitations under the License.\n *\n
=====
*/\n\nimport {TensorInfo} from '@tensorflow/tfjs-core';\n\nimport {MathBackendWebGL} from\n
'../backend_webgl';\nimport {UnaryOpProgram} from '../unaryop_gpu';\n\nconst TO_INT = `return\n
float(int(x));`\n\nexport function int(input: TensorInfo, backend: MathBackendWebGL): TensorInfo {\n const\n
program = new UnaryOpProgram(input.shape, TO_INT);\n const output = backend.runWebGLProgram(program,\n
[input], 'int32');\n return {dataId: output.dataId, shape: output.shape, dtype: output.dtype};\n}\n\n"/**\n * \n
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agreed to in writing, software distributed under the License is distributed on an "AS IS" BASIS, WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied. See the License for the specific language governing permissions and limitations under the License.

```
=====
*/\n\nimport { GPGPUContext } from './gpgpu_context';\nimport { GPGPUProgram } from './gpgpu_math';\n\nexport class ClipProgram implements GPGPUProgram {\n variableNames = ['A'];\n userCode: string;\n outputShape: number[];\n\n // Caching uniform locations for speed.\n minLoc: WebGLUniformLocation;\n maxLoc: WebGLUniformLocation;\n\n constructor(aShape: number[]) {\n this.outputShape = aShape;\n this.userCode =`\n uniform float minVal;\n uniform float maxVal;\n\n void main() {\n float value = getAAtOutCoords();\n if (isnan(value)) {\n setOutput(value);\n return;\n }\n setOutput(clamp(value, minVal, maxVal));\n }\n }\n\n getCustomSetupFunc(min: number, max: number) {\n return (gpgpu: GPGPUContext, webGLProgram: WebGLProgram) => {\n if (this.minLoc == null) {\n this.minLoc = gpgpu.getUniformLocationNoThrow(webGLProgram, 'minVal');\n this.maxLoc = gpgpu.getUniformLocationNoThrow(webGLProgram, 'maxVal');\n }\n gpgpu.gl.uniform1f(this.minLoc, min);\n gpgpu.gl.uniform1f(this.maxLoc, max);\n };\n }\n}\n\n", /**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS
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```
=====
*/\n\nimport { GPGPUContext } from './gpgpu_context';\nimport { GPGPUProgram } from './gpgpu_math';\n\nexport class ClipPackedProgram implements GPGPUProgram {\n variableNames = ['A'];\n packedInputs = true;\n packedOutput = true;\n userCode: string;\n outputShape: number[];\n\n // Caching uniform locations for speed.\n minLoc: WebGLUniformLocation;\n maxLoc: WebGLUniformLocation;\n\n constructor(aShape: number[]) {\n this.outputShape = aShape;\n this.userCode =`\n uniform float minVal;\n uniform float maxVal;\n\n void main() {\n vec4 value = getAAtOutCoords();\n if (any(isnan(value))) {\n setOutput(value);\n return;\n }\n setOutput(clamp(value, vec4(minVal), vec4(maxVal)));\n }\n }\n\n getCustomSetupFunc(min: number, max: number) {\n return (gpgpu: GPGPUContext, webGLProgram: WebGLProgram) => {\n if (this.minLoc == null) {\n this.minLoc = gpgpu.getUniformLocationNoThrow(webGLProgram, 'minVal');\n this.maxLoc = gpgpu.getUniformLocationNoThrow(webGLProgram, 'maxVal');\n }\n gpgpu.gl.uniform1f(this.minLoc, min);\n gpgpu.gl.uniform1f(this.maxLoc, max);\n };\n }\n}\n\n", /**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and limitations under the License.\n */
```

```
=====
*/\n\nimport { ClipByValue, ClipByValueAttrs, ClipByValueInputs, env, KernelConfig, KernelFunc, TensorInfo } from '@tensorflow/tfjs-core';\nimport { MathBackendWebGL } from '../backend_webgl';\nimport { ClipProgram } from '../clip_gpu';\nimport { ClipPackedProgram } from '../clip_packed_gpu';\n\nexport function clipByValue(args:
```

```

{\n inputs: ClipByValueInputs,\n backend: MathBackendWebGL,\n attrs: ClipByValueAttrs\n}): TensorInfo {\n
const {inputs, backend, attrs} = args;\n const {x} = inputs;\n const {clipValueMin, clipValueMax} = attrs;\n\n let
program;\n if (env().getBool('WEBGL_PACK_CLIP')) {\n program = new ClipPackedProgram(x.shape);\n }
else {\n program = new ClipProgram(x.shape);\n }\n const customSetup =
program.getCustomSetupFunc(clipValueMin, clipValueMax);\n return backend.runWebGLProgram(program,
[x], x.dtype, customSetup);\n}\n\nexport const clipByValueConfig: KernelConfig = {\n kernelName:
ClipByValue,\n backendName: 'webgl',\n kernelFunc: clipByValue as {} as KernelFunc\n};\n\n"/**\n * @license\n
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {GPGPUProgram} from './gpgpu_math';\n\nexport class ComplexAbsProgram implements
GPGPUProgram {\n variableNames = ['real', 'imag'];\n userCode: string;\n outputShape: number[];\n\n constructor(shape: number[]) {\n this.outputShape = shape;\n this.userCode = `\n void main() {\n float re
= abs(getRealAtOutCoords());\n float im = abs(getImagAtOutCoords());\n float mx = max(re, im);\n\n
// sadly the length function in glsl is not underflow-safe\n // (at least not on Intel GPUs). So the safe solution
is\n // to ensure underflow-safety in all cases.\n setOutput(\n mx == 0.0 ? 0.0 : mx * length(vec2(1,
min(re, im)/mx))\n);\n }\n `;\n }\n\n "/**\n * @license\n
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {ComplexAbs, ComplexAbsInputs, KernelConfig, KernelFunc, TensorInfo} from '@tensorflow/tfjs-
core';\n\nimport {MathBackendWebGL} from '../backend_webgl';\nimport {ComplexAbsProgram} from
'../complex_abs_gpu';\n\n// Returns a TensorInfo with the complex shape and the dataId of the\n// underlying part.
We need to do this because a reshaped complex tensor is\n// not reflected in its parts.\n\nfunction
makeComplexComponentTensorInfo(\n complexTensor: TensorInfo, complexPart: TensorInfo): TensorInfo {\n
return {\n dataId: complexPart.dataId,\n dtype: complexPart.dtype,\n shape: complexTensor.shape\n
};\n}\n\nexport function complexAbs(\n args: {inputs: ComplexAbsInputs, backend: MathBackendWebGL}):
TensorInfo {\n const {inputs, backend} = args;\n const {x} = inputs;\n\n const xData =
backend.texData.get(x.dataId);\n\n const program = new ComplexAbsProgram(x.shape);\n const programInputs =
[\n makeComplexComponentTensorInfo(x, xData.complexTensorInfos.real),\n
makeComplexComponentTensorInfo(x, xData.complexTensorInfos.imag),\n];\n\n return
backend.runWebGLProgram(\n program, programInputs, programInputs[0].dtype);\n}\n\nexport const
complexAbsConfig: KernelConfig = {\n kernelName: ComplexAbs,\n backendName: 'webgl',\n kernelFunc:
complexAbs as {} as KernelFunc\n};\n\n"/**\n * @license\n
* Copyright 2017 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the 'License')\n
* you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n
*\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is
distributed on an 'AS IS' BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
express or implied.\n * See the License for the specific language governing permissions and\n * limitations under

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the License.\n \*

```
=====
*\n\nimport {backend_util} from 'tensorflow/tfjs-core';\nimport {GPGPUProgram} from
'./gpgpu_math';\n\nexport class ConcatProgram implements GPGPUProgram {\n variableNames: string[];\n outputShape: number[] = [];\n userCode: string;\n\n // Concat 2d tensors along axis=1. See comments in
MathBackendWebGL.concat().\n constructor(shapes: Array<number, number>) {\n this.outputShape =
backend_util.computeOutShape(shapes, 1 /* axis */);\n this.variableNames = shapes.map((_, i) => `T${i}`);\n\n const offsets: number[] = new Array(shapes.length - 1);\n offsets[0] = shapes[0][1];\n for (let i = 1; i < offsets.length; i++) {\n offsets[i] = offsets[i - 1] + shapes[i][1];\n }\n\n const snippets = ['if (yC < ${offsets[0]}) setOutput(getT0(yR, yC));'];\n for (let i = 1; i < offsets.length;\n i++) {\n const shift = offsets[i - 1];\n snippets.push(\n `else if (yC < ${offsets[i]}) ` +\n `setOutput(getT${i}(yR, yC-${shift}));`);\n }\n const lastIndex = offsets.length;\n const lastShift =\n offsets[offsets.length - 1];\n snippets.push(`else setOutput(getT${lastIndex}(yR, yC-${lastShift}));`);\n\n this.userCode = `\n void main() {\n ivec2 coords = getOutputCoords();\n int yR = coords.x;\n int yC\n = coords.y;\n\n ${snippets.join("\n ")}\n }\n `;\n }\n\n /**\n * @license\n * Copyright 2019 Google\n * LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not\n * use this file except in compliance\n * with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is\n * distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either\n * express or implied.\n * See the License for the specific language governing permissions and\n * limitations under\n * the License.\n */\n}
```

```
=====
*\n\nimport {backend_util} from 'tensorflow/tfjs-core';\nimport {GPGPUProgram} from
'./gpgpu_math';\nimport {getChannels} from './packing_util';\nimport {getCoordsDataType} from
'./shader_compiler';\n\nexport class ConcatPackedProgram implements GPGPUProgram {\n variableNames:\n string[];\n packedInputs = true;\n packedOutput = true;\n outputShape: number[] = [];\n userCode: string;\n\n constructor(shapes: number[][], axis: number) {\n this.outputShape =\n backend_util.computeOutShape(shapes, axis);\n const shape = this.outputShape;\n const rank = shape.length;\n const dtype = getCoordsDataType(rank);\n const coords = getChannels('coords', rank);\n const channels = ['x',\n 'y', 'z', 'w', 'u', 'v'].slice(0, rank);\n this.variableNames = shapes.map((_, i) => `T${i}`);\n\n const offsets:\n number[] = new Array(shapes.length - 1);\n offsets[0] = shapes[0][axis];\n for (let i = 1; i < offsets.length; i++) {\n offsets[i] = offsets[i - 1] + shapes[i][axis];\n }\n\n const channel = channels[axis];\n const lastChannels\n = channels.slice(-2);\n const allChannels = channels.join();\n let getValueSnippet = `if (${channel} <\n ${offsets[0]}) {\n return getChannel(\n getT0(${allChannels}), vec2(${lastChannels.join()}));\n }`;\n for (let i = 1; i < offsets.length; i++) {\n const shift = offsets[i - 1];\n // Note: the >= comparison below\n may seem unnecessary given the check\n // above but is needed to workaround branch execution issues on some\n // devices. It makes all the\n conditions exclusive without relying on\n // execution order.\n getValueSnippet += `\n if (${channel} <\n ${offsets[i]} && ${channel} >= ${offsets[i - 1]}) {\n return getChannel(\n getT${i}(${shiftedChannels(channels, channel, shift)}),\n vec2(${shiftedChannels(lastChannels, channel,\n shift)}));\n }`;\n }\n const lastIndex = offsets.length;\n const shift = offsets[offsets.length - 1];\n getValueSnippet += `\n return getChannel(\n getT${lastIndex}(${shiftedChannels(channels, channel,\n shift)}),\n vec2(${shiftedChannels(lastChannels, channel, shift)}));`;\n\n this.userCode = `\n float\n getValue(${channels.map(x => `int ' + x`)} {\n ${getValueSnippet}\n }\n\n void main() {\n ${dtype}\n coords = getOutputCoords();\n vec4 result = vec4(getValue(${coords}), 0.,\n 0., 0.); \n ${coords[rank - 1]} = ${coords[rank - 1]} + 1;\n if (${coords[rank - 1]} < ${shape[rank - 1]})\n {\n result.g = getValue(${coords});\n ${coords[rank - 2]} = ${coords[rank - 2]} + 1;\n if`
```





```

* See the License for the specific language governing permissions and\n * limitations under the License.\n *
=====
\n
*\n\nimport {backend_util} from '@tensorflow/tfjs-core';\nimport {GPGPUProgram} from
'./gpgpu_math';\n\nexport class Conv2DProgram implements GPGPUProgram {\n variableNames = ['x', 'W'];\n outputShape: number[];\n userCode: string;\n\n constructor(\n convInfo: backend_util.Conv2DInfo, addBias =
false,\n activation: string = null, hasPreluActivationWeights = false,\n hasLeakyreluAlpha = false) {\n this.outputShape = convInfo.outShape;\n const padTop = convInfo.padInfo.top;\n const padLeft =
convInfo.padInfo.left;\n const strideHeight = convInfo.strideHeight;\n
 const strideWidth = convInfo.strideWidth;\n const dilationHeight = convInfo.dilationHeight;\n const
dilationWidth = convInfo.dilationWidth;\n const filterHeight = convInfo.filterHeight;\n const filterWidth =
convInfo.filterWidth;\n\n const inputDepthNearestVec4 = Math.floor(convInfo.inChannels / 4) * 4;\n const
inputDepthVec4Remainder = convInfo.inChannels % 4;\n const isChannelsLast = convInfo.dataFormat ===
'channelsLast';\n\n const rowDim = isChannelsLast ? 1 : 2;\n const colDim = isChannelsLast ? 2 : 3;\n const
channelDim = isChannelsLast ? 3 : 1;\n\n let activationSnippet = "", applyActivationSnippet = ""; \n if (activation)
{\n if (hasPreluActivationWeights) {\n activationSnippet = `float activation(float a) {\n float b =
getPreluActivationWeightsAtOutCoords();\n ${activation}\n }`; \n } else if (hasLeakyreluAlpha) {\n
activationSnippet = `float activation(float a) {\n float b = getLeakyreluAlphaAtOutCoords();\n
 ${activation}\n }`; \n } else {\n activationSnippet = `\n float activation(float x) {\n
${activation}\n }\n `; \n } \n applyActivationSnippet = `result = activation(result);`; \n } \n\n
const addBiasSnippet = addBias ? 'result += getBiasAtOutCoords();' : ""; \n if (addBias) {\n
this.variableNames.push('bias'); \n } \n\n if (hasPreluActivationWeights) {\n
this.variableNames.push('preluActivationWeights'); \n } \n\n if (hasLeakyreluAlpha) {\n
this.variableNames.push('leakyreluAlpha'); \n } \n\n this.userCode = `\n ${activationSnippet}\n\n const
ivec2 strides = ivec2(${strideHeight}, ${strideWidth});\n const ivec2 pads = ivec2(${padTop}, ${padLeft});\n\n
 void main() {\n ivec4 coords = getOutputCoords();\n int batch = coords[0];\n int d2 =
coords[${channelDim}];\n\n ivec2 xRCCorner =\n ivec2(coords[${rowDim}],
coords[${colDim}]) * strides - pads;\n int xRCorner = xRCCorner.x;\n int xCCorner = xRCCorner.y;\n\n
 // Convolve x(?, ?, d1) with w(:, :, d1, d2) to get y(yR, yC, d2).\n // ? = to be determined. : = across all values
in that axis.\n float dotProd = 0.0;\n for (int wR = 0; wR < ${filterHeight}; wR++) {\n int xR =
xRCorner + wR * ${dilationHeight};\n\n if (xR < 0 || xR >= ${convInfo.inHeight}) {\n continue;\n
 }\n\n for (int wC = 0; wC < ${filterWidth}; wC++) {\n int xC = xCCorner + wC *
${dilationWidth};\n\n if (xC < 0 || xC >= ${convInfo.inWidth}) {\n continue;\n }\n
 }\n\n for (int d1 = 0; d1 < ${inputDepthNearestVec4}; d1 += 4) {\n vec4 wValues = vec4(\n getW(wR,
wC, d1, d2),\n getW(wR, wC, d1 + 1, d2),\n getW(wR, wC, d1 + 2, d2),\n getW(wR,
wC, d1 + 3, d2)\n);\n\n if (${isChannelsLast}) {\n vec4 xValues = vec4(\n getX(batch, xR, xC,
d1),\n getX(batch, xR, xC, d1 + 1),\n getX(batch, xR, xC, d1 + 2),\n getX(batch, xR,
xC, d1 + 3)\n);\n dotProd += dot(xValues, wValues);\n } else {\n vec4 xValues
= vec4(\n getX(batch, d1, xR, xC),\n getX(batch, d1 + 1, xR, xC),\n getX(batch, d1
+ 2, xR, xC),\n getX(batch, d1 + 3, xR, xC)\n);\n dotProd += dot(xValues,
wValues);\n }\n\n if (${inputDepthVec4Remainder} === 1) {\n if
(${isChannelsLast}) {\n dotProd +=\n getX(batch, xR, xC, ${inputDepthNearestVec4}) * \n
 getW(wR, wC, ${inputDepthNearestVec4}, d2);\n } else {\n
 dotProd +=\n getX(batch, ${inputDepthNearestVec4}, xR, xC) * \n
 getW(wR, wC, ${inputDepthNearestVec4}, d2);\n }\n } else if (${inputDepthVec4Remainder} === 2) {\n
 vec2 wValues = vec2(\n getW(wR, wC, ${inputDepthNearestVec4}, d2),\n getW(wR, wC,
${inputDepthNearestVec4} + 1, d2)\n);\n\n if (${isChannelsLast}) {\n vec2 xValues =
vec2(\n getX(batch, xR, xC, ${inputDepthNearestVec4}),\n getX(batch, xR, xC,

```

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 ${inputDepthNearestVec4} + 1)\n);\n dotProd += dot(xValues, wValues);\n } else {\n vec2 xValues = vec2(\n getX(batch, ${inputDepthNearestVec4}, xR, xC),\n getX(batch, ${inputDepthNearestVec4} + 1, xR, xC)\n);\n dotProd += dot(xValues, wValues);\n }\n\n } else if\n (${inputDepthVec4Remainder === 3}) {\n vec3 wValues = vec3(\n getW(wR, wC, ${inputDepthNearestVec4}, d2),\n getW(wR, wC, ${inputDepthNearestVec4} + 1, d2),\n getW(wR, wC, ${inputDepthNearestVec4} + 2, d2)\n);\n if (${isChannelsLast}) {\n vec3 xValues = vec3(\n getX(batch, xR, xC, ${inputDepthNearestVec4}),\n getX(batch, xR, xC, ${inputDepthNearestVec4} + 1),\n getX(batch, xR, xC, ${inputDepthNearestVec4} + 2)\n);\n dotProd += dot(xValues, wValues);\n } else {\n vec3 xValues = vec3(\n getX(batch, ${inputDepthNearestVec4}, xR, xC),\n getX(batch, ${inputDepthNearestVec4} + 1, xR, xC),\n getX(batch, ${inputDepthNearestVec4} + 2, xR, xC)\n);\n dotProd +=\n dot(xValues, wValues);\n }\n }\n\n }\n }\n }\n float result = dotProd;\n ${addBiasSnippet}\n ${applyActivationSnippet}\n setOutput(result);\n }\n `;\n }\n}\n\nexport class Conv3DProgram\nimplements GPGPUProgram {\n variableNames = ['x', 'W'];\n outputShape: number[];\n userCode: string;\n\n constructor(convInfo: backend_util.Conv3DInfo) {\n this.outputShape = convInfo.outShape;\n const padFront = convInfo.padInfo.front;\n const padTop = convInfo.padInfo.top;\n const padLeft = convInfo.padInfo.left;\n const strideDepth = convInfo.strideDepth;\n const strideHeight = convInfo.strideHeight;\n const strideWidth = convInfo.strideWidth;\n const dilationDepth = convInfo.dilationDepth;\n const dilationHeight = convInfo.dilationHeight;\n const dilationWidth = convInfo.dilationWidth;\n const filterDepth = convInfo.filterDepth;\n const filterHeight = convInfo.filterHeight;\n const filterWidth = convInfo.filterWidth;\n\n inputDepthNearestVec4 = Math.floor(convInfo.inChannels / 4) * 4;\n const inputDepthVec4Remainder = convInfo.inChannels % 4;\n\n this.userCode = `\n const ivec3 strides = ivec3(${strideDepth}, ${strideHeight}, ${strideWidth});\n const ivec3 pads = ivec3(${padFront}, ${padTop}, ${padLeft});\n\n void main()\n {\n ivec5 coords = getOutputCoords();\n int batch = coords.x;\n int d2 = coords.u;\n ivec3 xFRCCorner = ivec3(coords.y, coords.z, coords.w) * strides - pads;\n int xFCorner = xFRCCorner.x;\n int xRCorner = xFRCCorner.y;\n int xCCorner = xFRCCorner.z;\n\n // Convolve x(?, ?, ?, d1) with w(:, :, :, d1, d2) to get\n // y(yF, yR, yC, d2). ? = to be determined. := across all\n // values in that axis.\n float dotProd = 0.0;\n for (int wF = 0; wF < ${filterDepth}; wF++) {\n int xF = xFCorner + wF * ${dilationDepth};\n\n if (xF < 0 || xF >= ${convInfo.inDepth})\n continue;\n\n for (int wR = 0; wR < ${filterHeight}; wR++) {\n int xR = xRCorner + wR * ${dilationHeight};\n\n if (xR < 0 || xR >= ${convInfo.inHeight})\n continue;\n\n for (int wC = 0; wC < ${filterWidth}; wC++) {\n int xC = xCCorner + wC * ${dilationWidth};\n\n if (xC < 0 || xC >= ${convInfo.inWidth})\n continue;\n\n for (int d1 = 0; d1 < ${inputDepthNearestVec4}; d1 += 4) {\n vec4 xValues = vec4(\n getX(batch, xF, xR, xC, d1),\n getX(batch, xF, xR, xC, d1 + 1),\n getX(batch, xF, xR, xC, d1 + 2),\n getX(batch, xF, xR, xC, d1 + 3)\n);\n vec4 wValues = vec4(\n getW(wF, wR, wC, d1, d2),\n getW(wF, wR, wC, d1 + 1, d2),\n getW(wF, wR, wC, d1 + 2, d2),\n getW(wF, wR, wC, d1 + 3, d2)\n);\n dotProd += dot(xValues, wValues);\n }\n\n if (${inputDepthVec4Remainder === 1}) {\n dotProd +=\n getX(batch, xF, xR, xC, ${inputDepthNearestVec4}) * \n getW(wF, wR, wC, ${inputDepthNearestVec4}, d2);\n }\n else if (${inputDepthVec4Remainder === 2}) {\n vec2 xValues = vec2(\n getX(batch, xF, xR, xC, ${inputDepthNearestVec4} + 1),\n getX(batch, xF, xR, xC, ${inputDepthNearestVec4} + 2)\n);\n vec2 wValues = vec2(\n getW(wF, wR, wC, ${inputDepthNearestVec4}, d2),\n getW(wF, wR, wC, ${inputDepthNearestVec4} + 1, d2)\n);\n dotProd += dot(xValues, wValues);\n }\n else if (${inputDepthVec4Remainder === 3}) {\n vec3 xValues = vec3(\n
```

[illegible]

```

from './kernel_utils/kernel_funcs_utils';\nimport {MatMulPackedProgram} from './mulmat_packed_gpu';\nimport
* as webgl_util from './webgl_util';\n\nimport {batchMatMulImpl, MATMUL_SHARED_DIM_THRESHOLD}
from './BatchMatMul_impl';\nimport {identity} from './Identity';\nimport {reshape} from './Reshape';\n\ntype
Conv2DConfig = {\n x: TensorInfo,\n filter: TensorInfo,\n convInfo: backend_util.Conv2DInfo,\n backend:
MathBackendWebGL,\n bias?: TensorInfo,\n preluActivationWeights?: TensorInfo,\n leakyreluAlpha?: number,\n
activation?: backend_util.Activation\n};\n\n// For 1x1 kernels that iterate through every point in the input,
convolution\n// can be expressed as matrix multiplication (without need for memory\n// remapping).\n\nexport
function conv2dByMatMul({\n x,\n filter,\n convInfo,\n backend,\n bias = null,\n preluActivationWeights =
null,\n leakyreluAlpha = 0,\n activation = null\n}: Conv2DConfig) {\n // Reshapes conv2D input to 2D tensors,
uses
 matMul and then reshape the\n // result from 2D to 4D.\n const xShape = x.shape;\n const xTexData =
backend.texData.get(x.dataId);\n const sharedMatMulDim = convInfo.inChannels;\n const outerShapeX =
xShape[0] * xShape[1] * xShape[2];\n const outerShapeFilter = convInfo.outChannels;\n const isChannelsLast =
convInfo.dataFormat === 'channelsLast';\n const transposeA = false;\n const transposeB = false;\n\n let out:
TensorInfo;\n const intermediates: TensorInfo[] = [];\n\n // TODO: Once reduction ops are packed, batchMatMul
will always be packed\n // and we can remove this condition.\n const batchMatMulWillBeUnpacked =\n (outerShapeX === 1 || outerShapeFilter === 1) &&\n sharedMatMulDim >
MATMUL_SHARED_DIM_THRESHOLD;\n const reshapeWillBeExpensive = xShape[2] % 2 !== 0 &&
!!xTexData.isPacked;\n\n if (batchMatMulWillBeUnpacked || !env().getBool('WEBGL_LAZILY_UNPACK') ||\n !env().getBool('WEBGL_PACK_BINARY_OPERATIONS') ||\n !reshapeWillBeExpensive) {\n
 const targetShape = isChannelsLast ? xShape[0] * xShape[1] * xShape[2] :\n xShape[0]
* xShape[2] * xShape[3];\n const xReshaped = reshape({\n inputs: {x},\n backend,\n attrs: {shape: [1,
targetShape, convInfo.inChannels]}\n });\n const filterReshaped = reshape({\n inputs: {x: filter},\n
backend,\n attrs: {shape: [1, convInfo.inChannels, convInfo.outChannels]}\n });\n const result =
batchMatMulImpl({\n a: xReshaped,\n b: filterReshaped,\n transposeA,\n transposeB,\n backend,\n
bias,\n activation,\n preluActivationWeights,\n leakyreluAlpha\n });\n out = reshape({\n inputs:
{x: result},\n backend,\n attrs: {shape: convInfo.outShape}\n });\n intermediates.push(xReshaped);\n
intermediates.push(filterReshaped);\n intermediates.push(result);\n } else {\n // Following optimization is
specific to packed |x| with odd row count\n // (For
 example, in channelLast mode, 'row count' refers to x.shape[2]):\n // we avoid expensive packed 2x2 reshape by
padding row count to next,\n // even number. When x.shape[2] is odd, the result of packed batchMatMul is\n //
the same (has the same texture layout and values in the texture) as\n // it is for even x.shape[2] + 1. We make
the odd-rows tensor to look like\n // even-rows tensor before the operation and, after the batchMatMul,\n // fix
the even-rows result to have odd number of rows.\n const targetShape = isChannelsLast ?\n xShape[0] *
xShape[1] * (xShape[2] + 1) : \n xShape[0] * xShape[2] * (xShape[3] + 1);\n const xReshaped: TensorInfo =
{\n dataId: x.dataId,\n shape: [1, targetShape, convInfo.inChannels],\n dtype: x.dtype\n }; \n //
xTexData.shape gets referenced from GPGPUBinary.inShapeInfos.\n // Decrementing row count, after
batchMatMul->...->compileProgram leads to\n // invalid row count within the reference
in GPGPUBinary.inShapeInfos.\n // Alternative fix would be to provide a copy to GPGPUBinary.inShapeInfos\n
// in compileProgram method, but that would affect compilation of all\n // programs - instead, provide a copy here,
with even row count, before\n // calling batchMatMul->...->compileProgram and after that, the original\n //
xTexData.shape is restored.\n const originalXTexDataShape = xTexData.shape;\n xTexData.shape =
xTexData.shape.slice();\n xTexData.shape[xTexData.shape.length - 2]++; \n util.assert(\n
webgl_util.isReshapeFree(xTexData.shape, xReshaped.shape),\n () => `packed reshape ${xTexData.shape} to
${\n xReshaped.shape\n } isn't free`);\n const filterReshaped = reshape({\n inputs: {x: filter},\n
backend,\n attrs: {shape: [1, convInfo.inChannels, convInfo.outChannels]}\n });\n intermediates.push(filterReshaped);\n
const pointwiseConv = batchMatMulImpl({\n a: xReshaped,\n b:
filterReshaped,\n

```

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 backend,\n transposeA,\n transposeB,\n bias,\n activation,\n preluActivationWeights,\n leakyreluAlpha\n });\n\n const pointwiseConvTexData = backend.texData.get(pointwiseConv.dataId);\n util.assert(\n pointwiseConvTexData.isPacked,\n () => 'batchMatMul result is expected to be packed');\n // Restore the input shape to original.\n xTexData.shape = originalXTexDataShape;\n // Set the output shape -\n // there is no need for expensive reshape as data\n // layout is already correct.\n pointwiseConvTexData.shape =\n convInfo.outShape;\n\n out = identity({inputs: {x: pointwiseConv}, backend});\n out.shape =\n convInfo.outShape;\n\n intermediates.push(pointwiseConv);\n }\n\n for (const i of intermediates) {\n backend.disposeIntermediateTensorInfo(i);\n }\n\n return out;\n}\n\n// Implements the im2row algorithm as\n// outlined in \"High Performance\n// Convolutional Neural Networks for Document Processing\" (Suvisoft,\n// 2006)\nexport function conv2dWithIm2Row({\n x,\n filter,\n convInfo,\n backend,\n bias = null,\n preluActivationWeights = null,\n leakyreluAlpha = 0,\n activation = null\n}: Conv2DConfig) {\n // Rearranges\n // conv2d input so each block to be convolved over forms the\n // column of a new matrix with shape [filterWidth *\n // filterHeight *\n // inChannels, outHeight * outWidth]. The filter is also rearranged so each\n // output channel\n // forms a row of a new matrix with shape [outChannels,\n // filterWidth * filterHeight * inChannels]. The\n // convolution is then\n // computed by multiplying these matrices and reshaping the result.\n const {\n filterWidth,\n filterHeight,\n inChannels,\n outWidth,\n outHeight,\n dataFormat\n } = convInfo;\n\n const isChannelsLast = dataFormat === 'channelsLast';\n const sharedDim = filterWidth * filterHeight *\n inChannels;\n const numCols = outHeight * outWidth;\n const x2ColShape = [sharedDim, numCols];\n const\n transposeA\n = true;\n const transposeB = false;\n\n const intermediates: TensorInfo[] = [];\n\n const xSqueezed =\n reshape({inputs: {x}, backend, attrs: {shape: x.shape.slice(1)}});\n const w2Row = reshape({\n inputs: {x:\n filter},\n backend,\n attrs: {shape: [1, sharedDim, util.sizeFromShape(filter.shape) / sharedDim]}\n });\n\n intermediates.push(xSqueezed);\n intermediates.push(w2Row);\n\n const im2ColProgram =\n new\n Im2ColPackedProgram(x2ColShape, xSqueezed.shape, convInfo);\n const im2Col =\n backend.runWebGLProgram(im2ColProgram, [xSqueezed], 'float32');\n const im2ColReshaped = reshape({\n inputs: {x: im2Col},\n backend,\n attrs: {shape: [1, x2ColShape[0], x2ColShape[1]]}\n });\n\n intermediates.push(im2Col);\n intermediates.push(im2ColReshaped);\n\n const hasBias = bias != null;\n const\n hasPreluActivationWeights = preluActivationWeights != null;\n const\n hasLeakyreluAlpha = activation ===\n 'leakyrelu';\n const fusedActivation =\n activation ?\n mapActivationToShaderProgram(activation, true) : null;\n\n const matmulProgram = new MatMulPackedProgram(\n im2ColReshaped.shape as [number, number, number],\n w2Row.shape as [number, number, number],\n [1,\n numCols, convInfo.outChannels],\n transposeA, transposeB, hasBias,\n fusedActivation,\n hasPreluActivationWeights, hasLeakyreluAlpha);\n const inputs: TensorInfo[] = [im2ColReshaped, w2Row];\n if\n (bias) {\n inputs.push(bias);\n }\n if\n (hasPreluActivationWeights) {\n inputs.push(preluActivationWeights);\n }\n if\n (hasLeakyreluAlpha) {\n const $leakyreluAlpha = backend.makeTensorInfo(\n [], 'float32',\n util.createScalarValue(leakyreluAlpha as { } as 'float32', 'float32'));\n inputs.push($leakyreluAlpha);\n }\n intermediates.push($leakyreluAlpha);\n\n const product = backend.runWebGLProgram(matmulProgram, inputs,\n 'float32');\n\n const outShape = isChannelsLast ?\n [1, outHeight, outWidth, convInfo.outChannels] :\n [1,\n convInfo.outChannels,\n outHeight, outWidth];\n const out =\n reshape({inputs: {x: product}, backend, attrs: {shape: outShape}});\n\n intermediates.push(product);\n for (const i of intermediates) {\n backend.disposeIntermediateTensorInfo(i);\n }\n\n return out;\n}\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under\n * the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the\n * License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed\n * on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or\n * implied.\n * See the License for the specific language governing permissions and\n * limitations under the\n * License.\n */

```

```

=====\\n
*\\n\\nimport
{backend_util, Conv2D, Conv2DAttrs, Conv2DInputs, env, KernelConfig, KernelFunc, TensorInfo} from
'@tensorflow/tfjs-core';\\n\\nimport {MathBackendWebGL} from './backend_webgl';\\n\\nimport {Conv2DProgram}
from './conv_gpu';\\n\\nimport {conv2dByMatMul, conv2dWithIm2Row} from './Conv2D_impl';\\n\\nimport {reshape}
from './Reshape';\\n\\nexport function conv2d(\\n args:\\n {inputs: Conv2DInputs, attrs: Conv2DAttrs, backend:
MathBackendWebGL}) {\\n const {inputs, backend, attrs} = args;\\n const {x, filter} = inputs;\\n const {strides, pad,
dataFormat, dilations, dimRoundingMode} = attrs;\\n const $dataFormat =
backend_util.convertConv2DDataFormat(dataFormat);\\n const convInfo = backend_util.computeConv2DInfo(\\n
x.shape as [number, number, number, number],\\n filter.shape as [number, number, number, number], strides,
dilations, pad,\\n dimRoundingMode, false /* depthwise */, $dataFormat);\\n let out: TensorInfo;\\n if
(convInfo.filterHeight === 1 && convInfo.filterWidth ===
1 &&\\n convInfo.dilationHeight === 1 && convInfo.dilationWidth === 1 &&\\n convInfo.strideHeight ===
1 && convInfo.strideWidth === 1 &&\\n (convInfo.padInfo.type === 'SAME' || convInfo.padInfo.type ===
'VALID')) {\\n out = conv2dByMatMul({x, filter, convInfo, backend});\\n } else if
(env().getBool('WEBGL_CONV_IM2COL') && x.shape[0] === 1) {\\n out = conv2dWithIm2Row({x, filter,
convInfo, backend});\\n } else {\\n const program = new Conv2DProgram(convInfo);\\n out =
backend.runWebGLProgram(program, [x, filter], 'float32');\\n }\\n const outReshaped =\\n reshape({inputs: {x:
out}, backend, attrs: {shape: convInfo.outShape}});\\n backend.disposeIntermediateTensorInfo(out);\\n return
outReshaped;\\n}\\n}\\n\\nexport const conv2DConfig: KernelConfig = {\\n kernelName: Conv2D,\\n backendName:
'webgl',\\n kernelFunc: conv2d as {} as KernelFunc,\\n};\\n", "/*\\n * @license\\n * Copyright 2017 Google LLC. All
Rights Reserved.\\n * Licensed under the Apache License, Version
2.0 (the \"License\");\\n * you may not use this file except in compliance with the License.\\n * You may obtain a
copy of the License at\\n * http://www.apache.org/licenses/LICENSE-2.0\\n * Unless required by applicable
law or agreed to in writing, software\\n * distributed under the License is distributed on an \"AS IS\" BASIS,\\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\\n * See the License for
the specific language governing permissions and\\n * limitations under the License.\\n *
=====\\n
*\\n\\nimport {backend_util} from '@tensorflow/tfjs-core';\\n\\nimport {GPGPUProgram} from
'/gpgpu_math';\\n\\nexport class Conv2DDerFilterProgram implements GPGPUProgram {\\n variableNames = ['x',
'dy'];\\n outputShape: number[];\\n userCode: string;\\n constructor(convInfo: backend_util.Conv2DInfo) {\\n
this.outputShape = convInfo.filterShape;\\n const strideHeight = convInfo.strideHeight;\\n
const strideWidth = convInfo.strideWidth;\\n const padTop = convInfo.padInfo.top;\\n const padLeft =
convInfo.padInfo.left;\\n const isChannelsLast = convInfo.dataFormat === 'channelsLast';\\n this.userCode =
`\\n void main() {\\n ivec4 coords = getOutputCoords();\\n int wR = coords.x;\\n int wC = coords.y;\\n
int d1 = coords.z;\\n int d2 = coords.w;\\n // Convolve x(?, ?, d1) with dy(:, :, d2) to get dw(wR, wC, d1,
d2).\\n // ? = to be determined. : = across all values in that axis.\\n float dotProd = 0.0;\\n for (int b = 0;
b < ${convInfo.batchSize}; b++) {\\n for (int yR = 0; yR < ${convInfo.outHeight}; yR++) {\\n int xR =
wR + yR * ${strideHeight} - ${padTop};\\n if (xR < 0 || xR >= ${convInfo.inHeight}) {\\n
continue;\\n }\\n for (int yC = 0; yC < ${convInfo.outWidth}; yC++) {\\n int xC = wC + yC *
${strideWidth} - ${padLeft};\\n if (xC < 0 || xC >= ${convInfo.inWidth}) {\\n continue;\\n }\\n if
(${isChannelsLast}) {\\n float dyValue = getDy(b, yR, yC, d2);\\n float xValue = getX(b, xR, xC,
d1);\\n dotProd += (xValue * dyValue);\\n } else {\\n float dyValue = getDy(b, d2, yR,
yC);\\n float xValue = getX(b, d1, xR, xC);\\n dotProd += (xValue * dyValue);\\n }\\n
}\\n }\\n setOutput(dotProd);\\n }\\n }\\n }\\n}\\n}\\n\\nexport class Conv2DDerInputProgram
implements GPGPUProgram {\\n variableNames = ['dy', 'W'];\\n outputShape: number[];\\n userCode: string;\\n
constructor(convInfo: backend_util.Conv2DInfo) {\\n this.outputShape = convInfo.inShape;\\n const

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filterHeight = convInfo.filterHeight;\n const filterWidth = convInfo.filterWidth;\n const strideHeight =
convInfo.strideHeight;\n const strideWidth
= convInfo.strideWidth;\n const isChannelsLast = convInfo.dataFormat === 'channelsLast';\n\n const padTop =
filterHeight - 1 - convInfo.padInfo.top;\n const padLeft = filterWidth - 1 - convInfo.padInfo.left;\n\n const
rowDim = isChannelsLast ? 1 : 2;\n const colDim = isChannelsLast ? 2 : 3;\n const channelDim =
isChannelsLast ? 3 : 1;\n\n this.userCode = `\n const ivec2 pads = ivec2(${padTop}, ${padLeft});\n\n void
main() {\n ivec4 coords = getOutputCoords();\n int batch = coords[0];\n int d1 =
coords[${channelDim}];\n\n ivec2 dyCorner = ivec2(coords[${rowDim}], coords[${colDim}]) - pads;\n int
dyRCorner = dyCorner.x;\n int dyCCorner = dyCorner.y;\n\n // Convolve dy(?, ?, d2) with w(:, :, d1, d2) to
compute dx(xR, xC, d1).\n // ? = to be determined. : = across all values in that axis.\n float dotProd = 0.0;\n\n for (int wR = 0; wR < ${filterHeight}; wR++) {\n float dyR = float(dyRCorner
+ wR) / ${strideHeight}.0;\n\n if (dyR < 0.0 || dyR >= ${convInfo.outHeight}.0 || fract(dyR) > 0.0) {\n
continue;\n }\n int idyR = int(dyR);\n\n int wRPerm = ${filterHeight} - 1 - wR;\n\n for (int
wC = 0; wC < ${filterWidth}; wC++) {\n float dyC = float(dyCCorner + wC) / ${strideWidth}.0;\n\n if
(dyC < 0.0 || dyC >= ${convInfo.outWidth}.0 || fract(dyC) > 0.0) {\n continue;\n }\n int
idyC = int(dyC);\n\n int wCPerm = ${filterWidth} - 1 - wC;\n\n for (int d2 = 0; d2 <
${convInfo.outChannels}; d2++) {\n if (${isChannelsLast}) {\n float xValue = getDy(batch,
idyR, idyC, d2);\n float wValue = getW(wRPerm, wCPerm, d1, d2);\n dotProd += xValue *
wValue;\n } else {\n float xValue = getDy(batch, d2, idyR, idyC);\n float wValue =
getW(wRPerm,
wCPerm, d1, d2);\n dotProd += xValue * wValue;\n }\n }\n }\n }\n setOutput(dotProd);\n }\n `;\n}\n\n\nexport class Conv3DDerFilterProgram implements GPGPUProgram {\n variableNames = ['x', 'dy'];\n outputShape: number[];\n userCode: string;\n\n constructor(convInfo:
backend_util.Conv3DInfo) {\n this.outputShape = convInfo.filterShape;\n\n const strideDepth =
convInfo.strideDepth;\n const strideHeight = convInfo.strideHeight;\n const strideWidth =
convInfo.strideWidth;\n const padFront = convInfo.padInfo.front;\n const padTop = convInfo.padInfo.top;\n
const padLeft = convInfo.padInfo.left;\n\n this.userCode = `\n void main() {\n ivec5 coords =
getOutputCoords();\n int wF = coords.x;\n int wR = coords.y;\n int wC = coords.z;\n int d1 =
coords.w;\n int d2 = coords.u;\n\n float dotProd = 0.0;\n\n for (int b = 0; b < ${convInfo.batchSize};
b++) {\n for (int yF = 0; yF < ${convInfo.outDepth}; yF++) {\n int xF = wF + yF * ${strideDepth} -
${padFront};\n\n if (xF < 0 || xF >= ${convInfo.inDepth}) {\n continue;\n }\n\n for (int
yR = 0; yR < ${convInfo.outHeight}; yR++) {\n int xR = wR + yR * ${strideHeight} - ${padTop};\n\n if
(xR < 0 || xR >= ${convInfo.inHeight}) {\n continue;\n }\n\n for (int yC = 0; yC <
${convInfo.outWidth}; yC++) {\n int xC = wC + yC * ${strideWidth} - ${padLeft};\n\n if (xC <
0 || xC >= ${convInfo.inWidth}) {\n continue;\n }\n\n float dyValue = getDy(b, yF,
yR, yC, d2);\n float xValue = getX(b, xF, xR, xC, d1);\n dotProd += (xValue * dyValue);\n }\n }\n }\n }\n setOutput(dotProd);\n }\n `;\n }\n\n class Conv3DDerInputProgram implements GPGPUProgram {\n variableNames = ['dy', 'W'];\n outputShape:
number[];\n userCode: string;\n\n constructor(convInfo: backend_util.Conv3DInfo) {\n this.outputShape =
convInfo.inShape;\n\n const filterDepth = convInfo.filterDepth;\n const filterHeight = convInfo.filterHeight;\n
const filterWidth = convInfo.filterWidth;\n const strideDepth = convInfo.strideDepth;\n const strideHeight =
convInfo.strideHeight;\n const strideWidth = convInfo.strideWidth;\n\n const padFront = filterDepth - 1 -
convInfo.padInfo.front;\n const padTop = filterHeight - 1 - convInfo.padInfo.top;\n const padLeft = filterWidth -
1 - convInfo.padInfo.left;\n\n this.userCode = `\n const ivec3 pads = ivec3(${padFront}, ${padTop},
${padLeft});\n\n void main() {\n ivec5 coords = getOutputCoords();\n int batch = coords.x;\n int d1
= coords.u;\n\n ivec3 dyCorner = ivec3(coords.y, coords.z, coords.w)
- pads;\n int dyFCorner = dyCorner.x;\n int dyRCorner = dyCorner.y;\n int dyCCorner =
dyCorner.z;\n float dotProd = 0.0;\n for (int wF = 0; wF < ${filterDepth}; wF++) {\n float dyF =

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float(dyFCorner + wF) / ${strideDepth}.0;\n\n if (dyF < 0.0 || dyF >= ${convInfo.outDepth}.0 || fract(dyF) >
0.0) {\n continue;\n }\n int idyF = int(dyF);\n int wFPerm = ${filterDepth} - 1 - wF;\n for (int wR = 0; wR < ${filterHeight}; wR++) {\n float dyR = float(dyRCorner + wR) /
${strideHeight}.0;\n if (dyR < 0.0 || dyR >= ${convInfo.outHeight}.0 || fract(dyR) > 0.0) {\n
 continue;\n }\n int idyR = int(dyR);\n int wRPerm = ${filterHeight} - 1 - wR;\n }
for (int wC = 0; wC < ${filterWidth}; wC++) {\n float dyC = float(dyCCorner + wC) /
${strideWidth}.0;\n if (dyC < 0.0 || dyC
>= ${convInfo.outWidth}.0 || fract(dyC) > 0.0) {\n continue;\n }\n int idyC =
int(dyC);\n int wCPerm = ${filterWidth} - 1 - wC;\n for (int d2 = 0; d2 <
${convInfo.outChannels}; d2++) {\n float xValue = getDy(batch, idyF, idyR, idyC, d2);\n float
wValue = getW(wFPerm, wRPerm, wCPerm, d1, d2);\n dotProd += xValue * wValue;\n }\n }
}\n setOutput(dotProd);\n }\n `;\n}\n}\n", "/*\n * @license\n * Copyright 2020 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not
use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
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*\n\nimport {backend_util, Conv2DBackpropFilter, Conv2DBackpropFilterAttrs, Conv2DBackpropFilterInputs,
KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';\n\nimport {MathBackendWebGL} from
'./backend_webgl';\n\nimport {Conv2DDerFilterProgram} from './conv_backprop_gpu';\n\nexport function
conv2DBackpropFilter(args: {\n inputs: Conv2DBackpropFilterInputs,\n attrs: Conv2DBackpropFilterAttrs,\n backend: MathBackendWebGL\n}) {\n const {inputs, backend, attrs} = args;\n const {x, dy} = inputs;\n const
{strides, pad, dataFormat, dimRoundingMode, filterShape} = attrs;\n\n const $dataFormat =
backend_util.convertConv2DDataFormat(dataFormat);\n const convInfo = backend_util.computeConv2DInfo(\n
 x.shape as [number, number, number, number], filterShape, strides,\n 1 /* dilations */, pad,
dimRoundingMode, false /* depthwise */, $dataFormat);\n\n const program = new
Conv2DDerFilterProgram(convInfo);\n return backend.runWebGLProgram(program, [x, dy],
'float32');\n}\n\nexport const conv2DBackpropFilterConfig: KernelConfig = {\n kernelName:
Conv2DBackpropFilter,\n backendName: 'webgl',\n kernelFunc: conv2DBackpropFilter as {} as
KernelFunc,\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n *
distributed under the License is distributed
on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n

```

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=====
*\n\nimport {backend_util, Conv2DBackpropInput, Conv2DBackpropInputAttrs, Conv2DBackpropInputInputs,
KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';\n\nimport {MathBackendWebGL} from
'./backend_webgl';\n\nimport {Conv2DDerInputProgram} from './conv_backprop_gpu';\n\nexport function
conv2DBackpropInput(args: {\n inputs: Conv2DBackpropInputInputs,\n attrs: Conv2DBackpropInputAttrs,\n backend: MathBackendWebGL\n}) {\n const {inputs, backend, attrs} = args;\n const {dy, filter} = inputs;\n const
{inputShape, strides, pad, dataFormat, dimRoundingMode} = attrs;\n\n const $dataFormat =
backend_util.convertConv2DDataFormat(dataFormat);\n const convInfo = backend_util.computeConv2DInfo(\n
 inputShape, filter.shape as [number, number, number, number], strides,\n 1 /* dilations

```

```

*/, pad, dimRoundingMode, false, $dataFormat);\n\n const program = new Conv2DDerInputProgram(convInfo);\nreturn backend.runWebGLProgram(program, [dy, filter], 'float32');\n}\n\nexport const
conv2DBackpropInputConfig: KernelConfig = {\n kernelName: Conv2DBackpropInput,\n backendName:
'webgl',\n kernelFunc: conv2DBackpropInput as { } as KernelFunc,\n};\n\n"/**\n * @license\n * Copyright 2020
Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you
may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n
* =====\n
*\n\nimport { backend_util, Conv3D, Conv3DAttrs, Conv3DInputs, KernelConfig, KernelFunc } from
'@tensorflow/tfjs-core';\n\nimport { MathBackendWebGL } from '../backend_webgl';\nimport { Conv3DProgram }
from '../conv_gpu';\n\nexport function conv3D(\n args: {\n inputs: Conv3DInputs, attrs: Conv3DAttrs,
backend: MathBackendWebGL }) {\n const { inputs, backend, attrs } = args;\n const { x, filter } = inputs;\n const
{ strides, pad, dilations } = attrs;\n\n const convInfo = backend_util.computeConv3DInfo(\n x.shape as [number,
number, number, number, number],\n filter.shape as [number, number, number, number, number], strides,\n
dilations, pad);\n\n const program = new Conv3DProgram(convInfo);\n return
backend.runWebGLProgram(program, [x, filter], 'float32');\n}\n\nexport const conv3DConfig: KernelConfig = {\n
kernelName: Conv3D,\n backendName: 'webgl',\n kernelFunc: conv3D as { } as KernelFunc,\n};\n\n"/**\n
* @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version
2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n
* =====\n
*\n\nimport { backend_util, Conv3DBackpropFilterV2, Conv3DBackpropFilterV2Attrs,
Conv3DBackpropFilterV2Inputs, KernelConfig, KernelFunc } from '@tensorflow/tfjs-core';\n\nimport
{ MathBackendWebGL } from '../backend_webgl';\nimport { Conv3DDerFilterProgram } from
'../conv_backprop_gpu';\n\nexport
function conv3DBackpropFilterV2(args: {\n inputs: Conv3DBackpropFilterV2Inputs,\n attrs:
Conv3DBackpropFilterV2Attrs,\n backend: MathBackendWebGL }) {\n const { inputs, backend, attrs } = args;\n
const { x, dy } = inputs;\n const { strides, pad, filterShape } = attrs;\n\n const convInfo =
backend_util.computeConv3DInfo(\n x.shape as [number, number, number, number, number], filterShape,
strides,\n 1 /* dilations */, pad);\n\n const program = new Conv3DDerFilterProgram(convInfo);\n return
backend.runWebGLProgram(program, [x, dy], 'float32');\n}\n\nexport const conv3DBackpropFilterV2Config:
KernelConfig = {\n kernelName: Conv3DBackpropFilterV2,\n backendName: 'webgl',\n kernelFunc:
conv3DBackpropFilterV2 as { } as KernelFunc,\n};\n\n"/**\n
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2.0 (the "License");\n * you may not use this
file except in compliance with the License.\n * You
may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required
by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS"
BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the
License for the specific language governing permissions and\n * limitations under the License.\n
* =====\n
*\n\nimport { backend_util, Conv3DBackpropInputV2, Conv3DBackpropInputV2Attrs,
Conv3DBackpropInputV2Inputs, KernelConfig, KernelFunc } from '@tensorflow/tfjs-core';\n\nimport

```

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{MathBackendWebGL} from './backend_webgl';\nimport {Conv3DDerInputProgram} from
'./conv_backprop_gpu';\n\nexport function conv3DBackpropInput(args: {\n inputs:
Conv3DBackpropInputV2Inputs,\n attrs: Conv3DBackpropInputV2Attrs,\n backend: MathBackendWebGL\n})
{\n const {inputs, backend, attrs} = args;\n const {dy, filter}
= inputs;\n const {pad, strides, inputShape} = attrs;\n\n const convInfo = backend_util.computeConv3DInfo(\n
inputShape, filter.shape as [number, number, number, number, number],\n strides, 1 /* dilations */, pad);\n\n
const program = new Conv3DDerInputProgram(convInfo);\n return backend.runWebGLProgram(program, [dy,
filter], 'float32');\n}\n\nexport const conv3DBackpropInputConfig: KernelConfig = {\n kernelName:
Conv3DBackpropInputV2,\n backendName: 'webgl',\n kernelFunc: conv3DBackpropInput as {} as
KernelFunc,\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless
required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License
for the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport {Cos, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {CHECK_NAN_SNIPPET_UNARY,
unaryKernelFunc} from './kernel_utils/kernel_funcs_utils';\n\nconst COS = CHECK_NAN_SNIPPET_UNARY +
`\n return cos(x);\n`;\n\nexport const cos = unaryKernelFunc({opSnippet: COS});\n\nexport const cosConfig:
KernelConfig = {\n kernelName: Cos,\n backendName: 'webgl',\n kernelFunc: cos,\n};\n", "/*\n * @license\n *
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\"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport {Cosh, KernelConfig} from '@tensorflow/tfjs-core';\n\nimport {unaryKernelFunc} from
'./kernel_utils/kernel_funcs_utils';\n\nconst COSH = `\n float e2x = exp(-x);\n return (e2x + 1.0 / e2x) /
2.0;\n`;\n\nexport const cosh = unaryKernelFunc({opSnippet: COSH});\n\nexport const coshConfig: KernelConfig
= {\n kernelName: Cosh,\n backendName: 'webgl',\n kernelFunc: cosh,\n};\n", "/*\n * @license\n * Copyright
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applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\"
BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the
License for the specific language governing permissions and\n * limitations under the License.\n *
=====\n
*\n\nimport {GPGPUProgram} from './gpgpu_math';\n\nexport class CropAndResizeProgram implements
GPGPUProgram {\n variableNames = ['Image', 'Boxes', 'BoxInd'];\n outputShape: number[] = [];\n userCode:
string;\n\n constructor(\n imageShape: [number, number, number, number], boxShape: [number, number],\n
cropSize: [number, number], method: 'bilinear'|'nearest', extrapolationValue: number) {\n const [batch,
imageHeight, imageWidth, depth] = imageShape;\n const [numBoxes,
] = boxShape;\n const [cropHeight, cropWidth] = cropSize;\n this.outputShape = [numBoxes, cropHeight,
cropWidth, depth];\n const methodId = method === 'bilinear' ? 1 : 0;\n\n const [inputHeightFloat,
inputWidthFloat] = [\n ` ${imageHeight - 1}.0`, ` ${imageWidth - 1}.0`];\n\n const [heightRatio, heightScale,
inY] = cropHeight > 1 ?\n [\n ` ${ (imageHeight - 1) / (cropHeight - 1) }`,\n `(y2-y1) * height_ratio`,\n

```

```

 `y1*${inputHeightFloat} + float(y)*(height_scale)`,\n
];\n\n // Reference
implementation\n // tslint:disable-next-line:max-line-length\n //
https://github.com/tensorflow/tensorflow/blob/master/tensorflow/core/kernels/crop_and_resize_op_gpu.cu.cc\n
this.userCode = `
 const float height_ratio = float(${heightRatio});\n const float width_ratio =
float(${widthRatio});\n void main() {\n ivec4 coords = getOutputCoords();\n int b = coords[0];\n int
y = coords[1];\n int x = coords[2];\n int d = coords[3];\n // get box vals\n float y1 =
getBoxes(b,0);\n float x1 = getBoxes(b,1);\n float y2 = getBoxes(b,2);\n float x2 = getBoxes(b,3);\n\n
 // get image in batch index\n int bInd = round(getBoxInd(b));\n if(bInd < 0 || bInd >= ${batch}) {\n
return;\n }\n\n float height_scale = ${heightScale};\n float width_scale = ${widthScale};\n float
in_y = ${inY};\n if(in_y < 0.0 || in_y > ${inputHeightFloat}) {\n
 setOutput(float(${extrapolationValue}));\n return;\n }\n float in_x = ${inX};\n if(in_x < 0.0 ||
in_x > ${inputWidthFloat}) {\n setOutput(float(${extrapolationValue}));\n return;\n }\n\n vec2
sourceFracIndexCR = vec2(in_x,in_y);\n if(${methodId} == 1) {\n // Compute the four integer indices.\n
 ivec2 sourceFloorCR = ivec2(sourceFracIndexCR);\n ivec2 sourceCeilCR =
 ivec2(ceil(sourceFracIndexCR));\n float topLeft = getImage(b, sourceFloorCR.y, sourceFloorCR.x, d);\n
 float bottomLeft = getImage(b, sourceCeilCR.y, sourceFloorCR.x, d);\n float topRight = getImage(b,
sourceFloorCR.y, sourceCeilCR.x, d);\n float bottomRight = getImage(b, sourceCeilCR.y, sourceCeilCR.x,
d);\n\n vec2 fracCR = sourceFracIndexCR - vec2(sourceFloorCR);\n float top = topLeft + (topRight -
topLeft) * fracCR.x;\n float bottom = bottomLeft + (bottomRight
- bottomLeft) * fracCR.x;\n float newValue = top + (bottom - top) * fracCR.y;\n
 setOutput(newValue);\n } else {\n // Compute the coordinators of nearest neighbor point.\n ivec2
sourceNearestCR = ivec2(floor(\n sourceFracIndexCR + vec2(0.5,0.5)));\n float newValue =
 getImage(b, sourceNearestCR.y, sourceNearestCR.x, d);\n setOutput(newValue);\n }\n }\n`;
\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache
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BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the
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for the specific language governing permissions and\n * limitations under the License.\n *
=====
\n
*/\n\nimport {CropAndResize, CropAndResizeAttrs, CropAndResizeInputs, KernelConfig, KernelFunc,
TensorInfo} from '@tensorflow/tfjs-core';\n\nimport {MathBackendWebGL} from '../backend_webgl';\n\nimport
{CropAndResizeProgram} from '../crop_and_resize_gpu';\n\nexport const cropAndResize = (args: {\n inputs:
CropAndResizeInputs,\n backend: MathBackendWebGL,\n attrs: CropAndResizeAttrs\n}): TensorInfo => {\n
const {inputs, backend, attrs} = args;\n const {image, boxes, boxInd} = inputs;\n const {cropSize, method,
extrapolationValue} = attrs;\n\n const program = new CropAndResizeProgram(\n image.shape as [number,
number, number, number],\n boxes.shape as [number, number], cropSize, method, extrapolationValue);\n return
backend.runWebGLProgram(program, [image, boxes, boxInd], 'float32');\n\n\nexport const
cropAndResizeConfig: KernelConfig = {\n kernelName: CropAndResize,\n backendName: 'webgl',\n kernelFunc:
cropAndResize as {\n } as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2018 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,

```

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```
=====
*\nimport {GPGPUContext} from './gpgpu_context';\nimport {GPGPUProgram} from './gpgpu_math';\nimport {getCoordsDataType} from
 './shader_compiler';\n\nexport class CumSumProgram implements GPGPUProgram {\n variableNames = ['x'];\n outputShape: number[];\n userCode: string;\n\n // Caching uniform location for speed.\n index:
 WebGLUniformLocation;\n\n constructor(shape: number[], exclusive: boolean, reverse: boolean) {\n
 this.outputShape = shape;\n const rank = shape.length;\n const val = exclusive ? '0.0' : `getX(${getCoords(rank,
 'coords')})`; \n const length = shape[shape.length - 1];\n let condition = ";\n let idxString = ";\n // When
 exclusive is set, the cumsum op becomes roll op that copies the\n // value from the previous index based on the
 direction specified by the\n // reverse flag.\n if (exclusive) {\n condition = reverse ? `end != ${length - 1}` :
 'end != 0';\n idxString = reverse ? `end + 1` : `end - 1`;\n } else {\n condition = reverse ? `end + pow2 <
 ${length}` : `end >= pow2`;\n idxString = (reverse ? `end + pow2` : `end - pow2`);\n
 }\n\n this.userCode = `\n uniform float index;\n void main() {\n ${getCoordsDataType(rank)} coords =
 getOutputCoords();\n int end = ${getFinalCoord(rank, 'coords')};\n float val = ${val};\n int pow2 =
 int(pow(2.0, index));\n if (${condition}) {\n int idx = ${idxString};\n ${getFinalCoord(rank,
 'coords')} = idx;\n val += getX(${getCoords(rank, 'coords')});\n }\n setOutput(val);\n }\n
 `;\n\n getCustomSetupFunc(index: number) {\n return (gpgpu: GPGPUContext, webGLProgram:
 WebGLProgram) => {\n if (this.index == null) {\n this.index = gpgpu.getUniformLocation(webGLProgram,
 'index');\n }\n gpgpu.gl.uniform1f(this.index, index);\n };\n }\n\n function getCoords(rank: number,
 name: string): string {\n if (rank === 1) {\n return `${name}`;\n } else if (rank === 2) {\n return `${name}.x,
 ${name}.y`;\n } else if (rank === 3) {\n return `${name}.x, ${name}.y,
 ${name}.z`;\n } else if (rank === 4) {\n return `${name}.x, ${name}.y, ${name}.z, ${name}.w`;\n } else {\n
 throw Error(`Cumulative sum for rank ${rank} is not yet supported`);\n }\n }\n\n function getFinalCoord(rank:
 number, name: string): string {\n if (rank === 1) {\n return `${name}`;\n } else if (rank === 2) {\n return
 `${name}.y`;\n } else if (rank === 3) {\n return `${name}.z`;\n } else if (rank === 4) {\n return
 `${name}.w`;\n } else {\n throw Error(`Cumulative sum for rank ${rank} is not yet supported`);\n }\n }\n
 }\n\n /**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version
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 IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */
 }\n
}
```

```
=====
*\n\nimport {backend_util, Cumsum, CumsumAttrs, CumsumInputs, KernelConfig, KernelFunc, TensorInfo} from
 '@tensorflow/tfjs-core';\nimport {MathBackendWebGL} from './backend_webgl';\nimport {CumSumProgram}
 from './cumsum_gpu';\nimport {identity} from './Identity';\nimport {transpose} from './Transpose';\n\nexport
 function cumsum(\n args: {\n inputs: CumsumInputs, backend: MathBackendWebGL, attrs: CumsumAttrs\n }):\n TensorInfo {\n const {inputs, backend, attrs} = args;\n const {x} = inputs;\n const {axis, exclusive, reverse} =
 attrs;\n\n const xRank = x.shape.length;\n const permutation = backend_util.getAxesPermutation([axis], xRank);\n
 let permutedX = x;\n if (permutation != null) {\n permutedX = transpose({inputs: {x}, backend, attrs: {perm: permutation}});\n }\n const permutedAxis =
 backend_util.getInnerMostAxes(1, xRank)[0];\n\n if (permutedAxis !== xRank - 1) {\n throw new Error(\n
 `WebGL cumsum shader expects an inner-most axis=${\n x.shape.length - 1\n } ` +\n `but got
 axis=${axis}`);\n }\n const size = permutedX.shape[permutedAxis];\n let result = identity({inputs: {x:
 permutedX}, backend});\n // Use cumsum parallel algorithm, ref:\n //
 }
```

```

https://developer.nvidia.com/gpugems/gpugems3/part-vi-gpu-computing/chapter-39-parallel-prefix-sum-scan-
cuda\n\n for (let i = 0; i <= Math.ceil(Math.log2(size)) - 1; i++) {\n const program = new
CumSumProgram(permutedX.shape, false, reverse);\n const customSetup = program.getCustomSetupFunc(i);\n
const prevResult = result;\n result =\n backend.runWebGLProgram(program, [result], result.dtype,
customSetup);\n backend.disposeIntermediateTensorInfo(prevResult);\n } // For
exclusive cumsum, shift the end result in the direction of sum\n // and add 0 to the front index.\n if (exclusive) {\n
const program = new CumSumProgram(permutedX.shape, exclusive, reverse);\n const prevResult = result;\n
result = backend.runWebGLProgram(program, [result], result.dtype);\n
backend.disposeIntermediateTensorInfo(prevResult);\n }\n\n if (permutation != null) {\n const
reversePermutation = backend_util.getUndoAxesPermutation(permutation);\n const reverseTransposedResult =
transpose(\n {inputs: {x: result}}, backend, attrs: {perm: reversePermutation});\n}\n\n
backend.disposeIntermediateTensorInfo(result);\n backend.disposeIntermediateTensorInfo(permutedX);\n\n
return reverseTransposedResult;\n }\n\n return result;\n}\n\nexport const cumsumConfig: KernelConfig = {\n
kernelName: Cumsum,\n backendName: 'webgl',\n kernelFunc: cumsum as { } as KernelFunc\n};\n", "/*\n *
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the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n
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distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n *
=====
*\n\nimport { DenseBincount, DenseBincountAttrs, DenseBincountInputs, KernelConfig, KernelFunc, TensorInfo,
TypedArray } from '@tensorflow/tfjs-core';\n\nimport { MathBackendWebGL } from '../backend_webgl';\n\nimport
{ bincountImplCPU, bincountReduceImplCPU } from './kernel_utils/shared';\n\nexport function denseBincount(args:
{\n inputs: DenseBincountInputs,\n
 backend: MathBackendWebGL,\n attrs: DenseBincountAttrs\n}): TensorInfo {\n const {inputs, backend, attrs} =
args;\n const {x, weights} = inputs;\n const {size, binaryOutput} = attrs;\n\n if (x.shape.length === 1) {\n const
xVals = backend.readSync(x.dataId) as TypedArray;\n const weightsVals = backend.readSync(weights.dataId) as
TypedArray;\n\n const outVals =\n bincountImplCPU(xVals, weightsVals, weights.dtype, weights.shape,
size);\n\n return backend.makeTensorInfo([size], weights.dtype, outVals);\n } else if (x.shape.length === 2) {\n
const xBuf = backend.bufferSync(x);\n const weightsBuf = backend.bufferSync(weights);\n\n const outBuf =
bincountReduceImplCPU(xBuf, weightsBuf, size, binaryOutput);\n\n return
backend.makeTensorInfo(outBuf.shape, weights.dtype, outBuf.values);\n }\n\n throw new Error(\n `Error in
denseBincount: input must be at most rank 2, but got rank` +\n `${x.shape.length}`);\n}\n\nexport const
denseBincountConfig:
KernelConfig = {\n kernelName: DenseBincount,\n backendName: 'webgl',\n kernelFunc: denseBincount as { } as
KernelFunc\n};\n", "/*\n *
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implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
=====
*\n\nimport { GPGPUProgram } from './gpgpu_math';\n\nexport class DepthToSpaceProgram implements
GPGPUProgram {\n variableNames = ['x'];\n outputShape:

```

```

number[] = [];\n userCode: string;\n blockSize: number;\n dataFormat: string;\n\n constructor(\n outputShape:
number[], blockSize: number, dataFormat: 'NHWC'|'NCHW') {\n this.outputShape = outputShape;\n
this.blockSize = blockSize;\n this.dataFormat = dataFormat;\n this.userCode = `\n void main() {\n ivec4
coords = getOutputCoords();\n int b = coords[0];\n int h = ${this.getHeightCoordString()};\n int w =
${this.getWidthCoordString()};\n int d = ${this.getDepthCoordString()};\n\n int in_h = h / ${blockSize};\n
int offset_h = imod(h, ${blockSize});\n int in_w = w / ${blockSize};\n int offset_w = imod(w,
${blockSize});\n int offset_d = (offset_h * ${blockSize} + offset_w) *\n ${this.getOutputDepthSize()};\n
int in_d = d + offset_d;\n\n float result = ${this.getInputSamplingString()};\n setOutput(result);\n }\n `;\n
}\n\n private getHeightCoordString(): string {\n if (this.dataFormat
=== 'NHWC') {\n return `coords[1]`;}\n } else {\n return `coords[2]`;}\n }\n\n private
getWidthCoordString(): string {\n if (this.dataFormat === 'NHWC') {\n return `coords[2]`;}\n } else {\n
return `coords[3]`;}\n }\n\n private getDepthCoordString(): string {\n if (this.dataFormat === 'NHWC') {\n
return `coords[3]`;}\n } else {\n return `coords[1]`;}\n }\n\n private getOutputDepthSize(): number {\n if
(this.dataFormat === 'NHWC') {\n return this.outputShape[3];}\n } else {\n return this.outputShape[1];}\n
}\n\n private getInputSamplingString(): string {\n if (this.dataFormat === 'NHWC') {\n return `getX(b,
in_h, in_w, in_d)`;\n } else {\n return `getX(b, in_d, in_h, in_w)`;\n }\n }\n\n `\"/*\n * @license\n *
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distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n *
=====
*\n\nimport {DepthToSpace, DepthToSpaceAttrs, DepthToSpaceInputs, KernelConfig, KernelFunc, TensorInfo,
util} from '@tensorflow/tfjs-core';\n\nimport {MathBackendWebGL} from '../backend_webgl';\n\nimport
{DepthToSpaceProgram} from '../depth_to_space_gpu';\n\nexport function depthToSpace(args: {\n inputs:
DepthToSpaceInputs,\n backend: MathBackendWebGL,\n attrs: DepthToSpaceAttrs\n}): TensorInfo {\n const
{inputs, backend, attrs} = args;\n const {x} = inputs;\n
const {blockSize, dataFormat} = attrs;\n util.assert(\n blockSize > 1,\n () => `blockSize should be > 1 for
depthToSpace, but was: ${blockSize}`);\n const batchSize = x.shape[0];\n const inputHeight = (dataFormat ===
'NHWC') ? x.shape[1] : x.shape[2];\n const inputWidth = (dataFormat === 'NHWC') ? x.shape[2] : x.shape[3];\n
const inputDepth = (dataFormat === 'NHWC') ? x.shape[3] : x.shape[1];\n\n const outputHeight = inputHeight *
blockSize;\n const outputWidth = inputWidth * blockSize;\n const outputDepth = inputDepth / (blockSize *
blockSize);\n\n const outputShape = (dataFormat === 'NHWC') ?\n [batchSize, outputHeight, outputWidth,
outputDepth] :\n [batchSize, outputDepth, outputHeight, outputWidth];\n\n const program = new
DepthToSpaceProgram(outputShape, blockSize, dataFormat);\n return backend.runWebGLProgram(program, [x],
x.dtype);\n\n}\n\nexport const depthToSpaceConfig: KernelConfig = {\n kernelName: DepthToSpace,\n
backendName: 'webgl',\n kernelFunc:
depthToSpace as { } as KernelFunc\n};\n\n `/*\n * @license\n * Copyright 2017 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {backend_util} from '@tensorflow/tfjs-core';\n\nimport {GPGPUProgram} from

```

```

'/gpgpu_math';\n\nexport class DepthwiseConv2DProgram implements GPGPUProgram {\n variableNames = ['x',
'W'];\n outputShape: number[];\n userCode:
string;\n\n constructor(\n convInfo: backend_util.Conv2DInfo, addBias = false,\n activation: string = null,
hasPreluActivation = false,\n hasLeakyReluAlpha = false) {\n this.outputShape = convInfo.outShape;\n\n const xNumRows = convInfo.inHeight;\n const xNumCols = convInfo.inWidth;\n const padTop =
convInfo.padInfo.top;\n const padLeft = convInfo.padInfo.left;\n const strideHeight = convInfo.strideHeight;\n const strideWidth = convInfo.strideWidth;\n const dilationHeight = convInfo.dilationHeight;\n const
dilationWidth = convInfo.dilationWidth;\n const filterHeight = convInfo.filterHeight;\n const filterWidth =
convInfo.filterWidth;\n const channelMul = convInfo.outChannels / convInfo.inChannels;\n\n let
activationSnippet = "", applyActivationSnippet = "";\n if (activation) {\n if (hasPreluActivation) {\n
activationSnippet = `float activation(float a) {\n float b = getPreluActivationWeightsAtOutCoords();\n
 ${activation}\n }`; \n } else if (hasLeakyReluAlpha) {\n activationSnippet = `float activation(float
a) {\n float b = getLeakyreluAlphaAtOutCoords();\n ${activation}\n }`; \n } else {\n
activationSnippet = `\n float activation(float x) {\n ${activation}\n }\n `;\n }\n\n applyActivationSnippet = `result = activation(result);`\n }\n\n const addBiasSnippet = addBias ? 'result +=
getBiasAtOutCoords();' : "";\n if (addBias) {\n this.variableNames.push('bias');\n }\n\n if
(hasPreluActivation) {\n this.variableNames.push('preluActivationWeights');\n }\n if (hasLeakyReluAlpha)
{\n this.variableNames.push('leakyreluAlpha');\n }\n\n this.userCode = `\n ${activationSnippet}\n\n const ivec2 strides = ivec2(${strideHeight}, ${strideWidth});\n const ivec2 pads = ivec2(${padTop},
${padLeft});\n\n void main() {\n ivec4
coords = getOutputCoords();\n int batch = coords.x;\n ivec2 xRCCorner = coords.yz * strides - pads;\n
int d2 = coords.w;\n int d1 = d2 / ${channelMul};\n int q = d2 - d1 * ${channelMul};\n\n int xRCorner
= xRCCorner.x;\n int xCCorner = xRCCorner.y;\n\n // Convolve x(?, ?, d1) with w(:, :, d1, q) to get y(yR,
yC, d2).\n // ? = to be determined. : = across all values in that axis.\n float dotProd = 0.0;\n // TO
DO(dsmilkov): Flatten the two for loops and vec4 the operations.\n for (int wR = 0; wR < ${filterHeight};
wR++) {\n int xR = xRCorner + wR * ${dilationHeight};\n if (xR < 0 || xR >= ${xNumRows}) {\n
continue;\n }\n for (int wC = 0; wC < ${filterWidth}; wC++) {\n int xC = xCCorner + wC *
${dilationWidth};\n if (xC < 0 || xC >= ${xNumCols}) {\n continue;\n }\n float
xVal = getX(batch, xR,
xC, d1);\n float wVal = getW(wR, wC, d1, q);\n dotProd += xVal * wVal;\n }\n }\n
float result = dotProd;\n ${addBiasSnippet}\n ${applyActivationSnippet}\n setOutput(result);\n }\n
`;\n }\n}\n\n", "/*\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the
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on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n */\n\n
=====
*/\n\nimport
{ backend_util, util } from '@tensorflow/tfjs-core';\n\nimport { GPGPUProgram } from './gpgpu_math';\n\nexport
class DepthwiseConvPacked2DProgram implements GPGPUProgram {\n variableNames = ['x', 'W'];\n packedInputs =
true;\n packedOutput = true;\n outputShape: number[];\n userCode: string;\n constructor(\n convInfo:
backend_util.Conv2DInfo, addBias = false,\n activation: string = null, hasPreluActivation = false,\n hasLeakyReluAlpha = false) {\n this.outputShape = convInfo.outShape;\n\n const xNumRows =
convInfo.inHeight;\n const xNumCols = convInfo.inWidth;\n const padTop = convInfo.padInfo.top;\n const
padLeft = convInfo.padInfo.left;\n const strideHeight = convInfo.strideHeight;\n const strideWidth =
convInfo.strideWidth;\n const dilationHeight = convInfo.dilationHeight;\n const dilationWidth =

```



```

convInfo.dilationWidth;\n const filterHeight = convInfo.filterHeight;\n const filterWidth =
convInfo.filterWidth;\n const texelsAcross
= filterWidth;\n\n let mainLoop = `int xR; int xC; int xCOffset;`;
for (let r = 0; r < filterHeight; r++) {\n
for (let c = 0; c < filterWidth; c++) {\n mainLoop += `\n vec4 xTexelR${r}C${c} = vec4(0.);
vec4 wR${r}C${c} = vec4(0.);
vec4 xR${r}C${c} = vec4(0.);`;
 }\n }\n\n /**\n * This vectorized
implementation works by gathering the values needed for\n * each output channel's dot product into vec4's and
then multiplying them\n * all together (this happens in the final double for-loop below). Most of\n * the main
loop consists of constructing these vec4's with the minimum\n * number of texture2D calls, which means making
use of all four returned\n * values from a texture2D call at once.\n */\n for (let r = 0; r < filterHeight; r++) {\n
 for (let texelC = 0; texelC < texelsAcross; texelC++) {\n const c = texelC * 2;\n mainLoop += `\n
xR = xRCorner + ${r *
dilationHeight};\n xC = xCCorner + ${c * dilationWidth};\n `;\n if (strideWidth === 1) {\n if
(c < filterWidth) {\n // If padding is odd, the outer texels have to be composed.\n if (padLeft % 2 ===
1) {\n // TODO: Ensure vec4 previous does not result in redundant sample,\n // and avoid setting
xTexelRC's that exceed the boundary in the\n // first place rather than resetting them to vec4(0)).\n \n
// To compute xCOffset:\n // - If padding is odd, we must add 1 to ensure we ask for an\n // even-
numbered row.\n // - We subtract 2 to access the previous texel.\n mainLoop += `\n
xCOffset = xC + 1;\n if(xR >= 0 && xR < ${xNumRows} && xCOffset >= 0 && xCOffset < ${\n
xNumCols}) {\n xTexelR${r}C${c} = getX(batch, xR, xCOffset, d1);\n // Need to
manually
clear unused channels in case\n // we're reading from recycled texture.\n if(xCOffset + 1 >=
${xNumCols}) {\n xTexelR${r}C${c}.zw = vec2(0.);
 }\n } else {\n
xTexelR${r}C${c} = vec4(0.);
 }\n xCOffset = xC + 1 - 2;\n if(xR >= 0 && xR <
${xNumRows} && xCOffset >= 0 && xCOffset < ${\n
xNumCols}) {\n vec4 previous =
getX(batch, xR, xCOffset, d1);\n // Need to manually clear unused channels in case\n // we're
reading from recycled texture.\n if(xCOffset + 1 >= ${xNumCols}) {\n previous.zw =
vec2(0.);
 }\n xR${r}C${c} = vec4(previous.zw, xTexelR${r}C${c}.xy);\n } else
{\n xR${r}C${c} = vec4(0, 0, xTexelR${r}C${c}.xy);\n }\n `;\n } else
{\n // Padding is even, so xRC corresponds to a single texel.\n mainLoop += `\n if(xR >=
0 && xR < ${xNumRows} && xC >= 0 && xC < ${xNumCols}) {\n xTexelR${r}C${c} = getX(batch,
xR, xC, d1);\n } else {\n xTexelR${r}C${c} = vec4(0.);
 }\n }\n xR${r}C${c} = xTexelR${r}C${c};\n `;\n }\n if (c + 1 < filterWidth) {\n // If
dilation is even, the second entry should match the first\n // (either both are composed or both are single
samples). But if\n // dilation is odd, then the second entry should be the opposite\n // of the first (if
the first is composed, the second is a single\n // sample, and vice versa.)\n const nextTexelOffset =
padLeft % 2 === 0 ?\n util.nearestLargerEven(dilationWidth) :\n dilationWidth;\n \n
if ((dilationWidth % 2 === 0 && padLeft % 2 === 1) ||\n (dilationWidth % 2 !== 0 && padLeft % 2
!== 1)) {\n mainLoop += `\n xCOffset = xC + ${padLeft % 2} + ${nextTexelOffset};\n
 \n
if(xR >= 0 && xR < ${xNumRows} &&\n xCOffset >= 0 && xCOffset < ${xNumCols}) {\n
 xTexelR${r}C${c + 2} = getX(batch, xR, xCOffset, d1);\n }\n `;\n \n
// If dilation
> 1 then the xRC's will not be able to share any\n // values, so each xRC will require two unique calls to
getX.\n if (dilationWidth > 1) {\n mainLoop += `\n xCOffset -= 2;\n
if(xR >= 0 && xR < ${xNumRows} &&\n xCOffset >= 0 && xCOffset < ${xNumCols}) {\n
 xTexelR${r}C${c} = getX(batch, xR, xCOffset, d1);\n } else {\n xTexelR${r}C${c}
= vec4(0.);
 }\n `;\n }\n mainLoop += `\n xR${r}C${c + 1}
= vec4(\n xTexelR${r}C${c}.zw, xTexelR${r}C${c + 2}.xy);\n `;\n } else {\n
mainLoop += `\n xCOffset = xC + ${nextTexelOffset};\n \n
if(xR >= 0 && xR <
${xNumRows} &&\n xCOffset >= 0 && xCOffset < ${xNumCols}) {\n xTexelR${r}C${c}

```

```

+ 2} = getX(batch, xR, xCOffset, d1);\n
};\n
}\n
}\n
}\n
} else { // stride > 1\n
if (c < filterWidth) {\n
mainLoop
+= \n
if(xR >= 0 && xR < ${xNumRows}) {\n
};\n\n
// Depending on whether padLeft is
even or odd, we want either the\n
// xy or zw channels from X texels for xR${r}C${c}.
If padLeft is\n
// even, xR${r}C${c + 1} is simply the zw channels of texels we've\n
// already
sampled. But if padLeft is odd, xR${r}C${c + 1}.zw will\n
// need to come from the xy channels of a new
texel, hence the `vec4`\n
// final` initialized below.\n
if (padLeft % 2 === 1) {\n
mainLoop +=
\n
xCOffset = xC + 1 - ${strideWidth};\n
if(xCOffset >= 0 && xCOffset < ${xNumCols}) {\n
xTexelR${r}C${c} = getX(batch, xR, xCOffset, d1);\n
} else {\n
xTexelR${r}C${c} =
vec4(0.);\n
}\n\n
if(xC + 1 >= 0 && xC + 1 < ${xNumCols}) {\n
xTexelR${r}C${c +
2} = getX(batch, xR, xC + 1, d1);\n
} else {\n
xTexelR${r}C${c + 2} = vec4(0.);\n
}\n\n
xR${r}C${c} = vec4(\n
xTexelR${r}C${c}.zw, xTexelR${r}C${c + 2}.zw);\n
};\n\n
if (c + 1 < filterWidth) {\n
mainLoop += \n
vec4 final = vec4(0.);\n
xCOffset = xC + 1 + ${strideWidth};\n
if(xCOffset >= 0 && xCOffset < ${xNumCols}) {\n
final = getX(batch, xR, xCOffset, d1);\n
}\n
xR${r}C${c + 1} = vec4(xTexelR${r}C${c +
2}.xy, final.xy);\n
};\n
}\n
} else {\n
mainLoop += \n
if(xC >= 0 && xC <
${xNumCols}) {\n
xTexelR${r}C${c} = getX(batch, xR, xC, d1);\n
} else {\n
xTexelR${r}C${c} = vec4(0.);\n
}\n\n
xCOffset = xC + ${strideWidth};\n
if(xCOffset
>= 0 && xCOffset < ${xNumCols}) {\n
xTexelR${r}C${c + 2} = getX(batch, xR, xCOffset, d1);\n
} else {\n
xTexelR${r}C${c + 2} = vec4(0.);\n
}\n\n
xR${r}C${c}
= vec4(\n
xTexelR${r}C${c}.xy, xTexelR${r}C${c + 2}.xy);\n
};\n\n
if (c + 1 <
filterWidth) {\n
mainLoop += \n
xR${r}C${c + 1} = vec4(\n
xTexelR${r}C${c}.zw, xTexelR${r}C${c + 2}.zw);\n
};\n
}\n
}\n\n
mainLoop +=
};\n
}\n
}\n\n
if (c < filterWidth) {\n
mainLoop += \n
vec4 wTexelR${r}C${c} =
getW(${r}, ${c}, d1, q);\n
wR${r}C${c} = vec4(wTexelR${r}C${c}.xz, wTexelR${r}C${c}.xz);\n
};\n\n
if (c + 1 < filterWidth) {\n
mainLoop += \n
vec4 wTexelR${r}C${c + 1} = getW(${r},
${c + 1}, d1, q);\n
wR${r}C${c + 1} =\n
vec4(wTexelR${r}C${c + 1}.xz, wTexelR${r}C${c +
1}.xz);\n
};\n
}\n
}\n
}\n\n
for (let r = 0; r < filterHeight; r++) {\n
for (let c = 0; c < filterWidth;
c++) {\n
mainLoop +=
`dotProd += xR${r}C${c} * wR${r}C${c};`\n
}\n
}\n\n
let activationSnippet = ", applyActivationSnippet =
";\n
if (activation) {\n
if (hasPreluActivation) {\n
activationSnippet = `vec4 activation(vec4 a) {\n
vec4 b = getPreluActivationWeightsAtOutCoords();\n
${activation}\n
};\n
} else if
(hasLeakyReluAlpha) {\n
activationSnippet = `vec4 activation(vec4 a) {\n
vec4 b =
getLeakyreluAlphaAtOutCoords();\n
${activation}\n
};\n
} else {\n
activationSnippet = `vec4
activation(vec4 x) {\n
${activation}\n
};\n
}\n\n
applyActivationSnippet = `result =
activation(result);`\n
}\n\n
const addBiasSnippet = addBias ? 'result += getBiasAtOutCoords();': '';\n
if
(addBias) {\n
this.variableNames.push('bias');\n
}\n\n
if (hasPreluActivation) {\n
this.variableNames.push('preluActivationWeights');\n
}\n
if (hasLeakyReluAlpha) {\n
this.variableNames.push('leakyreluAlpha');\n
}\n\n
this.userCode = \n
${activationSnippet}\n\n
const ivec2 strides = ivec2(${strideHeight},
${strideWidth});\n
const ivec2 pads = ivec2(${padTop}, ${padLeft});\n\n
void main() {\n\n
ivec4 coords
= getOutputCoords();\n
int batch = coords.x;\n
ivec2 xRCCorner = coords.yz * strides - pads;\n
int d2
= coords.w;\n
int d1 = d2;\n
int q = 0;\n
int xRCorner = xRCCorner.x;\n
int xCCorner =
xRCCorner.y;\n\n
vec4 dotProd = vec4(0.);\n
${mainLoop}\n\n
vec4 result = dotProd;\n
${addBiasSnippet}\n
${applyActivationSnippet}\n
setOutput(result);\n
}\n
};\n
}\n\n
}"/**\n
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the License.\n *
=====
*\n\nimport {backend_util, DepthwiseConv2dNative, DepthwiseConv2dNativeAttrs,
DepthwiseConv2dNativeInputs, env, KernelConfig, KernelFunc, util} from '@tensorflow/tfjs-core';\n\nimport
{MathBackendWebGL} from '../backend_webgl';\n\nimport {DepthwiseConv2DProgram} from
'../conv_gpu_depthwise';\n\nimport {DepthwiseConvPacked2DProgram} from
'../conv_packed_gpu_depthwise';\n\nexport function depthwiseConv2dNative(args: {\n inputs:
DepthwiseConv2dNativeInputs,\n attrs: DepthwiseConv2dNativeAttrs,\n backend: MathBackendWebGL\n}) {\n
const {inputs, backend,
attrs} = args;\n const {x, filter} = inputs;\n const {strides, pad, dilations, dimRoundingMode} = attrs;\n\n let
$dilations = dilations;\n if ($dilations == null) {\n $dilations = [1, 1];\n }\n\n util.assert(\n
backend_util.eitherStridesOrDilationsAreOne(strides, $dilations),\n () => 'Error in depthwiseConv2d: Either
strides or dilations must be ' +\n `1. Got strides ${strides} and dilations '${dilations}'`);\n\n const convInfo =
backend_util.computeConv2DInfo(\n x.shape as [number, number, number, number],\n filter.shape as
[number, number, number, number], strides, $dilations,\n pad, dimRoundingMode, true /* depthwise */);\n\n let
program: DepthwiseConv2DProgram|DepthwiseConvPacked2DProgram;\n if
(env().getBool('WEBGL_PACK_DEPTHWISECONV') && convInfo.strideWidth <= 2 &&\n
convInfo.outChannels / convInfo.inChannels === 1) {\n program = new
DepthwiseConvPacked2DProgram(convInfo);\n } else {\n program = new
DepthwiseConv2DProgram(convInfo);\n
}\n\n return backend.runWebGLProgram(program, [x, filter], 'float32');\n}\n\nexport const
depthwiseConv2dNativeConfig: KernelConfig = {\n kernelName: DepthwiseConv2dNative,\n backendName:
'webgl',\n kernelFunc: depthwiseConv2dNative as {} as KernelFunc,\n};\n\n\"/**\n * @license\n * Copyright 2018
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may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
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software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {backend_util} from '@tensorflow/tfjs-core';\n\nimport {GPGPUProgram} from
'../gpgpu_math';\n\nexport class DepthwiseConv2DDerFilterProgram implements GPGPUProgram {\n
variableNames = ['x', 'dy'];\n outputShape: number[];\n userCode: string;\n\n constructor(convInfo:
backend_util.Conv2DInfo) {\n this.outputShape = convInfo.filterShape;\n\n const strideHeight =
convInfo.strideHeight;\n const strideWidth = convInfo.strideWidth;\n const padTop = convInfo.padInfo.top;\n
const padLeft = convInfo.padInfo.left;\n const channelMul = convInfo.outChannels / convInfo.inChannels;\n\n
this.userCode = `\n void main() {\n ivec4 coords = getOutputCoords();\n int wR = coords.x;\n int
wC = coords.y;\n int d1 = coords.z;\n int dm = coords.w;\n int d2 = d1 * ${channelMul} + dm;\n\n
float dotProd = 0.0;\n\n // TO DO: Vec4 over the batch size\n for (int b = 0; b < ${convInfo.batchSize};
b++) {\n
for (int yR = 0; yR < ${convInfo.outHeight}; yR++) {\n int xR = wR + yR * ${strideHeight} -
${padTop};\n\n if (xR < 0 || xR >= ${convInfo.inHeight}) {\n continue;\n }\n\n for (int
yC = 0; yC < ${convInfo.outWidth}; yC++) {\n int xC = wC + yC * ${strideWidth} - ${padLeft};\n\n
if (xC < 0 || xC >= ${convInfo.inWidth}) {\n continue;\n }\n\n float dyValue = getDy(b,

```



```

*\n\nimport {backend_util, DepthwiseConv2dNativeBackpropInput, DepthwiseConv2dNativeBackpropInputAttrs,
DepthwiseConv2dNativeBackpropInputInputs, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';\n\nimport
{MathBackendWebGL} from './backend_webgl';\nimport {DepthwiseConv2DDerInputProgram} from
'./conv_backprop_gpu_depthwise';\n\nexport function depthwiseConv2dNativeBackpropInput(args: {\n inputs:
DepthwiseConv2dNativeBackpropInputInputs,\n attrs: DepthwiseConv2dNativeBackpropInputAttrs,\n backend:
MathBackendWebGL\n})
{\n const {inputs, backend, attrs} = args;\n const {dy, filter} = inputs;\n const {strides, dilations, pad,
dimRoundingMode, inputShape} = attrs;\n\n const convInfo = backend_util.computeConv2DInfo(\n inputShape,
filter.shape as [number, number, number, number], strides,\n dilations, pad, dimRoundingMode, true /*
depthwise */);\n\n const program = new DepthwiseConv2DDerInputProgram(convInfo);\n return
backend.runWebGLProgram(program, [dy, filter], 'float32');\n}\n\nexport const
depthwiseConv2dNativeBackpropInputConfig: KernelConfig = {\n kernelName:
DepthwiseConv2dNativeBackpropInput,\n backendName: 'webgl',\n kernelFunc:
depthwiseConv2dNativeBackpropInput as {} as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2019 Google
LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not
use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n
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distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n */
=====
*\n\nimport {GPGPUProgram} from './gpgpu_math';\n\nexport class DiagProgram implements GPGPUProgram
{\n variableNames = ['X'];\n outputShape: number[];\n userCode: string;\n\n constructor(size: number) {\n
this.outputShape = [size, size];\n this.userCode = `\n void main() {\n ivec2 coords = getOutputCoords();\n
float val = coords[0] == coords[1] ? getX(coords[0]) : 0.0;\n setOutput(val);\n }\n `;\n }\n}\n\n"/**\n
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by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS"
BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the
License for the specific language governing permissions and\n * limitations under the License.\n */
=====
*\n\nimport {Diag, DiagInputs, KernelConfig, KernelFunc, TensorInfo, util} from '@tensorflow/tfjs-
core';\n\nimport {MathBackendWebGL} from './backend_webgl';\nimport {DiagProgram} from
'./diag_gpu';\nimport {reshape} from './Reshape';\n\nexport function diag(args: {inputs: DiagInputs, backend:
MathBackendWebGL}): \n TensorInfo {\n const {inputs, backend} = args;\n const
{x} = inputs;\n\n const outShape = [...x.shape, ...x.shape];\n const xSize = util.sizeFromShape(x.shape);\n\n const
flat = reshape({inputs: {x}, backend, attrs: {shape: [xSize]}});\n\n const program = new DiagProgram(xSize);\n
const res = backend.runWebGLProgram(program, [flat], flat.dtype);\n\n const out = reshape({inputs: {x: res},
backend, attrs: {shape: outShape}});\n\n backend.disposeIntermediateTensorInfo(flat);\n
backend.disposeIntermediateTensorInfo(res);\n\n return out;\n}\n\nexport const diagConfig: KernelConfig = {\n
kernelName: Diag,\n backendName: 'webgl',\n kernelFunc: diag as {} as KernelFunc\n};\n\n"/**\n * @license\n *
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"License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
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=====
*\n\nimport {backend_util} from '@tensorflow/tfjs-core';\nimport {GPGPUProgram} from
'./gpgpu_math';\n\nexport class Dilation2DProgram implements GPGPUProgram {\n variableNames = ['x', 'W'];\n outputShape: number[];\n userCode: string;\n\n constructor(convInfo: backend_util.Conv2DInfo) {\n this.outputShape = convInfo.outShape;\n\n const {\n inHeight,\n inWidth,\n padInfo,\n strideHeight,\n strideWidth,\n filterHeight,\n filterWidth,\n dilationHeight,\n dilationWidth\n } = convInfo;\n\n const {top: padTop, left: padLeft} = padInfo;\n\n this.userCode = `\n const ivec2
 strides = ivec2(${strideHeight}, ${strideWidth});\n const ivec2 pads = ivec2(${padTop}, ${padLeft});\n\n const float neg_infinity = -3.4e38;\n\n void main() {\n ivec4 coords = getOutputCoords();\n int batch =
 coords.x;\n int d1 = coords.w;\n ivec2 outTopLeftCorner =\n coords.yz * strides - pads;\n int
 hBeg = outTopLeftCorner.x;\n int wBeg = outTopLeftCorner.y;\n\n float curVal = neg_infinity;\n for
 (int h = 0; h < ${filterHeight}; h++) {\n int hIn = hBeg + h * ${dilationHeight};\n\n if (hIn >= 0 && hIn
 < ${inHeight}) {\n for (int w = 0; w < ${filterWidth}; w++) {\n int wIn = wBeg + w *
 ${dilationWidth};\n\n if (wIn >= 0 && wIn < ${inWidth}) {\n float xVal = getX(batch, hIn, wIn,
 d1);\n float wVal = getW(h, w, d1);\n float val = xVal + wVal;\n if (val > curVal) {\n
 curVal =
 val;\n }\n }\n }\n }\n\n float result = curVal;\n setOutput(result);\n }\n `;\n }\n}\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the
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on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
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=====
*\n\nimport {backend_util, Dilation2D, Dilation2DAttrs, Dilation2DInputs, KernelConfig, KernelFunc,
TensorInfo}
from '@tensorflow/tfjs-core';\n\nimport {MathBackendWebGL} from './backend_webgl';\nimport
{Dilation2DProgram} from './dilation_gpu';\nimport {reshape} from './Reshape';\n\nexport function
dilation2D(args: {\n inputs: Dilation2DInputs,\n attrs: Dilation2DAttrs,\n backend: MathBackendWebGL\n}) {\n const {inputs, backend, attrs} = args;\n const {x, filter} = inputs;\n const {strides, pad, dilations} = attrs;\n\n const
 convInfo = backend_util.computeDilation2DInfo(\n x.shape as [number, number, number, number],\n filter.shape as [number, number, number], strides, pad,\n 'NHWC' /* dataFormat */, dilations);\n\n let out:
 TensorInfo;\n\n const program = new Dilation2DProgram(convInfo);\n out =
 backend.runWebGLProgram(program, [x, filter], 'float32');\n\n const outReshaped =\n reshape({inputs: {x: out},
 backend, attrs: {shape: convInfo.outShape}});\n\n backend.disposeIntermediateTensorInfo(out);\n\n return
 outReshaped;\n}\n\nexport const dilation2DConfig: KernelConfig
= {\n kernelName: Dilation2D,\n backendName: 'webgl',\n kernelFunc: dilation2D as {\n }\n as
 KernelFunc,\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the
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```

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*/\n\nimport {Elu, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';\nimport {unaryKernelFunc} from
'./kernel_utils/kernel_funcs_utils';\n\nconst ELU = `return
(x >= 0.0) ? x : (exp(x) - 1.0);`;
\n\nconst ELU_PACKED = `
 vec4 result;\n result.r = (x.r >= 0.0) ? x.r :
(exp(x.r) - 1.0);\n result.g = (x.g >= 0.0) ? x.g : (exp(x.g) - 1.0);\n result.b = (x.b >= 0.0) ? x.b : (exp(x.b) - 1.0);\n
result.a = (x.a >= 0.0) ? x.a : (exp(x.a) - 1.0);\n return result;`;
\n\nconst elu = unaryKernelFunc({opSnippet:
ELU, packedOpSnippet: ELU_PACKED});\n\nexport const eluConfig: KernelConfig = {\n kernelName: Elu,\n backendName: 'webgl',\n kernelFunc: elu as {} as KernelFunc\n};\n\n", "/*\n * @license\n * Copyright 2020 Google
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
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=====
*/\n\nimport {EluGrad, EluGradInputs, env, KernelConfig, KernelFunc, TensorInfo} from '@tensorflow/tfjs-
core';\nimport {MathBackendWebGL} from '../backend_webgl';\nimport {BinaryOpProgram} from
'./binaryop_gpu';\nimport {BinaryOpPackedProgram} from './binaryop_packed_gpu';\n\nconst ELU_DER = `return
(b >= 1.0) ? a : a * (b + 1.0);`;
\n\nconst ELU_DER_PACKED = `
 vec4 bGTEZero = vec4(greaterThanEqual(b,
vec4(0.0)));
 return (bGTEZero * a) + ((vec4(1.0) - bGTEZero) * (a * (b + vec4(1.0))));`;
\n\nexport const eluGrad
= {\n args: {inputs: EluGradInputs, backend: MathBackendWebGL}: TensorInfo => {\n const {inputs,
backend} = args;\n const {dy, y} = inputs;\n const program =
env().getBool('WEBGL_PACK_BINARY_OPERATIONS')
? \n new BinaryOpPackedProgram(ELU_DER_PACKED, dy.shape, y.shape) : \n new
BinaryOpProgram(ELU_DER, dy.shape, y.shape);\n return backend.runWebGLProgram(program, [dy, y],
dy.dtype);\n };
\n\nexport const eluGradConfig: KernelConfig = {\n kernelName: EluGrad,\n backendName:
'webgl',\n kernelFunc: eluGrad as {} as KernelFunc\n};\n\n", "/*\n * @license\n * Copyright 2020 Google LLC. All
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*/\n\nimport {Equal, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';\nimport {binaryKernelFunc} from
'./kernel_utils/kernel_funcs_utils';\n\nconst PACKED_EQUAL = `
 return vec4(equal(a, b));`;
\n\nconst EQUAL
= `return float(a == b);`;
\n\nexport const equal = binaryKernelFunc(\n {opSnippet: EQUAL, packedOpSnippet:
PACKED_EQUAL, dtype: 'bool'});\n\nexport const equalConfig: KernelConfig = {\n kernelName: Equal,\n backendName: 'webgl',\n kernelFunc: equal as {} as KernelFunc\n};\n\n", "/*\n * @license\n * Copyright 2020
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distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n *
=====
*/\n\nimport {backend_util, Erf, KernelConfig} from '@tensorflow/tfjs-core';\nimport {unaryKernelFunc} from

```

```

'./kernel_utils/kernel_funcs_utils';\n\nconst ERF = `
\n // Error function is calculated approximately with elementary
function.\n // See \"Handbook of Mathematical Functions with Formulas,\n // Graphs, and Mathematical Tables\",
Abramowitz and Stegun.\n float p = ${backend_util.ERF_P};\n float a1 = ${backend_util.ERF_A1};\n float a2 =
${backend_util.ERF_A2};\n float a3 = ${backend_util.ERF_A3};\n float a4 = ${backend_util.ERF_A4};\n float
a5 = ${backend_util.ERF_A5};\n\n float sign = sign(x);\n x = abs(x);\n float t = 1.0 / (1.0 + p * x);\n return sign *
(1.0 - (((((a5*t
+ a4)*t) + a3)*t + a2)*t + a1)*t*exp(-x*x));\n`;
\n\nexport const erf = unaryKernelFunc({opSnippet:
ERF});\n\nexport const erfConfig: KernelConfig = {\n kernelName: Erf,\n backendName: 'webgl',\n kernelFunc:
erf,\n};\n\n\", \"/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache
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BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the
License for the specific language governing permissions and\n * limitations under the License.\n *
=====
\n
*\n\nimport {ExpandDims, ExpandDimsAttrs, ExpandDimsInputs,
KernelConfig, KernelFunc, TensorInfo, util} from '@tensorflow/tfjs-core';\n\nimport {MathBackendWebGL} from
'./backend_webgl';\n\nimport {reshape} from './Reshape';\n\nexport function expandDims(args: {\n inputs:
ExpandDimsInputs,\n attrs: ExpandDimsAttrs,\n backend: MathBackendWebGL\n}): TensorInfo {\n const
{inputs, attrs, backend} = args;\n const {dim} = attrs;\n const {input} = inputs;\n\n const inputRank =
input.shape.length;\n const newShape = input.shape.slice();\n let $dim = dim;\n if (dim < 0) {\n // Negative value
is counted from the tail of rank.\n util.assert(\n -(inputRank + 1) <= dim,\n () => `Axis must be in the
interval [${-(inputRank + 1)}, ${\n inputRank}]);\n $dim = inputRank + dim + 1;\n }\n\n newShape.splice($dim, 0, 1);\n\n return reshape({inputs: {x: input}, backend, attrs: {shape:
newShape}});\n}\n\nexport const expandDimsConfig: KernelConfig = {\n kernelName: ExpandDims,\n
backendName: 'webgl',\n kernelFunc: expandDims
as {} as KernelFunc,\n};\n\n\", \"/*\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed
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on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
=====
\n
*\n\nimport {GPGPUProgram} from './gpgpu_math';\n\nexport class FFTProgram implements GPGPUProgram {\n
variableNames = ['real', 'imag'];\n outputShape: number[];\n userCode: string;\n\n constructor(\n component:
'real'|'imag', inputShape:
[number, number],\n inverse: boolean) {\n const innerDim = inputShape[1];\n this.outputShape =
inputShape;\n\n const exponentMultiplierSnippet =\n inverse ? `2.0 * ${Math.PI}` : `-.2.0 * ${Math.PI}`;\n\n const resultDenominator = inverse ? `${innerDim}.0` : '1.0';\n\n let opString: string;\n if (component === 'real')
{\n opString = 'return real * expR - imag * expI;'\n } else if (component === 'imag') {\n opString = 'return
real * expI + imag * expR;'\n } else {\n throw new Error(`FFT component must be either \"real\" or
\"imag\", got ${component}.`);\n }\n\n this.userCode = `\n const float exponentMultiplier =
${exponentMultiplierSnippet};\n\n float unaryOpComplex(float real, float expR, float imag, float expI) {\n
${opString}\n }\n\n float mulMatDFT(int batch, int index) {\n float indexRatio = float(index) /
float(${innerDim});\n\n float exponentMultiplierTimesIndexRatio =\n
exponentMultiplier * indexRatio;\n\n float result = 0.0;\n\n for (int i = 0; i < ${innerDim}; i++) {\n
// x = (-2/2 * PI / N) * index * i;\n float x = exponentMultiplierTimesIndexRatio * float(i);\n float

```



```
expR = cos(x);\n float expI = sin(x);\n float real = getReal(batch, i);\n float imag = getImag(batch,\ni);\n result +=\n unaryOpComplex(real, expR, imag, expI) / ${resultDenominator};\n }\n\nreturn result;\n }\n\nvoid main() {\n ivec2 coords = getOutputCoords();\n setOutput(mulMatDFT(coords[0], coords[1]));\n}\n\n`;\n}\n}\n}\n","/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an\n * \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n\n=====\n*/\n\nimport {TensorInfo, util} from '@tensorflow/tfjs-core';\nimport {MathBackendWebGL} from './backend_webgl';\nimport {FFTProgram} from './fft_gpu';\nimport {complex} from './Complex';\nimport {reshape} from './Reshape';\n\nexport function fftImpl(\n x: TensorInfo, inverse: boolean, backend:\n MathBackendWebGL): TensorInfo {\n const xData = backend.texData.get(x.dataId);\n\n const inputSize =\n util.sizeFromShape(x.shape);\n // Collapse all outer dimensions to a single batch dimension.\n const innerDimensionSize = x.shape[x.shape.length - 1];\n const batch = inputSize / innerDimensionSize;\n\n const input2D = reshape(\n {inputs: [x], backend, attrs: {shape: [batch, innerDimensionSize]}});\n\n const xShape = input2D.shape as [number, number];\n const realProgram = new FFTProgram('real', xShape, inverse);\n const imagProgram = new FFTProgram('imag', xShape, inverse);\n\n const inputs = [\n {\n dataId:\n xData.complexTensorInfos.real.dataId,\n dtype: xData.complexTensorInfos.real.dtype,\n shape: xShape\n },\n {\n dataId: xData.complexTensorInfos.imag.dataId,\n dtype: xData.complexTensorInfos.imag.dtype,\n shape: xShape\n }\n];\n\n const realPart = backend.runWebGLProgram(realProgram, inputs, 'float32');\n const imagPart = backend.runWebGLProgram(imagProgram, inputs, 'float32');\n\n const complexOutput =\n complex({inputs: {real: realPart, imag: imagPart}, backend});\n\n backend.disposeIntermediateTensorInfo(realPart);\n backend.disposeIntermediateTensorInfo(imagPart);\n\n const complexOutputReshaped\n =\n reshape({inputs: {x: complexOutput}, backend, attrs: {shape: x.shape}});\n\n backend.disposeIntermediateTensorInfo(input2D);\n backend.disposeIntermediateTensorInfo(complexOutput);\n\n return complexOutputReshaped;\n}\n\n","/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in\n * compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n * governing permissions and\n * limitations under the License.\n */\n\n=====\n*/\n\nimport {FFT, FFTInputs, KernelConfig,\n TensorInfo} from '@tensorflow/tfjs-core';\nimport {MathBackendWebGL} from './backend_webgl';\nimport {fftImpl} from './FFT_impl';\n\nexport function fft(args: {inputs: FFTInputs, backend: MathBackendWebGL}): \n TensorInfo {\n const {inputs, backend} = args;\n const {input} = inputs;\n\n return fftImpl(input, false /* inverse\n */, backend);\n}\n\nexport const fftConfig: KernelConfig = {\n kernelName: FFT,\n backendName: 'webgl',\n kernelFunc: fft\n};\n\n","/*\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under\n * the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the\n * License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed\n * on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or\n * implied.\n */
```

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=====
*\n\nimport {GPGPUContext} from './gpgpu_context';\nimport {GPGPUProgram} from './gpgpu_math';\n\nexport
class FillProgram implements GPGPUProgram {\n variableNames: string[];\n outputShape: number[] = [];\n userCode: string;\n valueLoc: WebGLUniformLocation;\n constructor(shape: number[], value: number) {\n
this.variableNames = ['x'];\n this.outputShape = shape;\n this.userCode = `\n uniform float value;\n void
main() {\n // Input can be obtained from uniform value.\n setOutput(value);\n }\n `;\n}\n\n
getCustomSetupFunc(value: number) {\n return (gpgpu: GPGPUContext, webGLProgram: WebGLProgram) =>
{\n if (this.valueLoc == null) {\n this.valueLoc = gpgpu.getUniformLocationNoThrow(webGLProgram,
'value');\n }\n gpgpu.gl.uniform1f(this.valueLoc,
value);\n };\n}\n}\n\n",/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed
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=====
*\n\nimport {Fill, FillAttrs, KernelConfig, KernelFunc, TensorInfo, util} from '@tensorflow/tfjs-core';\n\nimport
{MathBackendWebGL} from '../backend_webgl';\nimport {FillProgram} from '../fill_gpu';\n\nexport function
fill(args:
{backend: MathBackendWebGL, attrs: FillAttrs});\n TensorInfo {\n const {backend, attrs} = args;\n const
{shape, value} = attrs;\n let {dtype} = attrs;\n dtype = dtype || util.inferDtype(value);\n if (dtype === 'string')
{\n // String type should be handled in CPU memory.\n const values = util.getArrayFromDType(dtype,
util.sizeFromShape(shape));\n values.fill(value as string);\n return backend.makeTensorInfo(shape, dtype,
values);\n } else {\n const program = new FillProgram(shape, value as number);\n const customSetup =
program.getCustomSetupFunc(value as number);\n return backend.runWebGLProgram(program, [], dtype,
customSetup);\n }\n }\n\nexport const fillConfig: KernelConfig = {\n kernelName: Fill,\n backendName: 'webgl',\n
kernelFunc: fill as { } as KernelFunc\n};\n\n",/**\n * @license\n * Copyright 2020 Google LLC. All Rights
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express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n *
=====
*\n\nimport {GPGPUProgram} from './gpgpu_math';\n\nexport class FlipLeftRightProgram implements
GPGPUProgram {\n variableNames = ['Image'];\n outputShape: number[] = [];\n userCode: string;\n constructor(imageShape: [number, number, number, number]) {\n const imageWidth = imageShape[2];\n
this.outputShape = imageShape;\n this.userCode = `\n void main() {\n ivec4 coords =
getOutputCoords();\n int x = coords[2];\n\n int coordX = ${imageWidth} - x;\n float outputValue;\n if(coordX >= 0 && coordX <
${imageWidth}) {\n outputValue = getImage(coords[0], coords[1], coordX, coords[3]);\n } else {\n
outputValue = getImage(coords[0], coords[1], coords[2], coords[3]);\n }\n setOutput(outputValue);\n
}\n `;\n}\n\n",/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under
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```

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```
=====
* \n\nimport { KernelConfig, Tensor4D } from '@tensorflow/tfjs-core';\nimport { FlipLeftRight, FlipLeftRightInputs }
from '@tensorflow/tfjs-core';\n\nimport { MathBackendWebGL } from '../backend_webgl';\nimport
{ FlipLeftRightProgram } from '../flip_left_right_gpu';\n\nexport const flipLeftRightConfig: KernelConfig = {\n
kernelName: FlipLeftRight,\n backendName: 'webgl',\n kernelFunc: ({ inputs, backend }) => {\n const { image } =
inputs as FlipLeftRightInputs;\n const webglBackend = backend as MathBackendWebGL;\n\n const program =
new FlipLeftRightProgram((image as Tensor4D).shape);\n const output =
webglBackend.runWebGLProgram(program, [image], image.dtype);\n return output;\n };\n};\n", "/*\n *
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the License.\n *
```

```
=====
* \n\nimport { FloorDiv, KernelConfig, KernelFunc } from '@tensorflow/tfjs-core';\nimport { binaryKernelFunc }
from '../kernel_utils/kernel_funcs_utils';\n\n// We use native integer division to deal with floating point imprecision.
Since\n// we implement floor division and glsl implements truncated division, we\n// correct for this by subtracting 1
from result when the result is negative and\n// there is a remainder.\nconst INT_DIV = ` \n float s = sign(a) *
sign(b);\n
int ia = round(a);\n int ib = round(b);\n if (ib != 0) {\n // Windows (D3D) wants guaranteed non-zero int division
at compile-time.\n return float(idiv(ia, ib, s));\n } else {\n return NAN;\n }\n`;\n\nconst INT_DIV_PACKED =
`\n ivec4 ia = round(a);\n ivec4 ib = round(b);\n bvec4 cond = notEqual(ib, ivec4(0));\n ivec4 result = ivec4(0);\n
vec4 s = sign(a) * sign(b);\n\n // Windows (D3D) wants guaranteed non-zero int division at compile-time.\n if
(cond[0]) {\n result[0] = idiv(ia[0], ib[0], s[0]);\n }\n if (cond[1]) {\n result[1] = idiv(ia[1], ib[1], s[1]);\n }\n if
(cond[2]) {\n result[2] = idiv(ia[2], ib[2], s[2]);\n }\n if (cond[3]) {\n result[3] = idiv(ia[3], ib[3], s[3]);\n }\n
return vec4(result);\n`;\n\nexport const floorDiv = binaryKernelFunc(\n { opSnippet: INT_DIV, packedOpSnippet:
INT_DIV_PACKED, dtype: 'int32' });\n\nexport const floorDivConfig: KernelConfig = {\n kernelName:
FloorDiv,\n backendName: 'webgl',\n kernelFunc: floorDiv
as { } as KernelFunc\n};\n", "/*\n *
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License.\n *
```

```
=====
* \n\nimport { getGlslDifferences } from '../glsl_version';\nimport { GPGPUProgram } from
'../gpgpu_math';\n\nexport class FromPixelsProgram implements GPGPUProgram {\n variableNames = ['A'];\n userCode: string;\n outputShape: number[];\n\n constructor(outputShape:
number[]) {\n const glsl = getGlslDifferences();\n const [height, width,] = outputShape;\n this.outputShape =
outputShape;\n this.userCode = `\n void main() {\n ivec3 coords = getOutputCoords();\n int texR =
coords[0];\n int texC = coords[1];\n int depth = coords[2];\n vec2 uv = (vec2(texC, texR) + halfCR) /`
}
```



```

isImageBitmap) {\n if (fromPixels2DContext == null) {\n fromPixels2DContext =
document.createElement('canvas').getContext('2d');\n }\n\n fromPixels2DContext.canvas.width = width;\n fromPixels2DContext.canvas.height = height;\n fromPixels2DContext.drawImage(\n pixels as
HTMLVideoElement | HTMLImageElement | ImageBitmap,\n 0, 0, width, height);\n pixels =
fromPixels2DContext.canvas;\n }\n\n const tempPixelHandle = backend.makeTensorInfo(texShape, 'int32');\n //
This is a byte texture with pixels.\n backend.texData.get(tempPixelHandle.dataId).usage =
TextureUsage.PIXELS;\n backend.gpgpu.uploadPixelDataToTexture(\n
backend.getTexture(tempPixelHandle.dataId), pixels as ImageData);\n const program
= env().getBool('WEBGL_PACK') ?\n new FromPixelsPackedProgram(outShape) :\n new
FromPixelsProgram(outShape);\n const res = backend.runWebGLProgram(program, [tempPixelHandle], 'int32');\n
backend.disposeData(tempPixelHandle.dataId);\n return res;\n}\n\n", "/*\n * @license\n * Copyright 2020 Google
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
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=====
*/\n\nimport
{ backend_util, env, FusedConv2D, FusedConv2DAttrs, FusedConv2DInputs, KernelConfig, KernelFunc,
TensorInfo, util } from '@tensorflow/tfjs-core';\n\nimport { MathBackendWebGL } from '../backend_webgl';\nimport
{ Conv2DProgram } from '../conv_gpu';\nimport { mapActivationToShaderProgram } from
'../kernel_utils/kernel_funcs_utils';\n\nimport { conv2dByMatMul, conv2dWithIm2Row } from
'./Conv2D_impl';\n\nimport { reshape } from './Reshape';\n\nexport function fusedConv2d(args: {\n inputs:
FusedConv2DInputs,\n attrs: FusedConv2DAttrs,\n backend: MathBackendWebGL\n}) {\n const { inputs,
backend, attrs } = args;\n const { x, filter, bias, preluActivationWeights } = inputs;\n const {\n strides,\n pad,\n dataFormat,\n dilations,\n dimRoundingMode,\n activation,\n leakyreluAlpha\n } = attrs;\n\n const
$dataFormat = backend_util.convertConv2DDataFormat(dataFormat);\n const convInfo =
backend_util.computeConv2DInfo(\n x.shape as [number, number, number, number],\n filter.shape
as [number, number, number, number], strides, dilations, pad,\n dimRoundingMode, false /* depthwise */,\n $dataFormat);\n let out: TensorInfo;\n const intermediates: TensorInfo[] = [];\n\n if (convInfo.filterHeight === 1
&& convInfo.filterWidth === 1 &&\n convInfo.dilationHeight === 1 && convInfo.dilationWidth === 1 &&\n
convInfo.strideHeight === 1 && convInfo.strideWidth === 1 &&\n (convInfo.padInfo.type === 'SAME' ||
convInfo.padInfo.type === 'VALID')) {\n out = conv2dByMatMul({\n x,\n filter,\n convInfo,\n backend,\n bias,\n activation,\n preluActivationWeights,\n leakyreluAlpha\n });\n } else if
(env().getBool('WEBGL_CONV_IM2COL') && x.shape[0] === 1) {\n out = conv2dWithIm2Row({\n x,\n filter,\n convInfo,\n backend,\n bias,\n activation,\n preluActivationWeights,\n leakyreluAlpha\n });\n } else {\n const hasBias = bias != null;\n const hasPreluActivationWeights
= preluActivationWeights != null;\n const hasLeakyreluAlpha = activation === 'leakyrelu';\n const
fusedActivation =\n activation ? mapActivationToShaderProgram(activation, false) : null;\n const program =
new Conv2DProgram(\n convInfo, hasBias, fusedActivation, hasPreluActivationWeights,\n hasLeakyreluAlpha);\n const inputs: TensorInfo[] = [x, filter];\n if (bias) {\n inputs.push(bias);\n }\n if
(preluActivationWeights) {\n inputs.push(preluActivationWeights);\n }\n if (hasLeakyreluAlpha) {\n
const $leakyreluAlpha = backend.makeTensorInfo(\n [], 'float32',\n util.createScalarValue(leakyreluAlpha as {} as 'float32', 'float32'));\n inputs.push($leakyreluAlpha);\n
intermediates.push($leakyreluAlpha);\n }\n out = backend.runWebGLProgram(program, inputs, 'float32');\n
 }\n\n const outReshaped =\n reshape({ inputs: { x: out }, backend, attrs: { shape: convInfo.outShape } });\n\n intermediates.push(out);\n}

```

```

intermediates.forEach(t => backend.disposeIntermediateTensorInfo(t));\n\n return outReshaped;\n}\n\nexport
const fusedConv2DConfig: KernelConfig = {\n kernelName: FusedConv2D,\n backendName: 'webgl',\n
kernelFunc: fusedConv2d as { } as KernelFunc,\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All
Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*/\n\nimport
{ backend_util, env, FusedDepthwiseConv2D, FusedDepthwiseConv2DAttrs, FusedDepthwiseConv2DInputs,
KernelConfig, KernelFunc, TensorInfo, util } from '@tensorflow/tfjs-core';\n\nimport { MathBackendWebGL } from
'./backend_webgl';\n\nimport { DepthwiseConv2DProgram } from './conv_gpu_depthwise';\n\nimport
{ DepthwiseConvPacked2DProgram } from './conv_packed_gpu_depthwise';\n\nimport
{ mapActivationToShaderProgram } from './kernel_utils/kernel_funcs_utils';\n\nexport function
fusedDepthwiseConv2D(args: {\n inputs: FusedDepthwiseConv2DInputs,\n attrs: FusedDepthwiseConv2DAttrs,\n
backend: MathBackendWebGL\n}) {\n const { inputs, backend, attrs } = args;\n const { x, filter, bias,
preluActivationWeights } = inputs;\n const { strides, pad, dilations, dimRoundingMode, activation, leakyreluAlpha }
=\n attrs;\n\n const intermediates: TensorInfo[] = [];\n\n let $dilations = dilations;\n if ($dilations == null) {\n
$dilations = [1, 1];\n }\n\n util.assert(\n backend_util.eitherStridesOrDilationsAreOne(strides,
$dilations),\n () => 'Error in depthwiseConv2d: Either strides or dilations must be ' +\n `1. Got strides
${strides} and dilations '${dilations}');\n\n const convInfo = backend_util.computeConv2DInfo(\n x.shape as
[number, number, number, number],\n filter.shape as [number, number, number, number], strides, $dilations,\n
pad, dimRoundingMode, true /* depthwise */);\n\n const shouldPackDepthwiseConv =
env().getBool('WEBGL_PACK_DEPTHWISECONV') &&\n convInfo.strideWidth <= 2 &&\n
convInfo.outChannels / convInfo.inChannels === 1;\n\n const fusedActivation = activation ?\n
mapActivationToShaderProgram(activation, shouldPackDepthwiseConv) : \n null;\n\n const programInputs:
TensorInfo[] = [x, filter];\n\n const hasBias = bias != null;\n\n const hasPreluActivationWeights =
preluActivationWeights != null;\n\n const hasLeakyreluAlpha = activation === 'leakyrelu';\n\n if (hasBias) {\n
programInputs.push(bias);\n }\n\n
if (hasPreluActivationWeights) {\n programInputs.push(preluActivationWeights);\n }\n\n if (hasLeakyreluAlpha)
{\n const $leakyreluAlpha = backend.makeTensorInfo(\n [], 'float32',\n
util.createScalarValue(leakyreluAlpha as { } as 'float32', 'float32'));\n programInputs.push($leakyreluAlpha);\n
intermediates.push($leakyreluAlpha);\n }\n\n let program:
DepthwiseConv2DProgram|DepthwiseConvPacked2DProgram;\n\n if (shouldPackDepthwiseConv) {\n program =
new DepthwiseConvPacked2DProgram(\n convInfo, hasBias, fusedActivation, hasPreluActivationWeights,\n
hasLeakyreluAlpha);\n } else {\n program = new DepthwiseConv2DProgram(\n convInfo, hasBias,
fusedActivation, hasPreluActivationWeights,\n hasLeakyreluAlpha);\n }\n\n const result =
backend.runWebGLProgram(program, programInputs, 'float32');\n\n intermediates.forEach(t =>
backend.disposeIntermediateTensorInfo(t));\n\n return result;\n}\n\nexport const fusedDepthwiseConv2DConfig:
KernelConfig = {\n kernelName: FusedDepthwiseConv2D,\n backendName: 'webgl',\n kernelFunc:
fusedDepthwiseConv2D as { } as KernelFunc,\n};\n", "/*\n * @license\n * Copyright 2018 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language

```

governing permissions and\n \* limitations under the License.\n \*

```
=====\n
*\nimport {GPGPUProgram} from './gpgpu_math';\nimport {getCoordsDataType} from
'/shader_compiler';\n\nexport class GatherNDProgram implements
GPGPUProgram {\n variableNames = ['x', 'indices'];\n outputShape: number[];\n userCode: string;\n constructor(\n private sliceDim: number, private strides: number[], shape: number[]) {\n this.outputShape =
shape;\n const stridesType = getCoordsDataType(strides.length);\n const dtype =
getCoordsDataType(shape.length);\n const strideString = this.sliceDim > 1 ? 'strides[j]' : 'strides';\n this.userCode = `\n ${stridesType} strides = ${stridesType}(${this.strides});\n void main() {\n
${dtype} coords = getOutputCoords();\n int flattenIndex = 0;\n for (int j = 0; j < ${this.sliceDim}; j++)
{\n int index = round(getIndices(coords[0], j));\n flattenIndex += index * ${strideString};\n }\n
 setOutput(getX(flattenIndex, coords[1]));\n }\n `;\n}\n\n", "/*\n * @license\n * Copyright 2020
Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
\"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n
*\n\nimport {backend_util, GatherNd, GatherNdInputs, KernelConfig, KernelFunc, TensorInfo, util} from
'@tensorflow/tfjs-core';\nimport {MathBackendWebGL} from '../backend_webgl';\nimport {GatherNDProgram}
from '../gather_nd_gpu';\nimport {reshape} from './Reshape';\n\nexport function gatherNd(\n args: {inputs:
GatherNdInputs, backend: MathBackendWebGL}): TensorInfo {\n const {inputs, backend}
= args;\n const {params, indices} = inputs;\n\n const indicesShape = indices.shape;\n const sliceRank =
indicesShape[indicesShape.length - 1];\n\n const [resultShape, numSlices, sliceSize, strides] =\nbackend_util.prepareAndValidate(params, indices);\n\n const flattenIndices = reshape(\n {inputs: {x: indices},
backend, attrs: {shape: [numSlices, sliceRank]}});\n\n const flattenX = reshape({\n inputs: {x: params},\n
backend, attrs: {shape: [(util.sizeFromShape(params.shape) / sliceSize), sliceSize]}\n });\n\n const program =\n new GatherNDProgram(sliceRank, strides, [numSlices, sliceSize]);\n const res = backend.runWebGLProgram(\n
program, [flattenX, flattenIndices], flattenX.dtype);\n\n const reshaped =\n reshape({inputs: {x: res}, backend,
attrs: {shape: resultShape}});\n\n backend.disposeIntermediateTensorInfo(flattenIndices);\n
backend.disposeIntermediateTensorInfo(flattenX);\n backend.disposeIntermediateTensorInfo(res);\n\n return
reshaped;\n}\n\nexport
const gatherNdConfig: KernelConfig = {\n kernelName: GatherNd,\n backendName: 'webgl',\n kernelFunc:
gatherNd as {} as KernelFunc\n};\n\n", "/*\n * @license\n * Copyright 2017 Google LLC. All Rights Reserved.\n *
Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in
compliance with the License.\n * You may obtain a copy of the License at\n *\n
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
```

```
=====\n
*\nimport {GPGPUProgram} from './gpgpu_math';\nimport {getCoordsDataType} from
'/shader_compiler';\n\nexport class
GatherProgram implements GPGPUProgram {\n variableNames = ['A', 'indices'];\n outputShape: number[];\n userCode: string;\n rank: number;\n\n constructor(aShape: number[], outputShape: number[]) {\n this.outputShape = outputShape;\n this.rank = outputShape.length;\n const dtype =
getCoordsDataType(this.rank);\n const sourceCoords = getSourceCoords(aShape, 2);\n\n this.userCode = `
```

```
void main() {\n ${dtype} resRC = getOutputCoords();\n setOutput(getA(${sourceCoords}));\n }\n}\n\n// The input and output are always flattened into rank 4 tensors.\nfunction getSourceCoords(aShape:\nnumber[], axis: number): string {\n const currentCoords = ['resRC.x', 'resRC.y', 'resRC.z', 'resRC.w'];\n const\nsourceCoords = [];\n for (let i = 0; i < aShape.length; i++) {\n if (i === 2) {\n sourceCoords.push('int(getIndices(resRC.x, resRC.z))');\n } else {\n sourceCoords.push(`${currentCoords[i]}`);\n }\n }\n return sourceCoords.join();\n}\n\n/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version\n2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a\n copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable\n law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n the specific language governing permissions and\n * limitations under the License.\n */\n\n=====\n*\nimport {backend_util, GatherV2, GatherV2Attrs, GatherV2Inputs, KernelConfig, KernelFunc, TensorInfo,\nTypedArray, util} from '@tensorflow/tfjs-core';\nimport {MathBackendWebGL} from\n'./backend_webgl';\nimport {GatherProgram} from './gather_gpu';\nimport {gatherV2ImplCPU}\nfrom './kernel_utils/shared';\nimport {reshape} from './Reshape';\n\nexport function gatherV2(args: {\n inputs:\nGatherV2Inputs,\n backend: MathBackendWebGL,\n attrs: GatherV2Attrs\n}): TensorInfo {\n const {inputs,\nbackend, attrs} = args;\n const {x, indices} = inputs;\n const {axis, batchDims} = attrs;\n const parsedAxis =\nutil.parseAxisParam(axis, x.shape)[0];\n const shapeInfo = backend_util.segment_util.collectGatherOpShapeInfo(\n x, indices, parsedAxis, batchDims);\n const indicesSize = util.sizeFromShape(indices.shape);\n const\ntoDateDispose = [];\n const flattenX = reshape({\n inputs: {x},\n backend,\n attrs: {\n shape: [\n shapeInfo.batchSize, shapeInfo.outerSize, shapeInfo.dimSize,\n shapeInfo.sliceSize\n]\n }\n });\n const\nflattenIndex = reshape({\n inputs: {x: indices},\n backend,\n attrs: {\n shape: [shapeInfo.batchSize, indicesSize / \n shapeInfo.batchSize]\n }\n });\n toDateDispose.push(flattenX);\n toDateDispose.push(flattenIndex);\n const flattenOutputShape = [\n shapeInfo.batchSize, shapeInfo.outerSize,\n indicesSize / shapeInfo.batchSize, shapeInfo.sliceSize\n];\n if (backend.shouldExecuteOnCPU([x, indices]) ||\nx.dtype === 'string') {\n const indicesBuf = backend.bufferSync(flattenIndex);\n const xBuf =\n backend.bufferSync(flattenX);\n const outBuf = gatherV2ImplCPU(xBuf, indicesBuf, flattenOutputShape);\n }\n toDateDispose.forEach(t => backend.disposeIntermediateTensorInfo(t));\n return backend.makeTensorInfo({\n shapeInfo.outputShape, outBuf.dtype, outBuf.values as TypedArray\n });\n const program = new\n GatherProgram(flattenX.shape, flattenOutputShape);\n const res = backend.runWebGLProgram(program,\n[flattenX, flattenIndex], flattenX.dtype);\n toDateDispose.push(res);\n const reshaped = reshape({\n inputs: {x:\nres},\n backend, attrs: {\n shape: shapeInfo.outputShape\n }\n });\n toDateDispose.forEach(t =>\n backend.disposeIntermediateTensorInfo(t));\n\n return reshaped;\n}\n\nexport const gatherV2Config: KernelConfig = {\n kernelName: GatherV2,\n backendName: 'webgl',\n kernelFunc: gatherV2 as {} as KernelFunc\n};\n\n/*\n * @license\n * Copyright 2020\nGoogle LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you\nmay not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable\nlaw or agreed to in writing,\nsoftware\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\nOR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\nthe specific language\n governing permissions and\n * limitations under the License.\n */\n\n=====\n*\nimport {GreaterEqual, KernelConfig, KernelFunc} from '@tensorflow/tfjs-core';\nimport {binaryKernelFunc}\nfrom './kernel_utils/kernel_funcs_utils';\nconst GREATER_EQUAL = `return float(a >= b);`\nconst\nGREATER_EQUAL_PACKED = `return vec4(greaterThanEqual(a, b));`\n\nexport const greaterEqual =\nbinaryKernelFunc({\n opSnippet: GREATER_EQUAL,\n packedOpSnippet: GREATER_EQUAL_PACKED,\n
```



dtype: 'bool'\n});\n\nexport const greaterEqualConfig: KernelConfig = {\n kernelName: 'GreaterEqual',\n backendName: 'webgl',\n kernelFunc: 'greaterEqual' as {\n as KernelFunc\n };\n \"\", \"/\*\n \* @license\n \* Copyright 2020 Google LLC. All Rights Reserved.\n \* Licensed under the Apache License, Version 2.0 (the \"License\");\n \* you may not use this file except in compliance with the License.\n \* You may obtain a copy of the License at\n \* http://www.apache.org/licenses/LICENSE-2.0\n \* Unless required by applicable law or agreed to in writing, software\n \* distributed under the License is distributed on an \"AS IS\" BASIS,\n \* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*

=====\n\n\*\n\nimport { IFFT, IFFTInputs, KernelConfig, TensorInfo } from '@tensorflow/tfjs-core';\nimport { MathBackendWebGL } from '../backend\_webgl';\nimport { fftImpl } from './FFT\_impl';\n\nexport function ifft(args: { inputs: IFFTInputs, backend: MathBackendWebGL }):\n TensorInfo {\n const { inputs, backend } = args;\n const { input } = inputs;\n return fftImpl(input, true /\* inverse \*/, backend);\n }\n\nexport const ifftConfig: KernelConfig = {\n kernelName: 'IFFT',\n backendName: 'webgl',\n kernelFunc: 'ifft'\n};\n \"\", \"/\*\n \* @license\n \* Copyright 2020 Google LLC. All Rights Reserved.\n \* Licensed under the Apache License, Version 2.0 (the \"License\");\n \* you may not use this file except in compliance with the License.\n \* You may obtain a copy of the License at\n \* http://www.apache.org/licenses/LICENSE-2.0\n \* Unless required by applicable law or agreed to in writing, software\n \* distributed under the License is distributed on an \"AS IS\" BASIS,\n \* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*

=====\n\n\*\n\nimport { IsFinite, KernelConfig } from '@tensorflow/tfjs-core';\nimport { unaryKernelFunc } from '../kernel\_utils/kernel\_funcs\_utils';\n\nconst IS\_FINITE = `return float(!isnan(x) && !isinf(x));`\n\nexport const isFinite = unaryKernelFunc({ opSnippet: IS\_FINITE, dtype: 'bool' });\n\nexport const isFiniteConfig: KernelConfig = {\n kernelName: 'IsFinite',\n backendName: 'webgl',\n kernelFunc: 'isFinite'\n};\n \"\", \"/\*\n \* @license\n \* Copyright 2020 Google LLC. All Rights Reserved.\n \* Licensed under the Apache License, Version 2.0 (the \"License\");\n \* you may not use this file except in compliance with the License.\n \* You may obtain a copy of the License at\n \* http://www.apache.org/licenses/LICENSE-2.0\n \* Unless required by applicable law or agreed to in writing, software\n \* distributed under the License is distributed on an \"AS IS\" BASIS,\n \* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*

=====\n\n\*\n\nimport { IsInf, KernelConfig } from '@tensorflow/tfjs-core';\nimport { unaryKernelFunc } from '../kernel\_utils/kernel\_funcs\_utils';\n\nconst IS\_INF = `return float(isinf(x));`\n\nexport const isInf = unaryKernelFunc({ opSnippet: IS\_INF, dtype: 'bool' });\n\nexport const isInfConfig: KernelConfig = {\n kernelName: 'IsInf',\n backendName: 'webgl',\n kernelFunc: 'isInf'\n};\n \"\", \"/\*\n \* @license\n \* Copyright 2020 Google LLC. All Rights Reserved.\n \* Licensed under the Apache License, Version 2.0 (the \"License\");\n \* you may not use this file except in compliance with the License.\n \* You may obtain a copy of the License at\n \* http://www.apache.org/licenses/LICENSE-2.0\n \* Unless required by applicable law or agreed to in writing, software\n \* distributed under the License is distributed on an \"AS IS\" BASIS,\n \* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*

=====\n\n\*\n\nimport { IsNan, KernelConfig } from '@tensorflow/tfjs-core';\nimport { unaryKernelFunc } from

```

'./kernel_utils/kernel_funcs_utils';\n\nconst IS_NAN = `return float(isnan(x));`\n\nexport const isNaN =
unaryKernelFunc({ opSnippet: IS_NAN, dtype: 'bool' });\n\nexport const isNaNConfig: KernelConfig = {\n
kernelName: IsNaN,\n
 backendName: 'webgl',\n
 kernelFunc: isNaN,\n
};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All
Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport { KernelConfig, KernelFunc, LessEqual } from '@tensorflow/tfjs-core';\n\nimport { binaryKernelFunc }
from './kernel_utils/kernel_funcs_utils';\n\nexport const LESS_EQUAL = `return float(a <= b);`\n\nexport const
LESS_EQUAL_PACKED
= `\n return vec4(lessThanEqual(a, b));\n`;\n\nexport const lessEqual = binaryKernelFunc(\n { opSnippet:
LESS_EQUAL, packedOpSnippet: LESS_EQUAL_PACKED, dtype: 'bool' });\n\nexport const lessEqualConfig:
KernelConfig = {\n kernelName: LessEqual,\n backendName: 'webgl',\n kernelFunc: lessEqual as { } as
KernelFunc\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n *
=====
*\n\nimport { KernelConfig, KernelFunc, LinSpace, LinSpaceAttrs, TensorInfo } from '@tensorflow/tfjs-
core';\n\nimport { MathBackendWebGL } from './backend_webgl';\n\nimport { linSpaceImplCPU } from
'./kernel_utils/shared';\n\nexport function linSpace(\n args: { backend: MathBackendWebGL, attrs:
LinSpaceAttrs }): TensorInfo {\n const { backend, attrs } = args;\n const { start, stop, num } = attrs;\n\n // TODO:
Use CPU implementation due to the precision problem in Safari.\n const outVals = linSpaceImplCPU(start, stop,
num);\n return backend.makeTensorInfo([outVals.length], 'float32', outVals);\n}\n\nexport const linSpaceConfig:
KernelConfig = {\n kernelName: LinSpace,\n backendName: 'webgl',\n kernelFunc: linSpace as { } as
KernelFunc\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance
with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-
2.0\n * \n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is
distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n *
=====
*\n\nimport { KernelConfig, Log1p } from '@tensorflow/tfjs-core';\n\nimport { unaryKernelFunc } from
'./kernel_utils/kernel_funcs_utils';\n\nconst LOG1P = `return log(1.0 + x);`\n\nexport const log1p =
unaryKernelFunc({ opSnippet: LOG1P });\n\nexport const log1pConfig: KernelConfig = {\n kernelName: Log1p,\n
backendName: 'webgl',\n kernelFunc: log1p,\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version
2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *

```

WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*

```
=====\n\n*\n\nimport { KernelConfig, KernelFunc, LogicalAnd } from '@tensorflow/tfjs-core';\n\nimport\n{ binaryKernelFunc } from '../kernel_utils/kernel_funcs_utils';\n\nconst LOGICAL_AND = `return float(a >= 1.0 &&\nb >= 1.0);`;\nconst LOGICAL_AND_PACKED = `\n return vec4(\n vec4(greaterThanEqual(a, vec4(1.0))) *\nvec4(greaterThanEqual(b, vec4(1.0))))`;\n\nexport const logicalAnd = binaryKernelFunc({\n opSnippet: LOGICAL_AND,\n packedOpSnippet: LOGICAL_AND_PACKED,\n dtype: 'bool'\n});\n\nexport\nconst logicalAndConfig: KernelConfig = {\n kernelName: LogicalAnd,\n backendName: 'webgl',\n kernelFunc:\nlogicalAnd as { } as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in\ncompliance with the License.\n * You may obtain a copy of the License at\n *\n *\nhttp://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,\nsoftware\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\nOR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n * governing permissions and\n * limitations under the License.\n */\n`;\n\n
```

```
=====\n\n*\n\nimport { KernelConfig,\n LogicalNot } from '@tensorflow/tfjs-core';\n\nimport { unaryKernelFunc } from\n '../kernel_utils/kernel_funcs_utils';\n\nconst LOGICAL_NOT = `return float(!(x >= 1.0));`;\n\nexport const\nlogicalNot = unaryKernelFunc({ opSnippet: LOGICAL_NOT });\n\nexport const logicalNotConfig: KernelConfig =\n{\n kernelName: LogicalNot,\n backendName: 'webgl',\n kernelFunc: logicalNot,\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\nLicense at\n *\n *\nhttp://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or\nagreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *\nWITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\nthe specific language governing permissions and\n * limitations under\nthe License.\n */\n`;\n\n
```

```
=====\n\n*\n\nimport { KernelConfig, KernelFunc, LogicalOr } from '@tensorflow/tfjs-core';\n\nimport { binaryKernelFunc }\nfrom '../kernel_utils/kernel_funcs_utils';\n\nconst LOGICAL_OR = `return float(a >= 1.0 || b >= 1.0);`;\nconst\nLOGICAL_OR_PACKED = `\n return min(\n vec4(greaterThanEqual(a, vec4(1.0))) +\nvec4(greaterThanEqual(b, vec4(1.0))),\n vec4(1.0));`;\n\nexport const logicalOr = binaryKernelFunc(\n{\n opSnippet: LOGICAL_OR, packedOpSnippet: LOGICAL_OR_PACKED, dtype: 'bool'\n});\n\nexport const\nlogicalOrConfig: KernelConfig = {\n kernelName: LogicalOr,\n backendName: 'webgl',\n kernelFunc: logicalOr\nas { } as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2017 Google LLC. All Rights Reserved.\n * Licensed\nunder the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the\nLicense.\n * You may obtain a copy of the License at\n *\n *\nhttp://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,\nsoftware\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\nOR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n * governing permissions and\n * limitations under the License.\n */\n`;\n\n
```

```
=====\n\n*\n\nimport { GPGPUProgram } from './gpgpu_math';\n\nexport class LRNProgram implements GPGPUProgram\n{\n variableNames = ['x'];\n outputShape: number[] = [];\n userCode: string;\n\n constructor(\n xShape:\nnumber[], radius: number, bias: number, alpha: number,\n beta: number) {\n const rad = radius;\n const\nmaxD = xShape[3] - 1;\n this.outputShape = xShape;\n\n // optimize pow(bias + alpha * sum, -beta)\n // src:
```

```
https://github.com/tensorflow/tensorflow/blob/master/tensorflow/core/kernels/mkl_lrn_op.cc#L320\n // blob/26033a1644a9c4a5fbc3170ab2e864b6a4ccd4ca/\n // tensorflow/core/kernels/mkl_lrn_op.cc#L320\n let powOperator;\n const basis = `float(${bias}) +\n float(${alpha}) * sum`;\n if (beta === 0.5) {\n powOperator = `inversesqrt(${basis})`; \n } else if (beta ===\n 1.0) {\n powOperator = `1.0/(${basis})`; \n } else {\n powOperator = `exp(log(${basis}) * float(-\n ${beta}));`\n }\n\n this.userCode = `\n void main() {\n ivec4 coords = getOutputCoords();\n int b =\n coords[0];\n int r = coords[1];\n int c = coords[2];\n int d = coords[3];\n float x = getX(b, r, c, d);\n\n float sum = 0.0;\n for (int j = -${rad}; j <= ${rad}; j++) {\n int idx = d + j;\n if (idx >= 0 && idx\n <= ${maxD}) {\n float z = getX(b, r, c, idx);\n sum += z * z;\n }\n }\n float val = x *\n ${powOperator};\n setOutput(val);\n }\n`;\n}\n\n"/**\n * @license\n * Copyright 2019 Google LLC.\n All Rights
```

```

*\\n\\nimport { GPGPUProgram } from './gpgpu_math';\\n\\nexport class LRNPackedProgram implements
GPGPUProgram {\\n variableNames = ['x'];\\n outputShape: number[] = [];\\n userCode: string;\\n packedInputs =
true;\\n packedOutput = true;\\n\\n constructor(\\n xShape: number[], radius: number, bias: number, alpha:
number,\\n beta:
number) {\\n const rad = radius;\\n const maxD = xShape[3] - 1;\\n this.outputShape = xShape;\\n\\n // optimize
pow(bias + alpha * sum, -beta)\\n // src: https://github.com/tensorflow/tensorflow/..\\n //
blob/26033a1644a9c4a5fbc3170ab2e864b6a4ccd4ca/..\\n // tensorflow/core/kernels/mkl_lrn_op.cc#L320\\n let
powOperator;\\n const basis = `float(${bias}) + float(${alpha}) * sum`;\\n if (beta === 0.5) {\\n powOperator =
`inversesqrt(${basis})`;\\n } else if (beta === 1.0) {\\n powOperator = `1.0/(${basis})`;\\n } else {\\n
powOperator = `exp(log(${basis}) * float(-${beta}))`;\\n }\\n\\n this.userCode = `\\n void main() {\\n ivec4
coords = getOutputCoords();\\n int b = coords.x;\\n int r = coords.y;\\n int c = coords.z;\\n int d =
coords.w;\\n\\n bool hasNextCol = d < ${this.outputShape[3]};\\n bool hasNextRow = c <
${this.outputShape[2]};\\n\\n vec4 sum = vec4(0.);\\n vec4 xFragAtOutputCoords =
getX(b, r, c, d);\\n\\n vec4 xAtOutputCoords = vec4(\\n getChannel(xFragAtOutputCoords, vec2(c, d)),\\n
hasNextCol ?\\n getChannel(xFragAtOutputCoords, vec2(c, d + 1)) : 0.0,\\n hasNextRow ?\\n
getChannel(xFragAtOutputCoords, vec2(c + 1, d)) : 0.0,\\n (hasNextRow && hasNextCol) ?\\n
getChannel(xFragAtOutputCoords, vec2(c + 1, d + 1)) : 0.0\\n);\\n\\n int firstChannel = d - ${rad};\\n
vec2 cache = vec2(0.);\\n if(firstChannel >= 0){\\n vec4 firstChannelFrag = getX(b, r, c, firstChannel);\\n
cache.x = getChannel(firstChannelFrag, vec2(c, firstChannel));\\n if(hasNextRow){\\n cache.y =
getChannel(firstChannelFrag, vec2(c + 1, firstChannel));\\n }\\n }\\n\\n ivec2 depth = ivec2(d, d + 1);\\n
for (int j = - ${rad}; j <= ${rad}; j++) {\\n ivec2 idx = depth + j;\\n bvec2 aboveLowerBound =
greaterThanEqual(idx, ivec2(0));\\n
 bvec2 belowUpperBound = lessThanEqual(idx, ivec2(${maxD}));\\n\\n bool depthInRange =
aboveLowerBound.x && belowUpperBound.x;\\n bool depthPlusOneInRange = aboveLowerBound.y &&
belowUpperBound.y;\\n\\n if(depthInRange || depthPlusOneInRange){\\n vec4 z = vec4(0.);\\n vec4
xFragAtCurrentDepth;\\n z.xz = cache.xy;\\n if(depthPlusOneInRange && hasNextCol){\\n
xFragAtCurrentDepth = idx.y != d ?\\n getX(b, r, c, idx.y) : xFragAtOutputCoords;\\n z.y =
getChannel(xFragAtCurrentDepth, vec2(c, idx.y));\\n if(hasNextRow){\\n z.w =
getChannel(xFragAtCurrentDepth, vec2(c + 1, idx.y));\\n }\\n }\\n cache.xy = z.yw;\\n
sum += z * z;\\n }\\n }\\n vec4 result = xAtOutputCoords * ${powOperator};\\n setOutput(result);\\n
 }\\n };\\n}\\n}\\n\\n", "/*\\n * @license\\n * Copyright 2020 Google LLC. All Rights

```

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```
=====
*\n\nimport {env, KernelConfig, KernelFunc, LRN, LRNAttrs, LRNInputs, TensorInfo} from '@tensorflow/tfjs-core';
\n\nimport {MathBackendWebGL} from '../backend_webgl';
\n\nimport {LRNProgram} from '../lrn_gpu';
\n\nimport {LRNPackedProgram} from '../lrn_packed_gpu';
\n\nexport const lrn = (args: {inputs: LRNInputs, backend: MathBackendWebGL, attrs: LRNAttrs}):
\n\n TensorInfo => {
\n\n const {inputs, backend, attrs} = args;
\n\n const {x} = inputs;
\n\n const {depthRadius, bias, alpha, beta} = attrs;
\n\n const program = env().getBool('WEBGL_PACK_NORMALIZATION') ?
\n\n new LRNPackedProgram(x.shape, depthRadius, bias, alpha, beta) :
\n\n new LRNProgram(x.shape, depthRadius, bias, alpha, beta);
\n\n return backend.runWebGLProgram(program, [x], x.dtype);
\n\n };
\n\n// tslint:disable-next-line: variable-name
\n\nexport const LRNConfig: KernelConfig = {
\n\n kernelName: LRN,
\n\n backendName: 'webgl',
\n\n kernelFunc: lrn as KernelFunc
\n\n};
\n\n"/**
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\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.
\n * See the License for the specific language governing permissions and
\n * limitations under the License.
\n */
=====
```

```

*\n\nimport {GPGPUProgram} from '../gpgpu_math';
\n\nexport class LRNGradProgram implements GPGPUProgram {
\n\n variableNames = ['inputImage', 'outputImage', 'dy'];
\n\n outputShape: number[] = [];
\n\n userCode: string;
\n\n depthRadius: number;
\n\n bias: number;
\n\n alpha: number;
\n\n beta: number;
\n\n depth: number;
\n\n constructor(
\n\n inputShape: number[],
\n\n depthRadius: number,
\n\n bias: number,
\n\n alpha: number,
\n\n beta: number
\n\n) {
\n\n this.outputShape = inputShape;
\n\n this.depth = inputShape[3];
\n\n this.depthRadius = depthRadius;
\n\n this.bias = bias;
\n\n this.alpha = alpha;
\n\n this.beta = beta;
\n\n this.userCode = `
\n\n void main() {
\n\n ivec4 coords = getOutputCoords();
\n\n int b = coords[0];
\n\n int r = coords[1];
\n\n int c = coords[2];
\n\n float result = 0.0;
\n\n for (int d = 0; d < ${this.depth}; ++d) {
\n\n int depthBegin = int(max(0.0, float(d - ${this.depthRadius})));
\n\n int depthEnd = int(min(float(${this.depth}), float(d + ${this.depthRadius} + 1)));
\n\n const int MIN_DEPTH_BEGIN = 0;
\n\n const int MAX_DEPTH_END = ${this.depth};
\n\n float norm = 0.0;
\n\n for (int k = MIN_DEPTH_BEGIN; k < MAX_DEPTH_END; ++k) {
\n\n if (k < depthBegin) {
\n\n continue;
\n\n }
\n\n else if (k >= depthBegin && k < depthEnd) {
\n\n norm += getInputImage(b, r, c, k) * getInputImage(b, r, c, k);
\n\n }
\n\n else {
\n\n break;
\n\n }
\n\n }
\n\n norm = float(${alpha}) * norm + float(${bias});
\n\n for (int k = MIN_DEPTH_BEGIN; k < MAX_DEPTH_END; ++k) {
\n\n if (k < depthBegin) {
\n\n continue;
\n\n }
\n\n else if (k >= depthBegin && k < depthEnd) {
\n\n float dyi = -2.0 * float(${alpha}) * float(${beta}) *
\n\n getInputImage(b, r, c, k) * getOutputImage(b, r, c, d) / norm;
\n\n if (k == d) {
\n\n dyi += pow(norm, -1.0 * ${beta});
\n\n }
\n\n if (k == coords[3]) {
\n\n dyi *= getDy(b, r, c, d);
\n\n result += dyi;
\n\n }
\n\n else {
\n\n break;
\n\n }
\n\n }
\n\n }
\n\n }
\n\n }
\n\n `;
\n\n setOutput(result);
\n\n }
\n\n}
\n\n"/**
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\n */
=====
```

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```
=====
* import { KernelConfig, KernelFunc, LRNGrad, LRNGradAttrs, LRNGradInputs, TensorInfo } from
'@tensorflow/tfjs-core';
import { MathBackendWebGL } from '../backend_webgl';
import { LRNGradProgram }
from '../lrn_grad_gpu';
export const lrnGrad = (args: { inputs: LRNGradInputs, backend:
MathBackendWebGL, attrs: LRNGradAttrs }): TensorInfo => { const { inputs, backend, attrs } = args;
const { x, y, dy } = inputs;
const { depthRadius, bias, alpha, beta } = attrs;
const program = new
LRNGradProgram(x.shape, depthRadius, bias, alpha, beta);
return backend.runWebGLProgram(program, [x, y, dy], x.dtype);
}
// tslint:disable-next-line: variable-
name
export const LRNGradConfig: KernelConfig = { kernelName: LRNGrad, backendName: 'webgl',
kernelFunc: lrnGrad as { } as KernelFunc };
"/**
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OR CONDITIONS OF ANY KIND, either express or implied.
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 */
=====
```

```
import { KernelFunc,
Max, MaxAttrs, MaxInputs, TensorInfo } from '@tensorflow/tfjs-core';
import { backend_util, KernelConfig,
TypedArray, util } from '@tensorflow/tfjs-core';
import { MathBackendWebGL } from
'../backend_webgl';
import { maxImplCPU } from '../kernel_utils/shared';
import { maxImpl } from
'./Max_impl';
import { transposeImpl, transposeImplCPU } from './Transpose_impl';
export function max(
args: { inputs: MaxInputs, backend: MathBackendWebGL, attrs: MaxAttrs }):
TensorInfo { const { inputs,
backend, attrs } = args;
const { x } = inputs;
const { reductionIndices, keepDims } = attrs;
const xRank =
x.shape.length;
const origAxes = util.parseAxisParam(reductionIndices, x.shape);
let axes = origAxes;
const permutedAxes = backend_util.getAxesPermutation(axes, xRank);
const maxInputIsTransposed =
permutedAxes != null;
const shouldExecuteOnCPU = backend.shouldExecuteOnCPU([x]);
let maxInput =
x;
if (maxInputIsTransposed) {
if (shouldExecuteOnCPU) {
const xTexData = backend.texData.get(maxInput.dataId);
const values = xTexData.values as
TypedArray;
const newShape: number[] = new Array(xRank);
for (let i = 0; i < newShape.length; i++) {
newShape[i] = x.shape[permutedAxes[i]];
}
const maxInputValues =
transposeImplCPU(values, x.shape, x.dtype, permutedAxes, newShape);
maxInput =
backend.makeTensorInfo(newShape, x.dtype);
const maxInputData = backend.texData.get(maxInput.dataId);
maxInputData.values = maxInputValues;
} else {
maxInput = transposeImpl(x, permutedAxes,
backend);
}
axes = backend_util.getInnerMostAxes(axes.length, xRank);
}
backend_util.assertAxesAreInnerMostDims('max', axes, xRank);
const [maxOutShape, reduceShape] =
backend_util.computeOutAndReduceShapes(maxInput.shape, axes);
let outShape = maxOutShape;
if (keepDims) {
// rather than reshape at the end, set the target
shape here.
outShape = backend_util.expandShapeToKeepDim(maxOutShape, origAxes);
}
let out;
if (shouldExecuteOnCPU) {
const xTexData = backend.texData.get(maxInput.dataId);
const values =
xTexData.values as TypedArray;
const outValues =
maxImplCPU(values,
util.sizeFromShape(reduceShape), outShape, x.dtype);
out = backend.makeTensorInfo(outShape, x.dtype);
const outData = backend.texData.get(out.dataId);
outData.values = outValues;
} else {
out =
```

```

maxImpl(maxInput, reduceShape, outShape, backend);\n }\n\n if (maxInputIsTransposed) {\n
backend.disposeIntermediateTensorInfo(maxInput);\n }\n\n return out;\n}\n\nexport const maxConfig:
KernelConfig = {\n kernelName: Max,\n backendName: 'webgl',\n kernelFunc: max as { } as
KernelFunc\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the
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http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*\nimport {backend_util, KernelConfig, KernelFunc, MaxPool, MaxPoolAttrs, MaxPoolInputs, TensorInfo, util}
from '@tensorflow/tfjs-core';\nimport {MathBackendWebGL} from '../backend_webgl';\nimport
{Pool2DProgram} from '../pool_gpu';\nimport {assertNotComplex} from '../webgl_util';\nimport {identity} from
'/Identity';\n\nexport function maxPool(args: {\n inputs: MaxPoolInputs,\n backend: MathBackendWebGL,\n attrs: MaxPoolAttrs\n}): TensorInfo {\n const
{inputs, backend, attrs} = args;\n const {x} = inputs;\n assertNotComplex(x, 'maxPool');\n const {filterSize,
strides, pad, dimRoundingMode} = attrs;\n const dilations = 1;\n util.assert(\n
backend_util.eitherStridesOrDilationsAreOne(strides, dilations),\n () => 'Error in maxPool: Either strides or
dilations must be 1. ' +\n `Got strides ${strides} and dilations '${dilations}'`);\n const convInfo =
backend_util.computePool2DInfo(\n x.shape as [number, number, number, number], filterSize, strides,\n
dilations, pad, dimRoundingMode);\n if (convInfo.filterWidth === 1 && convInfo.filterHeight === 1 &&\n
util.arraysEqual(convInfo.inShape, convInfo.outShape)) {\n return identity({inputs: {x}, backend});\n }\n const
maxPoolProgram = new Pool2DProgram(convInfo, 'max', false);\n return
backend.runWebGLProgram(maxPoolProgram, [x], x.dtype);\n}\n\nexport const maxPoolConfig: KernelConfig =
{\n kernelName: MaxPool,\n backendName: 'webgl',\n
 kernelFunc: maxPool as { } as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights
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software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
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=====
*\nimport {backend_util, KernelConfig, KernelFunc, MaxPool3D, MaxPool3DAttrs, MaxPool3DInputs,
TensorInfo} from '@tensorflow/tfjs-core';\nimport {MathBackendWebGL} from '../backend_webgl';\nimport
{Pool3DProgram} from '../pool_gpu';\n\nexport
function maxPool3d(args: {\n inputs: MaxPool3DInputs,\n backend: MathBackendWebGL,\n attrs:
MaxPool3DAttrs\n}): TensorInfo {\n const {inputs, backend, attrs} = args;\n const {x} = inputs;\n const
{filterSize, strides, pad, dataFormat, dimRoundingMode} = attrs;\n const dilations: [number, number, number] = [1,
1, 1];\n const convInfo = backend_util.computePool3DInfo(\n x.shape as [number, number, number, number,
number], filterSize, strides,\n dilations, pad, dimRoundingMode, dataFormat);\n const maxPoolProgram = new
Pool3DProgram(convInfo, 'max', false);\n return backend.runWebGLProgram(maxPoolProgram, [x],
x.dtype);\n}\n\nexport const maxPool3DConfig: KernelConfig = {\n kernelName: MaxPool3D,\n backendName:
'webgl',\n kernelFunc: maxPool3d as { } as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2017 Google LLC.
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```

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```
=====
*\n\nimport {backend_util} from '@tensorflow/tfjs-core';\nimport {GPGPUProgram} from
'./gpgpu_math';\n\nexport class MaxPool2DBackpropProgram implements GPGPUProgram {\n variableNames =
['dy', 'maxPos'];\n outputShape: number[];\n userCode: string;\n\n constructor(convInfo:
backend_util.Conv2DInfo) {\n this.outputShape = convInfo.inShape;\n const strideHeight =
convInfo.strideHeight;\n const strideWidth = convInfo.strideWidth;\n const dilationHeight
= convInfo.dilationHeight;\n const effectiveFilterHeight = convInfo.effectiveFilterHeight;\n const
effectiveFilterWidth = convInfo.effectiveFilterWidth;\n const padTop = effectiveFilterHeight - 1 -
convInfo.padInfo.top;\n const padLeft = effectiveFilterWidth - 1 - convInfo.padInfo.left;\n const lastIndex =
effectiveFilterHeight * effectiveFilterWidth - 1;\n this.userCode = `\n const ivec2 pads = ivec2(${padTop},
${padLeft});\n\n void main() {\n ivec4 coords = getOutputCoords();\n int b = coords[0];\n int d =
coords[3];\n\n ivec2 dyRCCorner = coords.yz - pads;\n int dyRCorner = dyRCCorner.x;\n int
dyCCorner = dyRCCorner.y;\n\n // Convolve dy(?, ?, d) with pos mask(:, :, d) to get dx(xR, xC, d).\n // ? =
to be determined. : = across all values in that axis.\n float dotProd = 0.0;\n for (int wR = 0; wR <
${effectiveFilterHeight};\n wR += ${dilationHeight}) {\n float
dyR = float(dyRCorner + wR) / ${strideHeight}.0;\n if (dyR < 0.0 || dyR >= ${convInfo.outHeight}.0 ||
fract(dyR) > 0.0) {\n continue;\n }\n int idyR = int(dyR);\n for (int wC = 0; wC <
${effectiveFilterWidth}; wC++) {\n float dyC = float(dyCCorner + wC) / ${strideWidth}.0;\n if
(dyC < 0.0 || dyC >= ${convInfo.outWidth}.0 ||\n fract(dyC) > 0.0) {\n continue;\n }\n int idyC = int(dyC);\n float dyValue = getDy(b, idyR, idyC, d);\n int maxPosValue = ${lastIndex} -
int(getMaxPos(b, idyR, idyC, d));\n // Get the current value, check it against the value from the\n //
position matrix.\n int curPosValue = wR * ${effectiveFilterWidth} + wC;\n float mask =
float(maxPosValue == curPosValue ? 1.0 : 0.0);\n dotProd += dyValue * mask;\n }\n }\n setOutput(dotProd);\n }\n }\n}\n\nexport class MaxPool3DBackpropProgram implements GPGPUProgram {\n variableNames =
['dy', 'maxPos'];\n outputShape: number[];\n userCode: string;\n\n constructor(convInfo:
backend_util.Conv3DInfo) {\n this.outputShape = convInfo.inShape;\n const strideDepth =
convInfo.strideDepth;\n const strideHeight = convInfo.strideHeight;\n const strideWidth =
convInfo.strideWidth;\n const dilationDepth = convInfo.dilationDepth;\n const dilationHeight =
convInfo.dilationHeight;\n const dilationWidth = convInfo.dilationWidth;\n const effectiveFilterDepth =
convInfo.effectiveFilterDepth;\n const effectiveFilterHeight = convInfo.effectiveFilterHeight;\n const
effectiveFilterWidth = convInfo.effectiveFilterWidth;\n const padFront = effectiveFilterDepth - 1 -
convInfo.padInfo.front;\n const padTop = effectiveFilterHeight - 1 - convInfo.padInfo.top;\n const padLeft =
effectiveFilterWidth - 1 - convInfo.padInfo.left;\n const lastIndex
= effectiveFilterDepth * effectiveFilterHeight * effectiveFilterWidth - 1;\n this.userCode = `\n const
ivec3 pads = ivec3(${padFront}, ${padTop}, ${padLeft});\n\n void main() {\n ivec5 coords =
getOutputCoords();\n int batch = coords.x;\n int ch = coords.u;\n ivec3 dyCorner = ivec3(coords.y,
coords.z, coords.w) - pads;\n int dyDCorner = dyCorner.x;\n int dyRCorner = dyCorner.y;\n int
dyCCorner = dyCorner.z;\n\n // Convolve dy(?, ?, ?, ch) with pos mask(:, :, :, d) to get\n // dx(xD, xR, xC,
ch).\n // ? = to be determined. : = across all values in that axis.\n float dotProd = 0.0;\n for (int wD =
0; wD < ${effectiveFilterDepth};\n wD += ${dilationDepth}) {\n float dyD = float(dyDCorner + wD) /
${strideDepth}.0;\n if (dyD < 0.0 || dyD >= ${convInfo.outDepth}.0 || fract(dyD) > 0.0) {\n continue;\n }\n int idyD = int(dyD);\n }\n }\n }\n}
```





```

{inputs, backend, attrs} = args;\n const {dy, input, output} = inputs;\n const x = input;\n assertNotComplex([input,
output], 'maxPoolGrad');\n const {filterSize,
strides, pad, dimRoundingMode} = attrs;\n\n const convInfo = backend_util.computePool2DInfo(\n x.shape as
[number, number, number, number], filterSize, strides,\n 1 /* dilations */, pad, dimRoundingMode);\n const
getPositions = true;\n const maxPoolPositionsProgram =\n new Pool2DProgram(convInfo, 'max',
getPositions);\n const maxPoolPositions: TensorInfo =\nbackend.runWebGLProgram(maxPoolPositionsProgram, [x], x.dtype);\n\n const maxPoolBackPropProgram = new
MaxPool2DBackpropProgram(convInfo);\n const result = backend.runWebGLProgram(\n
maxPoolBackPropProgram, [dy, maxPoolPositions], x.dtype);\n
backend.disposeIntermediateTensorInfo(maxPoolPositions);\n return result;\n}\n\nexport const
maxPoolGradConfig: KernelConfig = {\n kernelName: MaxPoolGrad,\n backendName: 'webgl',\n kernelFunc:
maxPoolGrad as { } as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights
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the specific language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {backend_util, TensorInfo} from '@tensorflow/tfjs-core';\n\nimport {MathBackendWebGL} from
'./backend_webgl';\n\nimport {Pool2DProgram} from './pool_gpu';\n\nexport function maxPoolWithArgmaxImpl(\n
x: TensorInfo, includeBatchInIndex: boolean,\n convInfo: backend_util.Conv2DInfo,\n backend:
MathBackendWebGL): TensorInfo[] {\n let program = new Pool2DProgram(convInfo, 'max', false);\n
const poolOutput = backend.runWebGLProgram(program, [x], 'float32');\n\n program = new
Pool2DProgram(convInfo, 'max', true, true, includeBatchInIndex);\n const indexOutput =
backend.runWebGLProgram(program, [x], 'float32');\n return [poolOutput, indexOutput];\n}\n", "/*\n *
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=====
*\n\nimport
{MaxPoolWithArgmax, MaxPoolWithArgmaxAttrs, MaxPoolWithArgmaxInputs} from '@tensorflow/tfjs-
core';\n\nimport {backend_util, KernelConfig, util} from '@tensorflow/tfjs-core';\n\nimport {MathBackendWebGL}
from './backend_webgl';\n\nimport {maxPoolWithArgmaxImpl} from './MaxPoolWithArgmax_impl';\n\nexport
const maxPoolWithArgmaxConfig: KernelConfig = {\n kernelName: MaxPoolWithArgmax,\n backendName:
'webgl',\n kernelFunc: ({inputs, attrs, backend}) => {\n const {x} = inputs as MaxPoolWithArgmaxInputs;\n
const {filterSize, strides, pad, includeBatchInIndex} =\n attrs as { } as MaxPoolWithArgmaxAttrs;\n const
webglBackend = backend as MathBackendWebGL;\n\n util.assert(\n x.shape.length === 4,\n () => `Error
in maxPool: input must be rank 4 but got rank ${\n x.shape.length}`);\n const dilations: [number, number]
= [1, 1];\n util.assert(\n backend_util.eitherStridesOrDilationsAreOne(strides, dilations),\n () => `Error in
maxPool: Either strides or dilations must be 1. '\n `Got strides ${strides} and dilations ${dilations}`);\n\n
const convInfo = backend_util.computePool2DInfo(\n x.shape as [number, number, number, number],
filterSize, strides,\n dilations, pad);\n\n const [result, indexes] =\n maxPoolWithArgmaxImpl(x,
includeBatchInIndex, convInfo, webglBackend);\n return [result, indexes];\n };\n", "/*\n * @license\n *
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```

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```
=====\n*\n\nimport {TensorInfo, util} from '@tensorflow/tfjs-core';\nimport {MathBackendWebGL} from\n'./backend_webgl';\nimport {reduce} from './kernel_utils/reduce';\nimport {reshape} from\n'./kernels/Reshape';\n\nexport function meanImpl(\n x: TensorInfo, reduceShape: number[], outShape:\n number[],\n backend: MathBackendWebGL): TensorInfo {\n const inSize = util.sizeFromShape(reduceShape);\n const xSize = util.sizeFromShape(x.shape);\n const batchSize = xSize / inSize;\n const reshapedInput =\n reshape({inputs: {x}, attrs: {shape: [batchSize, inSize]}, backend});\n\n const reduced = reduce(reshapedInput,\n 'float32', 'mean', backend);\n const reshapedOutput =\n reshape({inputs: {x: reduced}, attrs: {shape: outShape},\n backend});\n\n backend.disposeIntermediateTensorInfo(reshapedInput);\n backend.disposeIntermediateTensorInfo(reduced);\n\n return reshapedOutput;\n}\n\n/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in\n * compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\n * OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n * governing permissions and\n * limitations under the License.\n *
```

```
=====\n*\n\nimport {backend_util, KernelConfig, Mean, MeanAttrs, MeanInputs, TensorInfo, TypedArray, util} from\n'@tensorflow/tfjs-core';\nimport {MathBackendWebGL} from './backend_webgl';\nimport {meanImpl} from\n'./Mean_impl';\nimport\n{transposeImpl, transposeImplCPU} from './Transpose_impl';\n\nexport const meanConfig: KernelConfig = {\n kernelName: Mean,\n backendName: 'webgl',\n kernelFunc: ({inputs, attrs, backend}) => {\n const {x} = inputs\n as MeanInputs;\n const {keepDims, axis} = attrs as {\n } as MeanAttrs;\n const webglBackend = backend as\n MathBackendWebGL;\n\n const xRank = x.shape.length;\n const origAxes = util.parseAxisParam(axis,\n x.shape);\n\n let axes = origAxes;\n const permutedAxes = backend_util.getAxesPermutation(axes, xRank);\n\n const meanInputIsTransposed = permutedAxes != null;\n const shouldExecuteOnCPU =\n webglBackend.shouldExecuteOnCPU([x]);\n\n const intermediates: TensorInfo[] = [];\n\n let meanInput = x;\n\n if (meanInputIsTransposed) {\n if (shouldExecuteOnCPU) {\n const xTexData =\n webglBackend.texData.get(meanInput.dataId);\n const values = xTexData.values as TypedArray;\n const\n newShape: number[] = new Array(xRank);\n\n for (let i = 0; i < newShape.length; i++) {\n newShape[i] = x.shape[permutedAxes[i]];\n }\n\n const meanInputValues =\n transposeImplCPU(values, x.shape, x.dtype, permutedAxes, newShape);\n\n meanInput = webglBackend.makeTensorInfo(newShape, x.dtype);\n const meanInputData =\n webglBackend.texData.get(meanInput.dataId);\n meanInputData.values = meanInputValues;\n } else {\n meanInput = transposeImpl(x, permutedAxes, webglBackend);\n }\n\n intermediates.push(meanInput);\n\n axes = backend_util.getInnerMostAxes(axes.length, xRank);\n }\n\n backend_util.assertAxesAreInnerMostDims('sum', axes, xRank);\n const [meanOutShape, reduceShape] =\n backend_util.computeOutAndReduceShapes(meanInput.shape, axes);\n\n let outShape = meanOutShape;\n\n if (keepDims) {\n // rather than reshape at the end, set the target shape here.\n outShape =\n backend_util.expandShapeToKeepDim(meanOutShape,
```

```
origAxes);\n }\n\n const out = meanImpl(meanInput, reduceShape, outShape, webglBackend);\n for (const i\nof intermediates) {\n webglBackend.disposeIntermediateTensorInfo(i);\n }\n\n return out;\n }\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version\n 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a\n copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable\n law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n\n*\n\nimport { backend_util, KernelConfig, KernelFunc, Min,\nMinAttrs, MinInputs, TensorInfo, util } from '@tensorflow/tfjs-core';\nimport { MathBackendWebGL } from\n'./backend_webgl';\nimport { reduce } from './kernel_utils/reduce';\nimport { reshape } from './Reshape';\nimport\n{ transpose } from './Transpose';\n\nexport function min(\n args: { inputs: MinInputs, backend:\nMathBackendWebGL, attrs: MinAttrs }):\n TensorInfo {\n const { inputs, backend, attrs } = args;\n const { x } =\ninputs;\n const { axis, keepDims } = attrs;\n\n const xRank = x.shape.length;\n\n const origAxes =\nutil.parseAxisParam(axis, x.shape);\n let axes = origAxes;\n const permutedAxes =\nbackend_util.getAxesPermutation(axes, xRank);\n let permutedX = x;\n if (permutedAxes !== null) {\npermutedX = transpose({ inputs: { x }, backend, attrs: { perm: permutedAxes } });\n axes =\nbackend_util.getInnerMostAxes(axes.length, x.shape.length);\n }\n\n backend_util.assertAxesAreInnerMostDims('min', axes, xRank);\n const [outShape, reduceShape] =\nbackend_util.computeOutAndReduceShapes(permutedX.shape,\naxes);\n const inSize = util.sizeFromShape(reduceShape);\n const a2D =\n reshape({ inputs: { x: permutedX },\nbackend, attrs: { shape: [-1, inSize] } });\n const reduced = reduce(a2D, a2D.dtype, 'min', backend);\n let res;\n if\n(keepDims) {\n const newShape = backend_util.expandShapeToKeepDim(outShape, origAxes);\n res =\nreshape({ inputs: { x: reduced }, backend, attrs: { shape: newShape } });\n } else {\n res = reshape({ inputs: { x:\nreduced }, backend, attrs: { shape: outShape } });\n }\n\n backend.disposeIntermediateTensorInfo(a2D);\n backend.disposeIntermediateTensorInfo(reduced);\n\n if (permutedAxes !== null) {\nbackend.disposeIntermediateTensorInfo(permutedX);\n }\n\n return res;\n }\n\nexport const minConfig:\nKernelConfig = {\n kernelName: Min,\n backendName: 'webgl',\n kernelFunc: min as {\nKernelFunc\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the\nApache License, Version 2.0\n (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy\nof the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or\nagreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n\n*\n\nimport { GPGPUProgram } from './gpgpu_math';\nimport { getCoordsDataType } from\n'./shader_compiler';\n\nexport class MirrorPadProgram implements GPGPUProgram {\n variableNames = ['x'];\n outputShape: number[];\n userCode: string;\n\n constructor(\n xShape: number[],\n paddings: Array<[number,\nnumber]>,\n mode: 'reflect' | 'symmetric') {\n this.outputShape = paddings.map((p,\ni) => p[0] /* beforePad */ + xShape[i] + p[1] /* afterPad */);\n const rank = xShape.length;\n const dtype =\ngetCoordsDataType(rank);\n\n const start = paddings.map(p => p[0]).join(',');\n const end = paddings.map((p, i)\n=> p[0] + xShape[i]).join(',');\n const unpackedCoords =\n ['coords[0]', 'coords[1]', 'coords[2]',\n'coords[3]'].slice(0, rank);\n const offset = mode === 'reflect' ? 0 : 1;\n\n if (rank === 1) {\n this.userCode =\n`\n int start = ${start};\n int end = ${end};\n\n void main() {\n int outC = getOutputCoords();\n if (outC < start) {\n outC = start * 2 - outC - ${offset};\n } else if (outC >= end) {\n outC =\n(end - 1) * 2 - outC + ${offset};\n }\n setOutput(getX(outC - start));\n }\n`;\n return;\n }\n}
```

```

this.userCode = `
 ${dtype} start = ${dtype}(${start});
 ${dtype} end = ${dtype}(${end});

 void
 main() {
 ${dtype} outC = getOutputCoords();
 for (int i = 0; i < ${rank}; i++) {
 if (outC[i] < start[i]) {
 outC[i] = start[i] * 2 - outC[i] - ${offset};
 } else if (outC[i] >= end[i]) {
 outC[i] = (end[i] - 1) * 2 -
 outC[i] + ${offset};
 }
 }
 ${dtype} coords = outC - start;
 setOutput(getX(${unpackedCoords}));
 }
`;
}

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 */
=====
*/
import {GPGPUProgram} from './gpgpu_math';
import {getChannels} from './packing_util';
import
{getCoordsDataType} from './shader_compiler';

/*
 * Example shader code for
 * `mirrorPad(tf.tensor1d([1,
 * 2, 3], 'int32'), [[2, 2]], 'reflect')`
 */
const int start = int(2);
const int end = int(5);

void main() {
 int outputLoc = getOutputCoords();
 vec4 result = vec4(0.);
 int rc = outputLoc;

 int source = rc;
 if (source < start) {
 source = start * 2 - source - 0;
 } else if (source >= end) {
 source = (end - 1) * 2 - source + 0;
 }
 source -= start;
 result[0] =
 getChannel(getX(source), source);
 rc += 1;
 if (rc < 6) {
 int source = rc;
 if (source <
 start) {
 source = start * 2 - source - 0;
 } else if (source >= end) {
 source = (end - 1) * 2 -
 source + 0;
 }
 source -= start;
 result[1] = getChannel(getX(source), source);
 }
 setOutput(result);
}

*/
export class MirrorPadPackedProgram implements
GPGPUProgram {
 variableNames = ['x'];
 packedInputs = true;
 packedOutput = true;
 outputShape:
number[];
 userCode: string;

 constructor(xShape: number[], paddings: Array<[number, number]>,
mode: 'reflect'|'symmetric') {
 this.outputShape = paddings.map((p, i) => p[0] /* beforePad */ + xShape[i]
+ p[1] /* afterPad */);
 const rank = xShape.length;
 const dtype = getCoordsDataType(rank);
 const start
= paddings.map(p => p[0]).join(',');
 const end = paddings.map((p, i) => p[0] + xShape[i]).join(',');
 const
coords = getChannels('rc', rank);
 const source
= getChannels('source', rank);
 const cLimit = `${coords[rank - 1]} < ${this.outputShape[rank - 1]}`;
 const innerDims =
rank === 1 ? 'source' : `vec2(${source.slice(-2).join()})`;
 const offset = mode === 'reflect' ?
0 : 1;

 let mainLoop = `
 if (rank === 1) {
 const padSetup = `
 ${dtype} source = rc;
 if
 (source < start) {
 source = start * 2 - source - ${offset};
 } else if (source >= end) {
 source =
 (end - 1) * 2 - source + ${offset};
 }
 source -= start;
 }
 `;
 mainLoop += `
 ${dtype} rc =
 outputLoc;
 ${padSetup}
 result[0] = getChannel(getX(${source.join()}), ${innerDims});
 ${coords[rank - 1]} += 1;
 if (${cLimit}) {
 ${padSetup}
 result[1] =
 getChannel(getX(${source.join()}), ${innerDims});
 }
 `;
 } else {
 const padSetup = `
 ${dtype} source = rc;
 ${dtype} lt = ${dtype}(lessThan(source,
 start));
 ${dtype} gte = ${dtype}(greaterThanEqual(source, end));
 ${dtype} orig = 1 - (lt + gte);
 source = orig * source +
 lt * (start * 2 - source - ${offset}) +
 gte * ((end - 1) * 2 - source +
 ${offset});
 source -= start;
 `;
 mainLoop += `
 ${dtype} rc = outputLoc;
 ${padSetup}
 result[0] = getChannel(getX(${source.join()}), ${innerDims});
 ${coords[rank - 1]} += 1;
 if (${cLimit}) {
 ${padSetup}
 result[1] = getChannel(getX(${source.join()}), ${innerDims});
 }
 rc = outputLoc;
 ${coords[rank - 2]} += 1;
 if (${coords[rank - 2]} < ${this.outputShape[rank -
 2]}) {
 ${padSetup}
 result[2] = getChannel(getX(${source.join()}), ${innerDims});
 }
 ${coords[rank - 1]} += 1;
 if (${cLimit}) {
 ${padSetup}
 result[3] =

```

```

getChannel(getX({source.join()}),
 ${innerDims});\n }\n }\n `;\n }\n }\n this.userCode = `\n const ${dtype} start =
${dtype}(${start});\n const ${dtype} end = ${dtype}(${end});\n void main() {\n ${dtype} outputLoc =
getOutputCoords();\n vec4 result = vec4(0.);\n ${mainLoop}\n setOutput(result);\n }\n `;\n
}\n}\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache
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License for the specific language governing permissions and\n * limitations under the License.\n
* =====\n
*\n\nimport {env, KernelConfig, KernelFunc, MirrorPad, MirrorPadAttrs, MirrorPadInputs, TensorInfo} from
'@tensorflow/tfjs-core';\n\nimport {MathBackendWebGL} from '../backend_webgl';\n\nimport {MirrorPadProgram}
from '../mirror_pad_gpu';\n\nimport {MirrorPadPackedProgram} from '../mirror_pad_packed_gpu';\n\n\nexport const
mirrorPadKernelFunc: (params: {\n inputs: MirrorPadInputs,\n backend: MathBackendWebGL,\n attrs:
MirrorPadAttrs\n}) => TensorInfo = ({inputs, backend, attrs}) => {\n const {x} = inputs;\n const {paddings,
mode} = attrs;\n const program = env().getBool('WEBGL_PACK_ARRAY_OPERATIONS') ?\n new
MirrorPadPackedProgram(x.shape, paddings, mode) :\n new MirrorPadProgram(x.shape, paddings, mode);\n const output = backend.runWebGLProgram(program, [x], x.dtype);\n return output;\n};\n\n\nexport const
mirrorPadConfig: KernelConfig = {\n kernelName: MirrorPad,\n backendName:
'webgl',\n kernelFunc: mirrorPadKernelFunc as {} as KernelFunc,\n};\n", "/*\n * @license\n * Copyright 2020
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* =====\n
*\n\nimport {KernelConfig, KernelFunc, Mod} from '@tensorflow/tfjs-core';\n\nimport
{CHECK_NAN_SNIPPET} from '../binaryop_packed_gpu';\n\nimport {binaryKernelFunc} from
'../kernel_utils/kernel_funcs_utils';\n\n\nconst
MOD = `if (b == 0.0) return NaN;\n return mod(a, b);`;\n\n\nconst MOD_PACKED = `\n vec4 result = mod(a, b);\n
vec4 isNaN = vec4(equal(b, vec4(0.0))); \n ` +\n CHECK_NAN_SNIPPET + `\n return result;\n`;\n\n\nexport const
mod = binaryKernelFunc({\n opSnippet: MOD,\n packedOpSnippet: MOD_PACKED,\n});\n\n\nexport const
modConfig: KernelConfig = {\n kernelName: Mod,\n backendName: 'webgl',\n kernelFunc: mod as {} as
KernelFunc\n};\n", "/*\n * @license\n * Copyright 2017 Google LLC. All Rights Reserved.\n * Licensed under the
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implied.\n * See the License for the
specific language governing permissions and\n * limitations under the License.\n
* =====\n
*\n\nimport {GPGPUContext} from './gpgpu_context';\n\nimport {GPGPUProgram} from './gpgpu_math';\n\n\nexport
class MultinomialProgram implements GPGPUProgram {\n variableNames = ['probs'];\n outputShape: number[];\n userCode: string;\n // Caching uniform location for speed.\n seedLoc: WebGLUniformLocation;\n constructor(batchSize: number, numOutcomes: number, numSamples: number) {\n this.outputShape = [batchSize,
numSamples];\n this.userCode = `\n uniform float seed;\n void main() {\n ivec2 coords =

```

```

getOutputCoords();\n int batch = coords[0];\n float r = random(seed);\n float cdf = 0.0;\n for
(int i = 0; i < ${numOutcomes - 1}; i++) {\n cdf += getProbs(batch, i);\n if (r < cdf) {\n
setOutput(float(i));\n return;\n
 }\n }\n // If no other event happened, last event happened.\n setOutput(float(${numOutcomes -
1}));\n }\n }\n getCustomSetupFunc(seed: number) {\n return (gpgpu: GPGPUContext,
webGLProgram: WebGLProgram) => {\n if (this.seedLoc == null) {\n this.seedLoc =
gpgpu.getUniformLocation(webGLProgram, 'seed');\n }\n gpgpu.gl.uniform1f(this.seedLoc, seed);\n };\n }\n /**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache
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BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the
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language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport {RealDiv} from '@tensorflow/tfjs-core';\nimport {KernelConfig} from '@tensorflow/tfjs-
core';\nimport {binaryKernelFunc} from '../kernel_utils/kernel_funcs_utils';\n\n// Without the equality check div
produces 0.9999 for a = b, which when\n// floored can cause errors.\nconst DIV = \nif (a == b) {\n return
1.0;\n};\nreturn a / b;\n\n// We do the same as in ./binaryop_gpu, with vec4 and ivec4.\n// On Linux, the vectorized
implementation produces NaNs when a and b are 0.\nconst DIV_PACKED = \n// vec4 one = vec4(equal(a, b));\n\n
// return one + (vec4(1.0) - one) * a / b;\n vec4 result = a / b;\n if(a.x == b.x) {\n result.x = 1.;\n }\n if(a.y ==
b.y) {\n result.y = 1.;\n }\n if(a.z == b.z) {\n result.z = 1.;\n }\n if(a.w == b.w) {\n result.w = 1.;\n }\n\n
return result;\n\n\nexport const realDiv
= binaryKernelFunc(\n {opSnippet: DIV, packedOpSnippet: DIV_PACKED, checkOutOfBounds:
true});\n\nexport const realDivConfig: KernelConfig = {\n kernelName: RealDiv,\n backendName: 'webgl',\n
kernelFunc: realDiv,\n};\n\n/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed
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on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
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License.\n *
=====
*\n\nimport {backend_util, KernelConfig, KernelFunc,
Softmax, SoftmaxAttrs, SoftmaxInputs, TensorInfo, util} from '@tensorflow/tfjs-core';\n\nimport
{MathBackendWebGL} from '../backend_webgl';\n\nimport {exp} from './Exp';\nimport {max} from
'./Max';\nimport {realDiv} from './RealDiv';\nimport {reshape} from './Reshape';\nimport {sub} from
'./Sub';\nimport {sum} from './Sum';\n\nexport function softmax(args: {\n inputs: SoftmaxInputs,\n backend:
MathBackendWebGL,\n attrs: SoftmaxAttrs\n}): TensorInfo {\n const {inputs, backend, attrs} = args;\n const
{logits} = inputs;\n const {dim} = attrs;\n\n const axes = util.parseAxisParam([dim], logits.shape);\n\n const
maxLogit = max({\n inputs: {x: logits},\n backend,\n attrs: {reductionIndices: axes, keepDims: false}\n
 });\n\n const expandedShape = backend_util.expandShapeToKeepDim(maxLogit.shape, axes);\n\n const
maxLogitsReshaped =\n reshape({inputs: {x: maxLogit}, backend, attrs: {shape: expandedShape}});\n const a
=\n sub({inputs: {a: logits, b: maxLogitsReshaped},
backend}) as TensorInfo;\n const b = exp({inputs: {x: a}, backend}) as TensorInfo;\n const sumExp =\n sum({inputs: {x: b}, backend, attrs: {axis: axes, keepDims: false}});\n const sumExpReshaped =\n reshape({inputs: {x: sumExp}, backend, attrs: {shape: expandedShape}});\n\n const res =\n realDiv({inputs: {a:
b, b: sumExpReshaped}, backend}) as TensorInfo;\n\n backend.disposeIntermediateTensorInfo(maxLogit);\n

```

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backend.disposeIntermediateTensorInfo(maxLogitsReshaped);\n backend.disposeIntermediateTensorInfo(a);\n
backend.disposeIntermediateTensorInfo(b);\n backend.disposeIntermediateTensorInfo(sumExp);\n
backend.disposeIntermediateTensorInfo(sumExpReshaped);\n\n return res;\n)\n\nexport const softmaxConfig:
KernelConfig = {\n kernelName: Softmax,\n backendName: 'webgl',\n kernelFunc: softmax as {} as
KernelFunc\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the
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WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific
language governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport { KernelConfig, KernelFunc, Multinomial, MultinomialAttrs, MultinomialInputs, TensorInfo } from
'@tensorflow/tfjs-core';\n\nimport { MathBackendWebGL } from '../backend_webgl';\n\nimport
{ MultinomialProgram } from '../multinomial_gpu';\n\nimport { softmax } from './Softmax';\n\nexport function
multinomial(args: {\n inputs: MultinomialInputs,\n backend: MathBackendWebGL,\n attrs: MultinomialAttrs\n}):
TensorInfo
{\n const { inputs, backend, attrs } = args;\n const { logits } = inputs;\n const { numSamples, seed, normalized } =
attrs;\n\n const probs = normalized ?\n logits :\n softmax(\n { inputs: { logits }, backend, attrs: { dim:
logits.shape.length - 1 } }\n);\n const batchSize = probs.shape[0];\n const numOutcomes = probs.shape[1];\n const
program = new MultinomialProgram(batchSize, numOutcomes, numSamples);\n const customSetup =
program.getCustomSetupFunc(seed);\n\n const res = backend.runWebGLProgram(program, [probs], 'int32',
customSetup);\n if (!normalized) {\n backend.disposeIntermediateTensorInfo(probs);\n }\n return
res;\n}\n\nexport const multinomialConfig: KernelConfig = {\n kernelName: Multinomial,\n backendName:
'webgl',\n kernelFunc: multinomial as {} as KernelFunc\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC.
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in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
=====
*\n\nimport { backend_util, kernel_impls, KernelConfig, KernelFunc, NonMaxSuppressionV3,
NonMaxSuppressionV3Attrs, NonMaxSuppressionV3Inputs, TypedArray } from '@tensorflow/tfjs-core';\n\nconst
nonMaxSuppressionV3Impl = kernel_impls.nonMaxSuppressionV3Impl;\n\nimport { MathBackendWebGL } from
'../backend_webgl';\n\nexport function nonMaxSuppressionV3(args: {\n inputs: NonMaxSuppressionV3Inputs,\n
backend: MathBackendWebGL,\n attrs: NonMaxSuppressionV3Attrs\n})
{\n backend_util.warn(\n 'tf.nonMaxSuppression() in webgl locks the UI thread. ' +\n 'Call
tf.nonMaxSuppressionAsync() instead');\n\n const { inputs, backend, attrs } = args;\n const { boxes, scores } =
inputs;\n const { maxOutputSize, iouThreshold, scoreThreshold } = attrs;\n\n const boxesVals =
backend.readSync(boxes.dataId) as TypedArray;\n const scoresVals = backend.readSync(scores.dataId) as
TypedArray;\n\n const { selectedIndices } = nonMaxSuppressionV3Impl(\n boxesVals, scoresVals,
maxOutputSize, iouThreshold, scoreThreshold);\n\n return backend.makeTensorInfo(\n [selectedIndices.length],
'int32', new Int32Array(selectedIndices));\n}\n\nexport const nonMaxSuppressionV3Config: KernelConfig = {\n
kernelName: NonMaxSuppressionV3,\n backendName: 'webgl',\n kernelFunc: nonMaxSuppressionV3 as {} as
KernelFunc\n};\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the
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=====
*\n\nimport {backend_util, kernel_impls, KernelConfig, KernelFunc, NonMaxSuppressionV4,
NonMaxSuppressionV4Attrs, NonMaxSuppressionV4Inputs, TensorInfo, TypedArray} from '@tensorflow/tfjs-
core';\nconst nonMaxSuppressionV4Impl = kernel_impls.nonMaxSuppressionV4Impl;\n\nimport
{MathBackendWebGL} from '../backend_webgl';\n\nexport function nonMaxSuppressionV4(args: {\n inputs:
NonMaxSuppressionV4Inputs,\n backend: MathBackendWebGL,\n
attrs: NonMaxSuppressionV4Attrs\n}): [TensorInfo, TensorInfo] {\n backend_util.warn(\n
'tf.nonMaxSuppression() in webgl locks the UI thread. ' +\n 'Call tf.nonMaxSuppressionAsync() instead');\n\n
const {inputs, backend, attrs} = args;\n const {boxes, scores} = inputs;\n const {maxOutputSize, iouThreshold,
scoreThreshold, padToMaxOutputSize} =\n attrs;\n\n const boxesVals = backend.readSync(boxes.dataId) as
TypedArray;\n const scoresVals = backend.readSync(scores.dataId) as TypedArray;\n\n const {selectedIndices,
validOutputs} = nonMaxSuppressionV4Impl(\n boxesVals, scoresVals, maxOutputSize, iouThreshold,
scoreThreshold,\n padToMaxOutputSize);\n\n return [\n backend.makeTensorInfo(\n
[selectedIndices.length], 'int32', new Int32Array(selectedIndices)),\n backend.makeTensorInfo([], 'int32', new
Int32Array([validOutputs]))\n];\n}\n\nexport const nonMaxSuppressionV4Config: KernelConfig = {\n
kernelName: NonMaxSuppressionV4,\n
backendName: 'webgl',\n kernelFunc: nonMaxSuppressionV4 as {} as KernelFunc\n};\n\n"/**\n * @license\n *
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'License');\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or
agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
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*\n\nimport {backend_util, kernel_impls, KernelConfig, KernelFunc, NonMaxSuppressionV5,
NonMaxSuppressionV5Attrs, NonMaxSuppressionV5Inputs, TensorInfo, TypedArray} from '@tensorflow/tfjs-
core';\n\nconst
nonMaxSuppressionV5Impl = kernel_impls.nonMaxSuppressionV5Impl;\n\nimport {MathBackendWebGL} from
'../backend_webgl';\n\nexport function nonMaxSuppressionV5(args: {\n inputs: NonMaxSuppressionV5Inputs,\n
backend: MathBackendWebGL,\n attrs: NonMaxSuppressionV5Attrs\n}): [TensorInfo, TensorInfo] {\n
 backend_util.warn(\n 'tf.nonMaxSuppression() in webgl locks the UI thread. ' +\n 'Call
tf.nonMaxSuppressionAsync() instead');\n\n const {inputs, backend, attrs} = args;\n const {boxes, scores} =
inputs;\n const {maxOutputSize, iouThreshold, scoreThreshold, softNmsSigma} = attrs;\n\n const boxesVals =
backend.readSync(boxes.dataId) as TypedArray;\n const scoresVals = backend.readSync(scores.dataId) as
TypedArray;\n\n const maxOutputSizeVal = maxOutputSize;\n const iouThresholdVal = iouThreshold;\n const
scoreThresholdVal = scoreThreshold;\n const softNmsSigmaVal = softNmsSigma;\n\n const {selectedIndices,
selectedScores} = nonMaxSuppressionV5Impl(\n boxesVals,
scoresVals, maxOutputSizeVal, iouThresholdVal,\n scoreThresholdVal, softNmsSigmaVal);\n\n return [\n
backend.makeTensorInfo(\n [selectedIndices.length], 'int32', new Int32Array(selectedIndices)),\n
backend.makeTensorInfo(\n [selectedScores.length], 'float32', new Float32Array(selectedScores))\n
];\n}\n\nexport const nonMaxSuppressionV5Config: KernelConfig = {\n kernelName: NonMaxSuppressionV5,\n
backendName: 'webgl',\n kernelFunc: nonMaxSuppressionV5 as {} as KernelFunc\n};\n\n"/**\n * @license\n *
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OF ANY KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*

```
=====\n\n*\n\nimport {GPGPUProgram} from './gpgpu_math';\n\nexport class OneHotProgram implements GPGPUProgram {\n variableNames = ['indices'];\n outputShape: number[];\n userCode: string;\n\n // Caching uniform location for speed.\n seedLoc: WebGLUniformLocation;\n\n constructor(\n numIndices: number, depth: number, onValue: number, offValue: number) {\n this.outputShape = [numIndices, depth];\n this.userCode = `\n void main() {\n ivec2 coords = getOutputCoords();\n int index = round(getIndices(coords.x));\n setOutput(mix(float($offValue), float($onValue)),\n float(index == coords.y));\n }\n `;\n}\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
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=====\n\n*\n\nimport {KernelConfig, KernelFunc, OneHot, OneHotAttrs, OneHotInputs, TensorInfo, util} from '@tensorflow/tfjs-core';\nimport {MathBackendWebGL} from './backend_webgl';\nimport {OneHotProgram} from './onehot_gpu';\nimport {reshape} from './Reshape';\n\nexport const oneHot = (args: {\n inputs: OneHotInputs,\n backend: MathBackendWebGL,\n attrs: OneHotAttrs\n}): TensorInfo => {\n const {inputs, backend, attrs} = args;\n const {indices} = inputs;\n const {depth, onValue, offValue} = attrs;\n\n const indicesSize = util.sizeFromShape(indices.shape);\n const program = new OneHotProgram(indicesSize, depth, onValue, offValue);\n const reshaped = reshape({inputs: {x: indices}, backend, attrs: {shape: [indicesSize]}});\n const result = backend.runWebGLProgram(program, [reshaped], indices.dtype);\n backend.disposeIntermediateTensorInfo(reshaped);\n\n const outShape = [...indices.shape, depth];\n const out = reshape({inputs: {x: result}, backend, attrs: {shape: outShape}});\n backend.disposeIntermediateTensorInfo(result);\n return out;\n};\n\nexport const oneHotConfig: KernelConfig = {\n kernelName: OneHot,\n backendName: 'webgl',\n kernelFunc: oneHot as {} as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n
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=====\n\n*\n\nimport {KernelConfig, KernelFunc, TensorInfo, ZerosLike, ZerosLikeInputs} from '@tensorflow/tfjs-core';\nimport {MathBackendWebGL} from './backend_webgl';\nimport {complex} from './Complex';\nimport {fill} from './Fill';\nimport {imag} from './Imag';\nimport {real} from './Real';\n\nexport function zerosLike(\n args: {\n inputs: ZerosLikeInputs,\n backend: MathBackendWebGL\n }): TensorInfo {\n const {inputs, backend} = args;\n const {x} = inputs;\n\n if (x.dtype === 'complex64') {\n const realPart = real({inputs: {input: x}, backend});\n const r = zerosLike({inputs: {x: realPart}, backend});\n const imagPart = imag({inputs: {input: x}, backend});\n const i = zerosLike({inputs: {x: imagPart}, backend});\n\n const result = complex({inputs: {r, i}});\n
```

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{real: r, imag: i}, backend));\n\n backend.disposeIntermediateTensorInfo(realPart);\nbackend.disposeIntermediateTensorInfo(r);\n backend.disposeIntermediateTensorInfo(imagPart);\nbackend.disposeIntermediateTensorInfo(i);\n\n return result;\n } else {\n return fill({\n attrs: {\n shape:\n x.shape,\n dtype: x.dtype,\n value: x.dtype === 'string' ? '' : 0\n },\n backend\n });\n }\n}\n\nexport\nconst zerosLikeConfig: KernelConfig = {\n kernelName: ZerosLike,\n backendName: 'webgl',\n kernelFunc:\n zerosLike as {} as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All\n Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this\n file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *\n http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,\n software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES\n OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n governing permissions and\n * limitations under the License.\n *\n =====\n\n */\n\nimport {KernelConfig, KernelFunc, OnesLike, OnesLikeInputs, TensorInfo} from '@tensorflow/tfjs-\ncore';\nimport {MathBackendWebGL} from '../backend_webgl';\nimport {complex} from './Complex';\nimport {fill} from './Fill';\nimport {imag} from './Imag';\nimport {real} from './Real';\nimport {zerosLike} from\n './ZerosLike';\n\nexport\nfunction onesLike(\n args: {inputs: OnesLikeInputs, backend: MathBackendWebGL}): TensorInfo {\n const\n {inputs, backend} = args;\n const {x} = inputs;\n\n if (x.dtype === 'string') {\n throw new Error('onesLike is not\n supported under string dtype');\n } else if (x.dtype === 'complex64') {\n const realPart = real({inputs: {input: x},\n backend});\n const r = onesLike({inputs: {x: realPart}, backend});\n const imagPart = imag({inputs: {input: x},\n backend});\n const i = zerosLike({inputs: {x: imagPart}, backend});\n\n const result = complex({inputs: {real: r,\n imag: i}, backend});\n\n backend.disposeIntermediateTensorInfo(realPart);\n backend.disposeIntermediateTensorInfo(r);\n backend.disposeIntermediateTensorInfo(imagPart);\n backend.disposeIntermediateTensorInfo(i);\n\n return result;\n } else {\n // TODO(cais, smilkov): Add WebGL\n shader for onesLike.\n // https://github.com/tensorflow/tfjs/issues/1293\n return fill({attrs: {shape:\n x.shape, dtype: x.dtype, value: 1}, backend});\n }\n}\n\nexport const onesLikeConfig: KernelConfig = {\n kernelName: OnesLike,\n backendName: 'webgl',\n kernelFunc: onesLike as {} as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version\n 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a\n copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable\n law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n the specific language governing permissions and\n * limitations under the License.\n *\n =====\n\n */\n\nimport {KernelConfig, KernelFunc, Pack, PackAttrs, PackInputs, TensorInfo,\n util} from '@tensorflow/tfjs-core';\nimport {MathBackendWebGL} from '../backend_webgl';\nimport {concat}\n from './Concat';\nimport {expandDims} from './ExpandDims';\n\nexport function pack(\n args: {inputs:\n PackInputs, backend: MathBackendWebGL, attrs: PackAttrs}): TensorInfo {\n const {inputs, backend, attrs} =\n args;\n const {axis} = attrs;\n\n if (inputs.length === 1) {\n return expandDims(\n {\n inputs: {input:\n inputs[0]},\n backend, attrs: {dim: axis}\n });\n }\n\n const shape = inputs[0].shape;\n const dtype =\n inputs[0].dtype;\n\n inputs.forEach(t => {\n util.assertShapesMatch(\n shape, t.shape,\n 'All tensors\n passed to stack must have matching shapes');\n util.assert(\n dtype === t.dtype,\n () => 'All tensors passed\n to stack must have matching dtypes');\n });\n\n const intermediateTensorInfos: TensorInfo[] = [];\n const\n expandedTensors = inputs.map(t => {\n const expandedT =\n expandDims({inputs: {input: t},\n backend, attrs: {dim: axis}});\n intermediateTensorInfos.push(expandedT);\n return expandedT;\n });\n\n const result = concat({inputs: expandedTensors, backend, attrs: {axis}});\n\n intermediateTensorInfos.forEach(\n t => backend.disposeIntermediateTensorInfo(t);\n);\n\n return result;\n}\n\nexport const packConfig: KernelConfig =

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{\n kernelName: Pack,\n backendName: 'webgl',\n kernelFunc: pack as { } as KernelFunc\n);\n", "/\*\*\n \* @license\n \* Copyright 2017 Google LLC. All Rights Reserved.\n \* Licensed under the Apache License, Version 2.0 (the \"License\");\n \* you may not use this file except in compliance with the License.\n \* You may obtain a copy of the License at\n \* http://www.apache.org/licenses/LICENSE-2.0\n \* Unless required by applicable law or agreed to in writing, software\n \* distributed under the License is distributed on an \"AS IS\" BASIS,\n \* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific

language governing permissions and\n \* limitations under the License.\n \*

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=====\n\n*\n\nimport { GPGPUProgram } from './gpgpu_math';\nimport { getCoordsDataType } from\n './shader_compiler';\n\nexport class PadProgram implements GPGPUProgram {\n variableNames = ['x'];\n outputShape: number[];\n userCode: string;\n\n constructor(\n xShape: number[],\n paddings: Array<[number, number]>,\n constantValue: number) {\n this.outputShape = paddings.map((p, i) => p[0] /* beforePad */\n + xShape[i] + p[1] /* afterPad */);\n const rank = xShape.length;\n const type = getCoordsDataType(rank);\n const start = paddings.map(p => p[0]).join(',');\n const end = paddings.map((p, i) => p[0] + xShape[i]).join(',');\n const unpackedCoords =\n ['coords[0]', 'coords[1]', 'coords[2]', 'coords[3]'].slice(0, rank);\n if (rank === 1) {\n this.userCode = `\n int start = ${start};\n int end = ${end};\n void main() {\n int outC = getOutputCoords();\n if (outC < start || outC\n >= end) {\n setOutput(float(${constantValue}));\n } else {\n setOutput(getX(outC - start));\n }\n return;\n }\n `;\n this.userCode = `\n ${type} start = ${type}(${start});\n ${type} end =\n ${type}(${end});\n void main() {\n ${type} outC = getOutputCoords();\n if (any(lessThan(outC,\n start)) || any(greaterThanEqual(outC, end))) {\n setOutput(float(${constantValue}));\n } else {\n ${type} coords = outC - start;\n setOutput(getX(${unpackedCoords}));\n }\n }\n `;\n }\n }\n\n /**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License
```

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```
=====\n\n*\n\nimport { GPGPUProgram } from './gpgpu_math';\nimport { getChannels } from './packing_util';\nimport { getCoordsDataType } from './shader_compiler';\n\nexport class PadPackedProgram implements GPGPUProgram {\n variableNames = ['x'];\n packedInputs = true;\n packedOutput = true;\n outputShape: number[];\n userCode: string;\n\n constructor(\n xShape: number[],\n paddings: Array<[number, number]>,\n constantValue: number) {\n this.outputShape = paddings.map((p, i) => p[0] /* beforePad */ + xShape[i] +\n p[1] /* afterPad */);\n const rank = xShape.length;\n const dtype = getCoordsDataType(rank);\n const start = paddings.map(p => p[0]).join(',');\n const end = paddings.map((p, i) => p[0] + xShape[i]).join(',');\n const coords = getChannels('rc', rank);\n const source = getChannels('source', rank);\n const cLimit = `${coords[rank - 1]} < ${this.outputShape[rank - 1]}`;\n const innerDims =\n rank === 1 ? 'source' : `vec2(${source.slice(-2).join(',')})`;\n const componentSetup = [\n `${dtype} rc = outputLoc;`,\n `${coords[rank - 1]} += 1;`\n];\n if (cLimit) {\n `,\n rank === 1 ? " : "`\n];\n rc = outputLoc;\n `${coords[rank - 2]} += 1;`\n if (cLimit) {\n `,\n rank === 1 ? " : "`\n];\n `${coords[rank - 1]} += 1;`\n if (cLimit) {\n `,\n rank === 1 ? " : "`\n];\n `rc < start || rc >= end`;\n `any(lessThan(rc, start)) || any(greaterThanEqual(rc, end))`;\n }\n\n let mainLoop = `;\n for (let i = 0, j = rank === 1 ? 2 : 4; i < j; i++) {\n mainLoop += `\n ${componentSetup[i]}\n if (${paddingArea}) {\n result[${i}] = float(${constantValue});\n } else {\n ${dtype} source = rc - start;\n result[${i}] = getChannel(getX(${source.join(',')}), ${innerDims});\n }\n }\n`;\n}
```

```
;};\n }\n mainLoop += (rank == 1 ? `:` : `');\n\n this.userCode = `\n const ${dtype} start =
${dtype}(${start});\n const ${dtype} end = ${dtype}(${end});\n\n void main() {\n ${dtype} outputLoc =
getOutputCoords();\n vec4 result = vec4(0.); \n ${mainLoop}\n setOutput(result);\n }\n `;\n}\n}\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache
License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You
may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is
distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either
express or implied.\n * See the License for the specific language governing permissions and\n * limitations under
the License.\n */\n=====\n*/\n\nimport {env, KernelConfig, KernelFunc, PadV2, PadV2Attrs, PadV2Inputs, TensorInfo} from
'@tensorflow/tfjs-core';\nimport {MathBackendWebGL} from '../backend_webgl';\nimport {PadProgram} from
../pad_gpu;\nimport {PadPackedProgram} from '../pad_packed_gpu';\n\nexport const padV2 = (\n args: {inputs:
PadV2Inputs, backend: MathBackendWebGL, attrs: PadV2Attrs}): \n TensorInfo => {\n const {inputs,
backend, attrs} = args;\n const [x] = inputs;\n const {padding, constantValue} = attrs;\n\n const
program = env().getBool('WEBGL_PACK_ARRAY_OPERATIONS') ?\n new
PadPackedProgram(x.shape, padding, constantValue) :\n new PadProgram(x.shape, padding,
constantValue);\n return backend.runWebGLProgram(program, [x], x.dtype);\n };\n\nexport const
padV2Config: KernelConfig = {\n kernelName: PadV2,\n backendName: 'webgl',\n kernelFunc: padV2 as {} as
KernelFunc\n};\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions
and\n * limitations under the License.\n */\n=====\n*/\n\nimport {KernelConfig, KernelFunc, Pow} from '@tensorflow/tfjs-core';\nimport
{CHECK_NAN_SNIPPET} from '../binaryop_packed_gpu';\nimport {binaryKernelFunc} from
../kernel_utils/kernel_funcs_utils;\n\nconst POW = (\n if(a < 0.0 && floor(b) < b){\n return NAN;\n }\n if (b
== 0.0) {\n return 1.0;\n }\n return (round(mod(b, 2.0)) != 1) ?\n pow(abs(a), b) : sign(a) * pow(abs(a),
b);\n);\n\nconst POW_PACKED = (\n // isModRound1 has 1 for components with round(mod(b, 2.0)) == 1, 0
otherwise.\n vec4 isModRound1 = vec4(equal(round(mod(b, 2.0)), ivec4(1)));\n vec4 multiplier = sign(a) *
isModRound1 + (vec4(1.0) - isModRound1);\n vec4 result = multiplier * pow(abs(a), b);\n\n // Ensure that a^0 = 1,
including 0^0 = 1 as this correspond to TF and JS\n bvec4 isExpZero = equal(b, vec4(0.0));\n result.r =
isExpZero.r ? 1.0 : result.r;\n
result.g = isExpZero.g ? 1.0 : result.g;\n result.b = isExpZero.b ? 1.0 : result.b;\n result.a = isExpZero.a ? 1.0 :
result.a;\n\n vec4 isNaN = vec4(lessThan(a, vec4(0.0))) * vec4(lessThan(floor(b), b));\n` +\nCHECK_NAN_SNIPPET +`\n return result;\n`;\n\nexport const pow = (\n binaryKernelFunc({opSnippet: POW,
packedOpSnippet: POW_PACKED});\n\nexport const powConfig: KernelConfig = {\n kernelName: Pow,\n
backendName: 'webgl',\n kernelFunc: pow as {} as KernelFunc\n};\n"/**\n * @license\n * Copyright 2020
Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either
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express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*

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=====
*\n\nimport {KernelConfig, KernelFunc, Range, RangeAttrs, TensorInfo} from '@tensorflow/tfjs-core';\n\nimport {MathBackendWebGL} from '../backend_webgl';\n\nimport {rangeImplCPU} from '../kernel_utils/shared';\n\n\nexport const range =\n (args: {backend: MathBackendWebGL, attrs: RangeAttrs}): TensorInfo => {\n const {backend, attrs} = args;\n const {start, stop, step, dtype} = attrs;\n const values = rangeImplCPU(start, stop, step, dtype);\n return backend.makeTensorInfo([values.length], dtype, values);\n };\n\n\nexport const rangeConfig: KernelConfig = {\n kernelName: Range,\n backendName: 'webgl',\n kernelFunc: range as { } as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
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=====
*\n\nimport {KernelConfig, Reciprocal} from '@tensorflow/tfjs-core';\n\nimport {unaryKernelFunc} from '../kernel_utils/kernel_funcs_utils';\n\n\nconst RECIPROCAL = `return 1.0 / x;`;\n\n\nexport const reciprocal = unaryKernelFunc({opSnippet: RECIPROCAL});\n\n\nexport const reciprocalConfig: KernelConfig = {\n kernelName: Reciprocal,\n backendName: 'webgl',\n kernelFunc: reciprocal,\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
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=====
*\n\nimport {KernelConfig, KernelFunc, Relu} from '@tensorflow/tfjs-core';\n\nimport {unaryKernelFunc} from '../kernel_utils/kernel_funcs_utils';\n\nimport {CHECK_NAN_SNIPPET} from '../unaryop_gpu';\n\n\nconst RELU = CHECK_NAN_SNIPPET + `\n return (x < 0.0) ? 0.0 : x;\n`;\n\n\nconst RELU_PACKED = `\n vec4 result = x * vec4(greaterThanEqual(x, vec4(0.0)));\n bvec4 isNaN = isnan(x);\n result.r = isNaN.r ? x.r : result.r;\n result.g = isNaN.g ? x.g : result.g;\n result.b = isNaN.b ? x.b : result.b;\n result.a = isNaN.a ? x.a : result.a;\n return result;\n`;\n\n\nexport const relu =\n unaryKernelFunc({opSnippet: RELU, packedOpSnippet: RELU_PACKED});\n\n\nexport const reluConfig: KernelConfig = {\n kernelName: Relu,\n backendName: 'webgl',\n kernelFunc: relu as { } as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
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=====
*\n\nimport {KernelConfig, KernelFunc, Relu6} from '@tensorflow/tfjs-core';\n\nimport {unaryKernelFunc} from '../kernel_utils/kernel_funcs_utils';\n\nimport {CHECK_NAN_SNIPPET} from '../unaryop_gpu';\n\n\nconst RELU6 = CHECK_NAN_SNIPPET + `\n return (x < 0.0) ? 0.0 : min(6.0, x);\n`;\n\n\nconst RELU6_PACKED = `\n vec4 result = min(x, vec4(6.)) * vec4(greaterThanEqual(x, vec4(0.0)));\n bvec4 isNaN = isnan(x);\n result.r = isNaN.r`
```

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? x.r : result.r;\n result.g = isNaN.g ? x.g : result.g;\n result.b = isNaN.b ? x.b : result.b;\n result.a = isNaN.a ? x.a :
result.a;\n\n return result;\n`;\n\nexport const relu6 = {\n unaryKernelFunc({ opSnippet: RELU6, packedOpSnippet:
RELU6_PACKED });\n\nexport const relu6Config: KernelConfig = {\n kernelName: Relu6,\n backendName:
'webgl',\n kernelFunc: relu6 as { } as KernelFunc\n};\n"/**\n * @license\n * Copyright 2017 Google LLC. All
Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
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=====\n
*/\n\nimport { GPGPUProgram } from './gpgpu_math';\n\nexport class ResizeBilinearProgram implements
GPGPUProgram {\n variableNames = ['A'];\n outputShape: number[] = [];\n userCode: string;\n\n constructor(\n inputShape: [number, number, number, number], newHeight: number,\n newWidth: number, alignCorners:
boolean, halfPixelCenters: boolean) {\n const [batch, oldHeight, oldWidth, depth] = inputShape;\n this.outputShape = [batch, newHeight, newWidth, depth];\n\n const effectiveInSize: [number, number] = [\n (alignCorners && newHeight > 1) ? oldHeight - 1 : oldHeight,\n (alignCorners && newWidth > 1) ? oldWidth - 1 : oldWidth\n];\n\n const effectiveOutSize: [number, number] = [\n (alignCorners && newHeight > 1) ?\n newHeight - 1 : newHeight,\n (alignCorners && newWidth > 1) ? newWidth - 1 : newWidth\n];\n\n let\n sourceFracIndexRC: string;\n if (halfPixelCenters) {\n sourceFracIndexRC =\n `(vec2(yRC) + vec2(0.5))\n * effectiveInputOverOutputRatioRC` +\n ` - vec2(0.5)`;\n } else {\n sourceFracIndexRC = `vec2(yRC) *\n effectiveInputOverOutputRatioRC`;\n }\n\n this.userCode = `\n const vec2\n effectiveInputOverOutputRatioRC\n = vec2(\n ${effectiveInSize[0] / effectiveOutSize[0]},\n ${effectiveInSize[1] / effectiveOutSize[1]});\n const vec2 inputShapeRC = vec2(${oldHeight}.0, ${oldWidth}.0);\n void main() {\n ivec4 coords =\n getOutputCoords();\n int b = coords[0];\n int d = coords[3];\n ivec2 yRC = coords.yz;\n //\n Fractional source index.\n vec2 sourceFracIndexRC = ${sourceFracIndexRC};\n // Compute the four\n integer indices.\n ivec2 sourceFloorRC = ivec2(max(sourceFracIndexRC, vec2(0.0)));\n ivec2\n sourceCeilRC = ivec2(\n min(inputShapeRC - 1.0, ceil(sourceFracIndexRC)));\n float topLeft = getA(b,\n sourceFloorRC.x, sourceFloorRC.y, d);\n float bottomLeft = getA(b, sourceCeilRC.x, sourceFloorRC.y, d);\n float topRight = getA(b, sourceFloorRC.x, sourceCeilRC.y, d);\n float bottomRight = getA(b, sourceCeilRC.x,\n sourceCeilRC.y, d);\n vec2 fracRC = sourceFracIndexRC\n - vec2(sourceFloorRC);\n float top = topLeft + (topRight - topLeft) * fracRC.y;\n float bottom =\n bottomLeft + (bottomRight - bottomLeft) * fracRC.y;\n float newValue = top + (bottom - top) * fracRC.x;\n setOutput(newValue);\n }\n `;\n\n }\n\n "/**\n * @license\n * Copyright 2017 Google LLC. All Rights\n Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file\n except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
```

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=====\n
*/\n\nimport { GPGPUProgram } from './gpgpu_math';\n\nexport class ResizeBilinearPackedProgram implements
GPGPUProgram {\n variableNames = ['A'];\n packedInputs = true;\n packedOutput = true;\n outputShape:
number[] = [];\n userCode: string;\n\n constructor(\n inputShape: [number, number, number, number],\n newHeight: number,\n newWidth: number, alignCorners: boolean, halfPixelCenters: boolean) {\n const [batch,\n oldHeight, oldWidth, depth] = inputShape;\n this.outputShape = [batch, newHeight, newWidth, depth];\n\n const\n effectiveInSize: [number, number] = [\n (alignCorners && newHeight > 1) ? oldHeight - 1 : oldHeight,\n
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 (alignCorners && newWidth > 1) ? oldWidth - 1 : oldWidth\n];\n\n const effectiveOutSize: [number, number]
= [\n (alignCorners && newHeight > 1) ? newHeight - 1 : newHeight,\n (alignCorners && newWidth > 1) ?
newWidth - 1 : newWidth\n];\n\n let sourceFracIndexRC: string;\n if (halfPixelCenters) {\n
 sourceFracIndexRC = `(vec3(yRC) + vec3(0.5)) * ` +\n `effectiveInputOverOutputRatioRC - vec3(0.5)`;\n
 } else {\n sourceFracIndexRC = `vec3(yRC) * effectiveInputOverOutputRatioRC`;\n }\n\n this.userCode =
`\n const vec3 effectiveInputOverOutputRatioRC = vec3(\n ${effectiveInSize[0] / effectiveOutSize[0]},\n
 ${effectiveInSize[1] / effectiveOutSize[1]},\n ${effectiveInSize[1] / effectiveOutSize[1]});\n const vec3
inputShapeRC = vec3(${oldHeight}.0, ${oldWidth}.0);\n\n ${oldWidth}.0);\n\n float
getAValue(int b, int r, int c, int d) {\n return getChannel(getA(b, r, c, d), vec2(c, d));\n }\n\n void main()
{\n ivec4 coords = getOutputCoords();\n int b = coords[0];\n int d = coords[3];\n // Calculate
values for next column in yRC.z.\n ivec3 yRC = coords.yzz + ivec3(0, 0, 1);\n // Fractional source
index.\n vec3 sourceFracIndexRC
= ${sourceFracIndexRC};\n\n // Compute the four integer indices.\n ivec3 sourceFloorRC =
ivec3(max(sourceFracIndexRC, vec3(0.0)));\n ivec3 sourceCeilRC = ivec3(\n min(inputShapeRC - 1.0,
ceil(sourceFracIndexRC));\n\n // Should we calculate next column and row elements in 2x2 packed cell.\n
bool hasNextCol = d < ${depth - 1};\n bool hasNextRow = coords.z < ${newWidth - 1};\n\n // In parallel,
construct four corners for all four components in\n // packed 2x2 cell.\n vec4 topLeft = vec4(\n
getAValue(b, sourceFloorRC.x, sourceFloorRC.y, d),\n hasNextCol ? getAValue(b, sourceFloorRC.x,
sourceFloorRC.y, d + 1)\n : 0.0,\n hasNextRow ? getAValue(b, sourceFloorRC.x,
sourceFloorRC.z, d)\n : 0.0,\n (hasNextRow && hasNextCol) ?\n getAValue(b,
sourceFloorRC.x, sourceFloorRC.z, d + 1) : 0.0);\n\n vec4 bottomLeft = vec4(\n getAValue(b,
sourceCeilRC.x, sourceFloorRC.y, d),\n hasNextCol ? getAValue(b, sourceCeilRC.x, sourceFloorRC.y, d +
1)\n : 0.0,\n hasNextRow ? getAValue(b, sourceCeilRC.x, sourceFloorRC.z, d)\n :
0.0,\n (hasNextRow && hasNextCol) ?\n getAValue(b, sourceCeilRC.x, sourceFloorRC.z, d + 1) :
0.0);\n\n vec4 topRight = vec4(\n getAValue(b, sourceFloorRC.x, sourceCeilRC.y, d),\n hasNextCol
? getAValue(b, sourceFloorRC.x, sourceCeilRC.y, d + 1)\n : 0.0,\n hasNextRow ? getAValue(b,
sourceFloorRC.x, sourceCeilRC.z, d)\n : 0.0,\n (hasNextRow && hasNextCol) ?\n getAValue(b, sourceFloorRC.x, sourceCeilRC.z, d + 1) : 0.0);\n\n vec4 bottomRight = vec4(\n
getAValue(b, sourceCeilRC.x, sourceCeilRC.y, d),\n hasNextCol ? getAValue(b, sourceCeilRC.x,
sourceCeilRC.y, d + 1)\n : 0.0,\n hasNextRow\n ? getAValue(b, sourceCeilRC.x, sourceCeilRC.z, d)\n : 0.0,\n (hasNextRow && hasNextCol) ?\n getAValue(b, sourceCeilRC.x, sourceCeilRC.z, d + 1) : 0.0);\n\n vec3 fracRC = sourceFracIndexRC -
vec3(sourceFloorRC);\n\n vec4 top = mix(topLeft, topRight, fracRC.yzz);\n vec4 bottom =
mix(bottomLeft, bottomRight, fracRC.yzz);\n vec4 newValue = mix(top, bottom, fracRC.x);\n\n setOutput(newValue);\n }\n `;\n }\n}\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY
KIND, either express or implied.\n * See the License for the specific language governing permissions and\n *
limitations under the License.\n */
=====
\n
*/\n\nimport {env, KernelConfig, KernelFunc, ResizeBilinear, ResizeBilinearAttrs, ResizeBilinearInputs,
TensorInfo} from '@tensorflow/tfjs-core';\n\nimport {MathBackendWebGL} from '../backend_webgl';\n\nimport
{ResizeBilinearProgram} from '../resize_bilinear_gpu';\n\nimport {ResizeBilinearPackedProgram} from
'../resize_bilinear_packed_gpu';\n\nexport function resizeBilinear(args: {\n inputs: ResizeBilinearInputs,\n
backend: MathBackendWebGL,\n attrs: ResizeBilinearAttrs\n}): TensorInfo {\n const {inputs, backend, attrs} =

```



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args;\n const { images } = inputs;\n const { alignCorners, halfPixelCenters, size } = attrs;\n\n const [newHeight,
newWidth] = size;\n\n const program = env().getBool('WEBGL_PACK_IMAGE_OPERATIONS') ?\n new
ResizeBilinearPackedProgram(\n
 images.shape as [number, number, number, number], newHeight, newWidth,\n
 alignCorners,
halfPixelCenters) :\n new ResizeBilinearProgram(\n
 images.shape as [number, number, number, number],
newHeight, newWidth,\n
 alignCorners, halfPixelCenters);\n return backend.runWebGLProgram(program,
[images], 'float32');\n}\n\nexport const resizeBilinearConfig: KernelConfig = {\n kernelName: ResizeBilinear,\n
backendName: 'webgl',\n kernelFunc: resizeBilinear as { } as KernelFunc\n};\n\n"/**\n * @license\n * Copyright
2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n *
you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS
OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions
and\n * limitations under the License.\n */
=====
*\n\nimport { GPGPUProgram } from './gpgpu_math';\n\nexport class ResizeBilinearBackpropProgram implements
GPGPUProgram {\n variableNames = ['dy'];\n outputShape: number[] = [];\n userCode: string;\n\n constructor(\n
 dyShape: [number, number, number, number],\n inputShape: [number, number, number, number],
alignCorners: boolean) {\n this.outputShape = inputShape;\n const [, xHeight, xWidth,] = inputShape;\n const
[, yHeight, yWidth] = dyShape;\n\n // In the backwards pass, we want to find the pixels that were generated for\n
// each pixel in the input image the forward pass and add the corresponding\n // coefficient from dy to the gradient
(with some interpolation).\n\n const effectiveXSize: [number, number] = [\n (alignCorners
&& yHeight > 1) ? xHeight - 1 : xHeight,\n (alignCorners && yWidth > 1) ? xWidth - 1 : xWidth\n];\n\n const effectiveYSize: [number, number] = [\n (alignCorners && yHeight > 1) ? yHeight - 1 : yHeight,\n
(alignCorners && yWidth > 1) ? yWidth - 1 : yWidth\n];\n\n const heightScale = effectiveXSize[0] /
effectiveYSize[0];\n const widthScale = effectiveXSize[1] / effectiveYSize[1];\n\n const invHeightScale = 1 /
heightScale;\n const invWidthScale = 1 / widthScale;\n\n // This defines the size of the window of values around
a particular\n // index in dy that we want to search for contributions to dx.\n const winHeight =
(Math.ceil(invHeightScale) * 2) + 2;\n const winWidth = (Math.ceil(invWidthScale) * 2) + 2;\n\n this.userCode
= `\n void main() {\n ivec4 coords = getOutputCoords();\n int b = coords[0];\n int d = coords[3];\n
 int r = coords[1];\n int c = coords[2];\n\n float accumulator
= 0.0;\n\n const float heightScale = float(${heightScale});\n const float widthScale =
float(${widthScale});\n\n const float invHeightScale = float(${invHeightScale});\n const float
invWidthScale = float(${invWidthScale});\n\n const int winHeight = int(${winHeight});\n const int
winWidth = int(${winWidth});\n\n // Compute bounds for where in dy we will look\n float startRLerp =
floor(float(r) * invHeightScale);\n int startDyR = int(startRLerp - float(winHeight / 2));\n\n float startCLerp
= floor(float(c) * invWidthScale);\n int startDyC = int(startCLerp - float(winWidth / 2));\n\n // Loop over
dy\n for (int dyROffset = 0; dyROffset < winHeight; dyROffset++) {\n int dyR = dyROffset +
startDyR;\n\n // Guard against the window exceeding the bounds of dy\n if (dyR < 0 || dyR >=
${yHeight}) {\n continue;\n }\n\n for (int dyCOffset = 0; dyCOffset
< winWidth; dyCOffset++) {\n int dyC = dyCOffset + startDyC;\n\n // Guard against the window
exceeding the bounds of dy\n if (dyC < 0 || dyC >= ${yWidth}) {\n continue;\n }\n\n
 float dxR = float(dyR) * heightScale;\n int topDxRIndex = int(floor(dxR));\n int bottomDxRIndex =
int(min(ceil(dxR), ${xHeight} - 1).0);\n float dxRLerp = dxR - float(topDxRIndex);\n float
inverseDxRLerp = 1.0 - dxRLerp;\n\n float dxC = float(dyC) * widthScale;\n int leftDxCIndex =
int(floor(dxC));\n int rightDxCIndex = int(min(ceil(dxC), ${xWidth} - 1).0);\n float dxCLerp = dxC -
float(leftDxCIndex);\n float inverseDxCLerp = 1.0 - dxCLerp;\n\n if (r == topDxRIndex && c ==

```

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leftDxCIndex) {\n // topLeft\n accumulator +=\n getDy(b, dyR, dyC, d) * inverseDxRLerp * inverseDxClerp;\n }\n if (r == topDxRIndex && c == rightDxCIndex) {\n // topRight\n accumulator +=\n getDy(b, dyR, dyC, d) * inverseDxRLerp * dxCLerp;\n }\n if (r == bottomDxRIndex && c ==\n leftDxCIndex) {\n // bottomLeft\n accumulator += getDy(b, dyR, dyC, d) * dxRLerp *\n inverseDxClerp;\n }\n if (r == bottomDxRIndex && c == rightDxCIndex) {\n //\n bottomRight\n accumulator += getDy(b, dyR, dyC, d) * dxRLerp * dxCLerp;\n }\n }\n}\n// End loop over dy\nsetOutput(accumulator);\n}\n`;\n}\n}\n","/*\n * @license\n * Copyright\n2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by\napplicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\"\nBASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the\nLicense for the specific language governing permissions and\n * limitations under the License.\n *\n=====\n*/\nimport { KernelConfig, KernelFunc, ResizeBilinearGrad, ResizeBilinearGradAttrs, ResizeBilinearGradInputs,\nTensorInfo } from '@tensorflow/tfjs-core';\nimport { MathBackendWebGL } from '../backend_webgl';\nimport\n{ ResizeBilinearBackpropProgram } from './resize_bilinear_backprop_gpu';\nnexport function\nresizeBilinearGrad(args: {\n inputs: ResizeBilinearGradInputs,\n backend: MathBackendWebGL,\n attrs:\nResizeBilinearGradAttrs\n}): TensorInfo {\n const { inputs, backend, attrs } = args;\n const { images, dy } = inputs;\nconst { alignCorners } = attrs;\n\n const program = new ResizeBilinearBackpropProgram(\n dy.shape as [number, number, number, number],\n images.shape as [number, number, number, number],\n alignCorners);\n\n return backend.runWebGLProgram(program, [dy], dy.dtype);\n}\nnexport const\nresizeBilinearGradConfig: KernelConfig = {\n kernelName: ResizeBilinearGrad,\n backendName: 'webgl',\n kernelFunc: resizeBilinearGrad as {} as KernelFunc\n};\n","/*\n * @license\n * Copyright 2018 Google LLC. All\nRights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this\nfile except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,\nsoftware\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\nOR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\ngoverning permissions and\n * limitations under the\nLicense.\n *\n=====\n*/\nimport { GPGPUProgram } from './gpgpu_math';\nnexport class ResizeNearestNeighborProgram implements\nGPGPUProgram {\n variableNames = ['A'];\n outputShape: number[] = [];\n userCode: string;\n\n constructor(\n inputShape: [number, number, number, number], newHeight: number,\n newWidth: number, alignCorners:\nboolean, halfPixelCenters: boolean) {\n const [batch, oldHeight, oldWidth, depth] = inputShape;\nthis.outputShape = [batch, newHeight, newWidth, depth];\n const effectiveInSize: [number, number] = [\n (alignCorners && newHeight > 1) ? oldHeight - 1 : oldHeight,\n (alignCorners && newWidth > 1) ? oldWidth -\n1 : oldWidth\n];\n const effectiveOutSize: [number, number] = [\n (alignCorners && newHeight > 1) ?\nnewHeight - 1 : newHeight,\n (alignCorners && newWidth > 1) ? newWidth - 1 : newWidth\n];\n\n // When\nalign corners is false,\nwe rounds the value with floor.\n const roundBase = alignCorners ? '0.5' : '0.0';\n let sourceFracIndexRC:\nstring;\n if (halfPixelCenters) {\n sourceFracIndexRC =`\n `max((vec2(yRC) + vec2(0.5)) *\neffectiveInputOverOutputRatioRC`+\n `, vec2(0.0));`\n } else {\n sourceFracIndexRC = `vec2(yRC) *\neffectiveInputOverOutputRatioRC`;`\n }\n this.userCode = `\n const vec2 effectiveInputOverOutputRatioRC\n= vec2(\n ${effectiveInSize[0] / effectiveOutSize[0]},\n ${effectiveInSize[1] / effectiveOutSize[1]});\n const vec2 inputShapeRC = vec2(${oldHeight}.0, ${oldWidth}.0);\n\n void main() {\n ivec4 coords =
```

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getOutputCoords();\n int b = coords[0];\n int d = coords[3];\n ivec2 yRC = coords.yz;\n //
Fractional source index.\n vec2 sourceFracIndexRC = ${sourceFracIndexRC};\n // Compute the
coordinators of nearest neighbor point.\n ivec2 sourceNearestRC = ivec2(\n
 min(inputShapeRC - 1.0, floor(sourceFracIndexRC + ${roundBase}));\n float newValue = getA(b,
sourceNearestRC.x, sourceNearestRC.y, d);\n setOutput(newValue);\n }\n `;\n }\n}\n\n", "/*\n *
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2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
=====
\n
*/\n\nimport {KernelConfig, KernelFunc, ResizeNearestNeighbor, ResizeNearestNeighborAttrs,
ResizeNearestNeighborInputs, TensorInfo} from '@tensorflow/tfjs-core';\n\nimport {MathBackendWebGL} from
'../backend_webgl';\n\nimport {ResizeNearestNeighborProgram} from '../resize_nearest_neighbor_gpu';\n\nexport
function resizeNearestNeighbor(args: {\n inputs: ResizeNearestNeighborInputs,\n backend:
MathBackendWebGL,\n attrs: ResizeNearestNeighborAttrs\n}): TensorInfo {\n const {inputs, backend, attrs} =
args;\n const {images} = inputs;\n const {alignCorners, halfPixelCenters, size} = attrs;\n const [newHeight,
newWidth] = size;\n const program = new ResizeNearestNeighborProgram(\n images.shape as [number,
number, number, number], newHeight, newWidth,\n alignCorners, halfPixelCenters);\n return
backend.runWebGLProgram(program, [images], images.dtype);\n}\n\nexport const resizeNearestNeighborConfig:
KernelConfig = {\n kernelName: ResizeNearestNeighbor,\n backendName: 'webgl',\n kernelFunc:
resizeNearestNeighbor as {} as KernelFunc\n};\n\n", "/*\n *
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
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\n
*/\n\nimport {GPGPUProgram} from './gpgpu_math';\n\nexport class ResizeNearestNeighborBackpropProgram
implements GPGPUProgram {\n variableNames = ['dy'];\n outputShape: number[] = [];\n userCode: string;\n constructor(\n dyShape: [number, number, number, number],\n
 inputShape: [number, number, number, number], alignCorners: boolean) {\n this.outputShape = inputShape;\n
 const [, xHeight, xWidth,] = inputShape;\n const [, yHeight, yWidth] = dyShape;\n // In the backwards pass,
we want to find the pixels that were generated for\n // each pixel in the input image the forward pass and add the
corresponding\n // coefficient from dy to the gradient (with some interpolation).\n const effectiveXSize:
[number, number] = [\n (alignCorners && yHeight > 1) ? xHeight - 1 : xHeight,\n (alignCorners && yWidth
> 1) ? xWidth - 1 : xWidth\n];\n const effectiveYSize: [number, number] = [\n (alignCorners && yHeight
> 1) ? yHeight - 1 : yHeight,\n (alignCorners && yWidth > 1) ? yWidth - 1 : yWidth\n];\n const
heightScale = effectiveXSize[0] / effectiveYSize[0];\n const widthScale = effectiveXSize[1] /
effectiveYSize[1];\n const invHeightScale = 1 / heightScale;\n const invWidthScale = 1 /
widthScale;\n // This defines the size of the window of values around a particular\n // index in dy that we want
to search for contributions to dx.\n const winHeight = (Math.ceil(invHeightScale) * 2) + 2;\n const winWidth =
(Math.ceil(invWidthScale) * 2) + 2;\n this.userCode = `\n void main() {\n ivec4 coords =
getOutputCoords();\n int b = coords[0];\n int d = coords[3];\n int r = coords[1];\n int c =
coords[2];\n float accumulator = 0.0;\n const float heightScale = float(${heightScale});\n const
float widthScale = float(${widthScale});\n const float invHeightScale = float(${invHeightScale});\n const

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float invWidthScale = float({invWidthScale});\n\n const int winHeight = int({winHeight});\n\n const int\nwinWidth = int({winWidth});\n\n // Compute bounds for where in dy we will look\n float startRLerp =\nfloor(float(r) * invHeightScale);\n\n int startDyR =\nint(floor(startRLerp - float(winHeight / 2)));\n\n float startCLerp = floor(float(c) * invWidthScale);\n\n int\nstartDyC = int(floor(startCLerp - float(winWidth / 2)));\n\n // Loop over dy\n for (int dyROffset = 0;\ndyROffset < winHeight; dyROffset++) {\n int dyR = dyROffset + startDyR;\n\n // Guard against the\nwindow exceeding the bounds of dy\n if (dyR < 0 || dyR >= {yHeight}) {\n continue;\n }\n\n for (int dyCOffset = 0; dyCOffset < winWidth; dyCOffset++) {\n int dyC = dyCOffset + startDyC;\n\n // Guard against the window exceeding the bounds of dy\n if (dyC < 0 || dyC >= {yWidth}) {\n continue;\n }\n\n float sourceFracRow =\n\n float({effectiveXSize[0]}) *\n(float(dyR) / float({effectiveYSize[0]}));\n\n float sourceFracCol =\n\n float({effectiveXSize[1]})\n*\n (float(dyC)\n\n / float({effectiveYSize[1]}));\n\n int sourceNearestRow = int(min(\n\n float(int({xHeight}) - 1),\n\n {\n alignCorners\n } ? float(round(sourceFracRow)) : float(floor(sourceFracRow)));\n\n int sourceNearestCol = int(min(\n\n float(int({xWidth}) - 1),\n\n {\n alignCorners\n } ?\nfloat(round(sourceFracCol)) : float(floor(sourceFracCol)));\n\n if (r ==\nsourceNearestRow && c == sourceNearestCol) {\n accumulator += getDy(b, dyR, dyC, d);\n }\n }\n }\n\n // End loop over dy\n setOutput(accumulator);\n}\n\n`;\n}\n}\n"\n"/**\n * @license\n *\nCopyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n\"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\nLicense at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is\n * distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either\n * express or implied.\n * See the License for the specific language governing permissions and\n * limitations under\n * the License.\n */\n\n=====\n*/\n\nimport {KernelConfig, KernelFunc, ResizeNearestNeighborGrad, ResizeNearestNeighborGradAttrs,\nResizeNearestNeighborGradInputs, TensorInfo} from '@tensorflow/tfjs-core';\n\nimport {MathBackendWebGL} from '../backend_webgl';\n\nimport {ResizeNearestNeighborBackpropProgram} from './resize_nearest_neighbor_backprop_gpu';\n\nexport function resizeNearestNeighborGrad(args: {\n inputs:\n ResizeNearestNeighborGradInputs,\n backend: MathBackendWebGL,\n attrs:\n ResizeNearestNeighborGradAttrs\n}): TensorInfo {\n const {inputs, backend, attrs} = args;\n const {images, dy} = inputs;\n const {alignCorners} = attrs;\n\n const program = new\n ResizeNearestNeighborBackpropProgram(\n dy.shape as [number, number, number, number],\n images.shape\nas [number, number, number, number], alignCorners);\n return backend.runWebGLProgram(program, [dy,\ndy.dtype]);\n}\n\nexport const resizeNearestNeighborGradConfig: KernelConfig = {\n kernelName:\n ResizeNearestNeighborGrad,\n backendName: 'webgl',\n kernelFunc: resizeNearestNeighborGrad as {} as\n KernelFunc\n};\n\n"/**\n * @license\n *\nCopyright 2017 Google LLC. All Rights Reserved.\n * Licensed under the\nApache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the\nLicense.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed\non an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR\n * CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing\npermissions and\n * limitations under the License.\n */\n\n=====\n*/\n\nimport {GPGPUProgram} from './gpgpu_math';\n\nimport {getCoordsDataType} from './shader_compiler';\n\nexport class ReverseProgram implements GPGPUProgram {\n variableNames = ['x'];\n\n outputShape: number[];\n userCode: string;\n\n constructor(xShape: number[], axis: number[]) {\n const rank =
```

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xShape.length;\n if (rank > 4) {\n throw new Error(\n `WebGL backend: Reverse of rank-${rank} tensor
is not yet supported`);\n }\n this.outputShape = xShape;\n\n if (rank === 1) {\n this.userCode = `\n
void main() {\n int coord = getOutputCoords();\n setOutput(getX(${xShape[0]} - coord - 1));\n }\n
`;\n return;\n }\n const getInCoord = (i: number) => {\n if (axis.indexOf(i)
!== -1 && xShape[i] !== 1) {\n return `${xShape[i]} - coords[${i]} - 1`;\n }\n return `coords[${i}]`;\n
};\n const inCoords = xShape.map((_, i) => getInCoord(i)).join(',');\n const type =
getCoordsDataType(rank);\n\n this.userCode = `\n void main() {\n ${type} coords = getOutputCoords();\n
 setOutput(getX(${inCoords}));\n }\n `;\n }\n}\n\n",`**\n * @license\n * Copyright 2019 Google LLC. All
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
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and\n * limitations under the License.\n *
=====
*\n\nimport {GPGPUProgram} from './gpgpu_math';\nimport {getChannels} from './packing_util';\nimport
{getCoordsDataType} from './shader_compiler';\n\nexport class ReversePackedProgram implements
GPGPUProgram {\n variableNames = ['x'];\n outputShape: number[];\n userCode: string;\n packedInputs =
true;\n packedOutput = true;\n\n constructor(xShape: number[], axis: number[]) {\n const rank =
xShape.length;\n if (rank > 4) {\n throw new Error(\n `WebGL backend: Reverse of rank-${rank} tensor
is not yet supported`);\n }\n this.outputShape = xShape;\n const channels = getChannels('rc', rank);\n const
nextColumn =\n `${channels[rank - 1]} + 1 < ${this.outputShape[rank - 1]}`;\n const nextRow =
`${channels[rank - 2]} + 1 < ${this.outputShape[rank - 2]}`;\n const type = getCoordsDataType(rank);\n if (rank
=== 1) {\n
 this.userCode = `\n void main() {\n int rc = getOutputCoords();\n vec4 result = vec4(0);\n
result.r = getChannel(getX(${xShape[0]} - rc - 1),\n ${xShape[0]} - rc - 1);\n if (${nextColumn}) {\n
 result.g = getChannel(getX(${xShape[0]} - (rc + 1) - 1),\n ${xShape[0]} - (rc + 1) - 1);\n }\n
setOutput(result);\n }\n `;\n } else {\n this.userCode = `\n void main() {\n ${type} rc =
getOutputCoords();\n vec4 result = vec4(0);\n result.r = ${getR(channels.slice())};\n
if (${nextColumn}) {\n result.g = ${getG(channels.slice())};\n }\n if (${nextRow}) {\n
result.b = ${getB(channels.slice())};\n if (${nextColumn}) {\n result.a = ${getA(channels.slice())};\n
 }\n }\n setOutput(result);\n }\n `;\n }\n\n function getR(channels: string[]):
string {\n return getChannel(channels);\n }\n\n function getG(channels: string[]): string {\n channels[rank
- 1] = '(' + channels[rank - 1] + ` + 1`;\n return getChannel(channels);\n }\n\n function getB(channels:
string[]): string {\n channels[rank - 2] = '(' + channels[rank - 2] + ` + 1`;\n return getChannel(channels);\n
}\n\n function getA(channels: string[]): string {\n channels[rank - 1] = '(' + channels[rank - 1] + ` + 1`;\n
channels[rank - 2] = '(' + channels[rank - 2] + ` + 1`;\n return getChannel(channels);\n }\n\n function
getChannel(channels: string[]): string {\n const inCoordsArray = xShape.map((_, i) => getInCoord(i,
channels));\n const inCoords = inCoordsArray.join(',');\n const innerDims = inCoordsArray.slice(-
2).join(',');\n return `getChannel(getX(${inCoords}), vec2(${innerDims}))`;\n }\n\n function getInCoord(i:
number, channels1: string[]): string {\n if (axis.indexOf(i)
!== -1 && xShape[i] !== 1) {\n return `${xShape[i]} - ${channels1[i]} - 1`;\n } else {\n return
`${channels1[i]}`;\n }\n }\n }\n}\n\n",`**\n * @license\n * Copyright 2020 Google LLC. All Rights
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```
=====
*\n\nimport {env, KernelConfig, KernelFunc, Reverse, ReverseAttrs, ReverseInputs, TensorInfo, util} from
'@tensorflow/tfjs-core';\n\nimport
{MathBackendWebGL} from '../backend_webgl';\n\nimport {ReverseProgram} from '../reverse_gpu';\n\nimport
{ReversePackedProgram} from '../reverse_packed_gpu';\n\nimport {identity} from './Identity';\n\n\nexport function
reverse(args: {\n inputs: ReverseInputs,\n backend: MathBackendWebGL,\n attrs: ReverseAttrs\n}): TensorInfo
{\n const {inputs, backend, attrs} = args;\n const {x} = inputs;\n const {dims} = attrs;\n\n const xRank =
x.shape.length;\n\n const $dims = util.parseAxisParam(dims, x.shape);\n\n if (xRank === 0) {\n return
identity({inputs: {x}, backend});\n }\n\n const program =
env().getBool('WEBGL_PACK_ARRAY_OPERATIONS') ?\n new ReversePackedProgram(x.shape, $dims) :\n new ReverseProgram(x.shape, $dims);\n\n return backend.runWebGLProgram(program, [x],
x.dtype);\n}\n\n\nexport const reverseConfig: KernelConfig = {\n kernelName: Reverse,\n backendName: 'webgl',\n kernelFunc: reverse as {\n } as KernelFunc\n};\n\n", "/*\n * @license\n
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====
*\n\nimport {backend_util} from '@tensorflow/tfjs-core';\n\nimport {GPGPUProgram} from
'./gpgpu_math';\n\n\nexport class RotateProgram implements GPGPUProgram {\n variableNames = ['Image'];\n outputShape: number[] = [];\n userCode: string;\n\n constructor(\n imageShape: [number, number, number,
number], radians: number,\n fillValue: number|[number, number, number],\n center: number|[number,
number]) {\n const imageHeight = imageShape[1];\n const imageWidth = imageShape[2];\n const sinFactor =
Math.sin(radians).toFixed(3);\n const cosFactor = Math.cos(radians).toFixed(3);\n this.outputShape =
imageShape;\n\n const [centerX, centerY] =\n backend_util.getImageCenter(center, imageHeight,
imageWidth);\n const centerXString = centerX.toFixed(3);\n const centerYString = centerY.toFixed(3);\n\n let
fillSnippet = ";\n if (typeof fillValue === 'number') {\n fillSnippet = `float outputValue =
${fillValue.toFixed(2)};`;\n } else {\n fillSnippet = `\n vec3 fill = vec3(${fillValue.join(',')});\n float
outputValue = fill[coords[3]];`;\n }\n\n this.userCode = `\n void main() {\n ivec4 coords =
getOutputCoords();\n int x = coords[2];\n int y = coords[1];\n float coordXFloat
= (float(x) - ${centerXString}) * ${\n cosFactor} - (float(y) - ${centerYString}) * ${sinFactor};\n float
coordYFloat = (float(x) - ${centerXString}) * ${\n sinFactor} + (float(y) - ${centerYString}) * ${cosFactor};\n
 int coordX = int(round(coordXFloat + ${centerXString}));\n int coordY = int(round(coordYFloat +
${centerYString}));\n ${fillSnippet}\n if(coordX >= 0 && coordX < ${imageWidth} && coordY >= 0
&& coordY < ${\n imageHeight}) {\n outputValue = getImage(coords[0], coordY, coordX, coords[3]);\n
 }\n setOutput(outputValue);\n }\n `;\n }\n}\n\n", "/*\n * @license\n
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http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by
applicable law or agreed to in writing, software\n * distributed under the License is distributed on an 'AS IS'
BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the
License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====
*\n\nimport {KernelConfig, Tensor4D} from '@tensorflow/tfjs-core';\n\nimport {RotateWithOffset,
```

```

RotateWithOffsetAttrs, RotateWithOffsetInputs} from '@tensorflow/tfjs-core';\n\nimport {MathBackendWebGL}
from './backend_webgl';\n\nimport {RotateProgram} from './rotate_gpu';\n\nexport const rotateWithOffsetConfig:
KernelConfig = {\n kernelName: RotateWithOffset,\n backendName: 'webgl',\n kernelFunc: ({inputs, attrs,
backend}) => {\n const {image} = inputs as RotateWithOffsetInputs;\n const {radians, fillValue, center} = attrs
as {} as RotateWithOffsetAttrs;\n const webglBackend = backend as MathBackendWebGL;\n\n const program = new RotateProgram(\n (image as Tensor4D).shape, radians, fillValue, center);\n const
output = webglBackend.runWebGLProgram(program, [image], image.dtype);\n return output;\n } \n};\n\n"/**\n *
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2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific
language governing permissions and\n * limitations under the License.\n *
=====
*/\n\nimport {KernelConfig, Round} from '@tensorflow/tfjs-core';\n\nimport
{unaryKernelFunc} from './kernel_utils/kernel_funcs_utils';\n\nconst ROUND = ` \n // OpenGL ES does not
support round function.\n // The algorithm is based on banker's rounding.\n float base = floor(x);\n if ((x - base) <
0.5) {\n return floor(x);\n } else if ((x - base) > 0.5) {\n return ceil(x);\n } else {\n if (mod(base, 2.0) == 0.0)
{\n return base;\n } else {\n return base + 1.0;\n }\n }`;\n\nexport const round =
unaryKernelFunc({opSnippet: ROUND});\n\nexport const roundConfig: KernelConfig = {\n kernelName:
Round,\n backendName: 'webgl',\n kernelFunc: round,\n};\n\n"/**\n * @license\n * Copyright 2018 Google LLC.
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WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific
language governing permissions and\n * limitations under the License.\n *
=====
*/\n\nimport {GPGPUProgram} from './gpgpu_math';\n\nimport {getCoordsDataType} from
'./shader_compiler';\n\nexport class ScatterProgram implements GPGPUProgram {\n variableNames = ['updates',
'indices', 'defaultValue'];\n outputShape: number[];\n userCode: string;\n\n constructor(\n updateSize: number,
sliceDim: number, indicesRank: number,\n updatesRank: number, strides: number[], shape: number[],\n summingDupeIndex = true) {\n this.outputShape = shape;\n const stridesType =
getCoordsDataType(strides.length);\n const dtype = getCoordsDataType(shape.length);\n let indicesString = `;\n
if (indicesRank
=== 1) {\n indicesString = 'i';\n } else if (indicesRank === 2) {\n indicesString = 'i, j';\n }\n const
indicesSnippet = `getIndices(${indicesString})`; \n\n let updatesString = `;\n if (updatesRank === 1) {\n
updatesString = 'i';\n } else if (updatesRank === 2) {\n updatesString = 'i, coords[1]';\n }\n const
updatesSnippet = `getUpdates(${updatesString})`; \n\n const strideString = sliceDim > 1 ? 'strides[j]' : 'strides';\n
this.userCode = `\n ${stridesType} strides = ${stridesType}(${strides});\n\n void main() {\n ${dtype}
coords = getOutputCoords();\n float sum = 0.0;\n bool found = false;\n for (int i = 0; i <
${updateSize}; i++) {\n int flattenedIndex = 0;\n for (int j = 0; j < ${sliceDim}; j++) {\n int
index = round(${indicesSnippet});\n flattenedIndex += index * ${strideString};\n }\n if
(flattenedIndex == coords[0])\n\n sum += ${updatesSnippet};\n found = true;\n }\n }\n
setOutput(mix(getDefaultValue(), sum, float(found)));\n } \n`;\n\n } \n};\n\n"/**\n * @license\n * Copyright
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you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *

```

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```
=====
\n
*\n\nimport { backend_util, KernelConfig, KernelFunc, ScatterNd, ScatterNdAttrs,
 ScatterNdInputs, TensorInfo } from '@tensorflow/tfjs-core';\n\nimport { MathBackendWebGL } from
 './backend_webgl';\n\nimport { ScatterProgram } from './scatter_gpu';\n\nimport { reshape } from './Reshape';\n\n\nexport
function scatterNd(args: {\n inputs: ScatterNdInputs,\n backend: MathBackendWebGL,\n attrs:
 ScatterNdAttrs\n}): TensorInfo {\n const { inputs, backend, attrs } = args;\n const { indices, updates } = inputs;\n const { shape } = attrs;\n\n const { sliceRank, numUpdates, sliceSize, strides, outputSize } =\n backend_util.calculateShapes(updates, indices, shape);\n\n const flattenShape = [outputSize / sliceSize,
 sliceSize];\n\n if (outputSize === 0) {\n return backend.makeTensorInfo(shape, indices.dtype);\n }\n\n const
 flattenIndices = reshape(\n { inputs: { x: indices }, backend, attrs: { shape: [numUpdates, sliceRank] } });\n const
 flattenX = reshape(\n { inputs: { x: updates }, backend, attrs: { shape: [numUpdates, sliceSize] } });\n\n const
 defaultValue = backend.makeTensorInfo(\n
 [], 'float32', new Float32Array([0])); // scalar(0)\n const program = new ScatterProgram(\n numUpdates,
 sliceRank, flattenIndices.shape.length, flattenX.shape.length,\n strides, flattenShape);\n const res =
 backend.runWebGLProgram(\n program, [flattenX, flattenIndices, defaultValue], flattenX.dtype);\n\n const
 reshaped = reshape({ inputs: { x: res }, backend, attrs: { shape } });\n\n backend.disposeIntermediateTensorInfo(flattenIndices);\n backend.disposeIntermediateTensorInfo(flattenX);\n backend.disposeIntermediateTensorInfo(res);\n backend.disposeIntermediateTensorInfo(defaultValue);\n\n return
 reshaped;\n}\n\n\nexport const scatterNdConfig: KernelConfig = {\n kernelName: ScatterNd,\n backendName:
 'webgl',\n kernelFunc: scatterNd as {} as KernelFunc\n};\n\n", "/*\n * @license\n * Copyright 2017 Google LLC.
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 the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software distributed under the License is distributed on an "AS IS" BASIS, WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied. See the License for the specific language governing permissions and limitations under the License.\n *
 =====
```

```
*\n\nimport { GPGPUProgram } from './gpgpu_math';\n\nimport { getCoordsDataType } from
 './shader_compiler';\n\n\nexport class SelectProgram implements GPGPUProgram {\n variableNames = ['c', 'a', 'b'];\n outputShape: number[];\n userCode: string;\n\n constructor(cRank: number, shape: number[], rank: number) {\n this.outputShape = shape;\n\n let cCoords;\n let abCoords;\n if (rank > 4) {\n throw Error(`Where for rank
 ${rank} is not yet supported`);\n }\n\n if (rank === 1) {\n abCoords = `resRC`;\n cCoords = `resRC`;\n } else {\n const currentCoords =
 ['resRC.x', 'resRC.y', 'resRC.z', 'resRC.w'];\n const cCoordVars = [];\n const abCoordVars = [];\n for (let i
 = 0; i < shape.length; i++) {\n abCoordVars.push(`${currentCoords[i]}`);\n if (i < cRank) {\n cCoordVars.push(`${currentCoords[i]}`);\n }\n }\n cCoords = cCoordVars.join();\n abCoords =
 abCoordVars.join();\n }\n\n const dtype = getCoordsDataType(rank);\n\n this.userCode = `\n void main()
 {\n ${dtype} resRC = getOutputCoords();\n float cVal = getC(${cCoords});\n if (cVal >= 1.0) {\n setOutput(getA(${abCoords}));\n } else {\n setOutput(getB(${abCoords}));\n }\n }\n `;\n }\n\n ", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache
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```
=====
*\n\nimport { KernelConfig, KernelFunc, Select, SelectInputs, TensorInfo, upcastType } from '@tensorflow/tfjs-core';
\nimport { MathBackendWebGL } from '../backend_webgl';
\nimport { SelectProgram } from '../select_gpu';
\nexport function select(args: { inputs: SelectInputs, backend: MathBackendWebGL }):\nTensorInfo {\n const { inputs, backend } = args;\n const { condition, t, e } = inputs;\n\n const program =\n new SelectProgram(condition.shape.length,\n t.shape, t.shape.length);\n return backend.runWebGLProgram(\n program, [condition, t, e], upcastType(t.dtype,\n e.dtype));\n}\n\nexport const selectConfig: KernelConfig = {\n kernelName: Select,\n backendName: 'webgl',\n kernelFunc: select as { } as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====
*\n\nimport { backend_util, KernelConfig, Selu } from '@tensorflow/tfjs-core';
\nimport { unaryKernelFunc } from '../kernel_utils/kernel_funcs_utils';
\nconst SELU =`\n // Stable and Attracting Fixed Point (0, 1) for Normalized Weights.\n // see: https://arxiv.org/abs/1706.02515\n float scaleAlpha =\n ${backend_util.SELU_SCALEALPHA};\n float scale = ${backend_util.SELU_SCALE};\n return (x >= 0.0) ?\n scale * x : scaleAlpha * (exp(x) - 1.0);\n`;\n\nexport const selu = unaryKernelFunc({ opSnippet: SELU });\n\nexport const seluConfig: KernelConfig = {\n kernelName: Selu,\n backendName: 'webgl',\n kernelFunc: selu,\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====
*\n\nimport { KernelConfig, Sigmoid } from '@tensorflow/tfjs-core';
\nimport { unaryKernelFunc } from '../kernel_utils/kernel_funcs_utils';
\nconst SIGMOID =`\nreturn 1.0 / (1.0 + exp(-1.0 * x));\n`;\n\nexport const sigmoid = unaryKernelFunc({ opSnippet: SIGMOID });\n\nexport const sigmoidConfig: KernelConfig = {\n kernelName: Sigmoid,\n backendName: 'webgl',\n kernelFunc: sigmoid,\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
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=====
*\n\nimport { KernelConfig, Sign } from '@tensorflow/tfjs-core';
\nimport { unaryKernelFunc } from '../kernel_utils/kernel_funcs_utils';
\n// Sign does not propagate NaNs.\nconst SIGN =`\n if (isnan(x)) { return 0.0; }\n return sign(x);\n`;\n\nexport const sign = unaryKernelFunc({ opSnippet: SIGN });\n\nexport const signConfig: KernelConfig = {\n kernelName: Sign,\n backendName: 'webgl',\n kernelFunc: sign,\n};\n\n"/**\n *
```

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```
=====\n\n*\n\nimport { KernelConfig, Sin } from '@tensorflow/tfjs-core';\nimport { CHECK_NAN_SNIPPET_UNARY, unaryKernelFunc } from '../kernel_utils/kernel_funcs_utils';\n\nconst SIN = CHECK_NAN_SNIPPET_UNARY +\n\nreturn sin(x);\n\n\nexport const sin = unaryKernelFunc({ opSnippet: SIN });\nexport const sinConfig: KernelConfig = {\n kernelName: Sin,\n backendName: 'webgl',\n kernelFunc: sin,\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
```

```
=====\n\n*\n\nimport { KernelConfig, Sinh } from '@tensorflow/tfjs-core';\nimport { unaryKernelFunc } from '../kernel_utils/kernel_funcs_utils';\n\nconst SINH =\n float e2x = exp(x);\n return (e2x - 1.0 / e2x) / 2.0;\n\n\nexport const sinh = unaryKernelFunc({ opSnippet: SINH });\nexport const sinhConfig: KernelConfig = {\n kernelName: Sinh,\n backendName: 'webgl',\n kernelFunc: sinh,\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
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=====\n\n*\n\nimport { KernelConfig, Softplus } from '@tensorflow/tfjs-core';\nimport { unaryKernelFunc } from '../kernel_utils/kernel_funcs_utils';\n\nconst SOFTPLUS =\n float epsilon = 1.1920928955078125e-7;\n float threshold = log(epsilon) + 2.0;\n bool too_large = x > -threshold;\n bool too_small = x < threshold;\n float result;\n float exp_x = exp(x);\n if (too_large){\n result = x;\n } else if (too_small){\n result = exp_x;\n } else{\n result = log(exp_x + 1.0);\n }\n return result;\n\n\nexport const softplus = unaryKernelFunc({ opSnippet: SOFTPLUS });\nexport const softplusConfig: KernelConfig = {\n kernelName: Softplus,\n backendName: 'webgl',\n kernelFunc: softplus,\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
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```
=====\n\n*\n\nimport { backend_util, KernelConfig, KernelFunc, SpaceToBatchND, SpaceToBatchNDAttrs, SpaceToBatchNDInputs, TensorInfo, util } from '@tensorflow/tfjs-core';\nimport { MathBackendWebGL } from '../backend_webgl';\nimport { padV2 } from './PadV2';\nimport { reshape } from './Reshape';\nimport { transpose } from './Transpose';\n\nexport const spaceToBatchND = (args: {\n inputs: SpaceToBatchNDInputs,\n backend:
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MathBackendWebGL,\n attrs: SpaceToBatchNDAAttrs\n)): TensorInfo => {\n const {inputs, backend, attrs} =
args;\n const {x} = inputs;\n const {blockShape, paddings} = attrs;\n\n util.assert(\n x.shape.length <= 4,\n () => 'spaceToBatchND for rank > 4 with a WebGL backend not ' +\n 'implemented yet');\n\n const prod = blockShape.reduce((a, b) => a * b);\n\n const completePaddings: Array<[number, number]>
= [[0, 0]];\n completePaddings.push(...paddings as Array<[number, number]>);\n for (let i = 1 +
blockShape.length; i < x.shape.length; ++i) {\n completePaddings.push([0, 0]);\n }\n\n const toDispose = [];\n\n const paddedX = padV2({\n inputs: {x},\n backend,\n attrs: {paddings: completePaddings, constantValue:
0}\n });\n\n const reshapedPaddedShape =\n backend_util.getReshaped(paddedX.shape, blockShape, prod,
false);\n\n const permutedReshapedPaddedPermutation = backend_util.getPermuted(\n
reshapedPaddedShape.length, blockShape.length, false);\n\n const flattenShape =\n backend_util.getReshapedPermuted(paddedX.shape, blockShape, prod, false);\n\n const reshapedPaddedX =
reshape(\n {inputs: {x: paddedX}, backend, attrs: {shape: reshapedPaddedShape}});\n\n const paddedXT =
transpose({\n inputs: {x: reshapedPaddedX},\n
 backend,\n attrs: {perm: permutedReshapedPaddedPermutation}\n });\n\n const result =\n reshape({inputs:
{x: paddedXT}, backend, attrs: {shape: flattenShape}});\n\n toDispose.push(paddedX);\n
toDispose.push(reshapedPaddedX);\n toDispose.push(paddedXT);\n\n toDispose.forEach(t =>
backend.disposeIntermediateTensorInfo(t));\n\n return result;\n});\n\nexport const spaceToBatchNDConfig:
KernelConfig = {\n kernelName: SpaceToBatchND,\n backendName: 'webgl',\n kernelFunc: spaceToBatchND as
{} as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed
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=====
*\n\nimport {backend_util, KernelConfig, KernelFunc, SparseToDense, SparseToDenseAttrs,
SparseToDenseInputs, TensorInfo} from '@tensorflow/tfjs-core';\n\nimport {MathBackendWebGL} from
'./backend_webgl';\nimport {ScatterProgram} from './scatter_gpu';\nimport {reshape} from './Reshape';\n\nexport
function sparseToDense(args: {\n inputs: SparseToDenseInputs,\n backend: MathBackendWebGL,\n attrs:
SparseToDenseAttrs\n}): TensorInfo {\n const {inputs, backend, attrs} = args;\n const {sparseIndices,
sparseValues, defaultValue} = inputs;\n const {outputShape} = attrs;\n\n const {sliceRank, numUpdates, strides,
outputSize} =\n backend_util.calculateShapes(sparseValues, sparseIndices, outputShape);\n\n const
sumDupeIndices = false;\n\n const program = new ScatterProgram(\n numUpdates, sliceRank, sparseIndices.shape.length,\n
sparseValues.shape.length, strides, [outputSize, 1], sumDupeIndices);\n\n const res =
backend.runWebGLProgram(\n program, [sparseValues, sparseIndices, defaultValue], sparseValues.dtype);\n\n
const reshaped =\n reshape({inputs: {x: res}, backend, attrs: {shape: outputShape}});\n\n
backend.disposeIntermediateTensorInfo(res);\n return reshaped;\n}\n\nexport const sparseToDenseConfig:
KernelConfig = {\n kernelName: SparseToDense,\n backendName: 'webgl',\n kernelFunc: sparseToDense as {} as
KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
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*\\n\\nimport {backend_util, KernelConfig, KernelFunc, SplitV, SplitVAttrs, SplitVInputs, TensorInfo, util} from
'@tensorflow/tfjs-core';\\n\\nimport {MathBackendWebGL} from '../backend_webgl';\\nimport {slice} from
'./Slice';\\n\\nexport function splitV(\\n args:\\n {inputs: SplitVInputs, backend: MathBackendWebGL, attrs:
SplitVAttrs}):\\n TensorInfo[] {\\n const {inputs, backend, attrs} = args;\\n const {x} = inputs;\\n const
{numOrSizeSplits, axis} = attrs;\\n\\n const $axis = util.parseAxisParam(axis, x.shape)[0];\\n const splitSizes =
backend_util.prepareSplitSize(x, numOrSizeSplits, $axis);\\n\\n const xRank = x.shape.length;\\n const
begin = new Array(xRank).fill(0);\\n const size = x.shape.slice();\\n\\n return splitSizes.map(s => {\\n const
sliceSize = [...size];\\n sliceSize[$axis] = s;\\n const sliceT =\\n slice({inputs: {x}, backend, attrs: {begin, size:
sliceSize}});\\n begin[$axis] += s;\\n return sliceT;\\n });\\n}\\n\\nexport const splitVConfig: KernelConfig = {\\n
kernelName: SplitV,\\n backendName: 'webgl',\\n kernelFunc: splitV as { } as KernelFunc\\n};\\n", "/*\\n *
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\\n * See the License
for the specific language governing permissions and\\n * limitations under the License.\\n *
=====\\n
*\\n\\nimport {KernelConfig, KernelFunc, Sqrt} from '@tensorflow/tfjs-core';\\nimport {unaryKernelFunc} from
'../kernel_utils/kernel_funcs_utils';\\n\\nconst Sqrt = `return sqrt(x);`;\\n\\nexport const sqrt =
unaryKernelFunc({opSnippet: Sqrt});\\n\\nexport const sqrtConfig: KernelConfig = {\\n kernelName: Sqrt,\\n
backendName: 'webgl',\\n kernelFunc: sqrt as { } as KernelFunc\\n};\\n", "/*\\n * @license\\n * Copyright 2019
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for the specific language governing permissions and\\n * limitations under the License.\\n *
=====\\n
*\\n\\nimport {KernelConfig, Square} from '@tensorflow/tfjs-core';\\nimport {unaryKernelFunc} from
'../kernel_utils/kernel_funcs_utils';\\n\\nconst SQUARE = `return x * x;`;\\n\\nexport const square =
unaryKernelFunc({opSnippet: SQUARE});\\n\\nexport const squareConfig: KernelConfig = {\\n kernelName:
Square,\\n backendName: 'webgl',\\n kernelFunc: square,\\n};\\n", "/*\\n * @license\\n * Copyright 2020 Google LLC.
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OR CONDITIONS OF ANY KIND, either express or implied.\\n * See the License for the specific language
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=====\\n
*\\n\\nimport {KernelConfig, KernelFunc, Step, StepAttrs, TensorInfo, UnaryInputs} from '@tensorflow/tfjs-
core';\\nimport {MathBackendWebGL} from '../backend_webgl';\\nimport {CHECK_NAN_SNIPPET,
UnaryOpProgram} from '../unaryop_gpu';\\n\\nexport function step(\\n {inputs, attrs, backend}:\\n {inputs:
UnaryInputs, attrs: StepAttrs, backend: MathBackendWebGL}):\\n TensorInfo {\\n const {x} = inputs;\\n const
opSnippet = CHECK_NAN_SNIPPET + `\\n return x > 0.0 ? 1.0 : float(${attrs.alpha});\\n `;\\n\\n const program =
new UnaryOpProgram(x.shape, opSnippet);\\n\\n return backend.runWebGLProgram(program, [x],
x.dtype);\\n}\\n\\nexport const
stepConfig: KernelConfig = {\\n kernelName: Step,\\n backendName: 'webgl',\\n kernelFunc: step as { } as
KernelFunc,\\n};\\n", "/*\\n * @license\\n * Copyright 2017 Google LLC. All Rights Reserved.\\n * Licensed under the

```

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```
=====
*import { GPGPUProgram } from './gpgpu_math';import { getCoordsDataType } from
'./shader_compiler';export class StridedSliceProgram implements GPGPUProgram
{
 variableNames = ['x'];
 outputShape: number[];
 userCode: string;
 constructor(begin: number[], strides:
number[], size: number[]) {
 this.outputShape = size;
 const rank = size.length;
 const inputDtype =
getCoordsDataType(size.length);
 const dtype = getCoordsDataType(size.length);
 let newCoords = "";
 if (rank === 1) {
 newCoords = 'coords * strides + begin';
 } else {
 let outputAxis = 0;
 newCoords
= size.map((_, i) => {
 outputAxis++;
 return size.length === 1 ? `coords
* strides[${i}] + begin[${i}]` : `coords[${outputAxis - 1}] * strides[${i}] + begin[${i}]`;
 }).join(',');
 }
 this.userCode = `
 ${inputDtype} begin = ${inputDtype}(${begin});
 ${inputDtype} strides = ${inputDtype}(${strides});
 void main() {
 ${dtype} coords =
getOutputCoords();
 setOutput(getX(${newCoords}));
 }
 `;
}
}
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 */
=====
```

```
*import { buffer, KernelConfig, KernelFunc, Rank, slice_util, StridedSlice, StridedSliceAttrs,
StridedSliceInputs, TensorBuffer, TensorInfo, TypedArray } from '@tensorflow/tfjs-core';import
{ MathBackendWebGL } from './backend_webgl';import
{ stridedSliceImplCPU } from './kernel_utils/shared';import { StridedSliceProgram } from
'./strided_slice_gpu';import { reshape } from './Reshape';import { slice } from './Slice';export function
stridedSlice(args: {
 inputs: StridedSliceInputs,
 backend: MathBackendWebGL,
 attrs: StridedSliceAttrs
}):
TensorInfo {
 const { inputs, backend, attrs } = args;
 const { x } = inputs;
 const {
 begin,
 end,
 strides,
 beginMask,
 endMask,
 ellipsisMask,
 newAxisMask,
 shrinkAxisMask
 } = attrs;
 const { nonStrided, $begin, $strides, size, newShape, outShape } = slice_util.sliceInfo(x.shape, begin,
end, strides, beginMask, endMask, ellipsisMask, newAxisMask, shrinkAxisMask);
 const $x =
reshape({ inputs: { x }, backend, attrs: { shape: newShape } });
 let result;
 if (nonStrided) {
 const sliced = slice({ inputs: { x: $x }, backend, attrs: { begin: $begin, size } });
 result = reshape({ inputs:
{ x: sliced }, backend, attrs: { shape: outShape } });
 } else if (outShape.some(axis => axis === 0)) {
 result = backend.makeTensorInfo(outShape, x.dtype, []);
 } else {
 const shouldExecuteOnCPU = backend.shouldExecuteOnCPU($x);
 if (shouldExecuteOnCPU) {
 const
xTexData = backend.texData.get($x.dataId);
 const values = xTexData.values as TypedArray;
 const xBuf
= buffer($x.shape, $x.dtype, values) as TensorBuffer<Rank>;
 const resultValues =
stridedSliceImplCPU(outShape, xBuf, $strides, $begin);
 result = backend.makeTensorInfo(outShape, $x.dtype,
resultValues.values);
 } else {
 const program = new StridedSliceProgram($begin, $strides, outShape);
 result = backend.runWebGLProgram(program, [$x], $x.dtype);
 }
 }
 const resultReshaped =
reshape({ inputs: { x: result }, backend, attrs: { shape: outShape } });
 backend.disposeIntermediateTensorInfo($x);
}
```

```

backend.disposeIntermediateTensorInfo(result);\n\n return resultReshaped;\n}\n\nexport const stridedSliceConfig:
KernelConfig = {\n kernelName: StridedSlice,\n backendName: 'webgl',\n kernelFunc: stridedSlice as { } as
KernelFunc\n};\n", "/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
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```

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```
=====\n
*\n\nimport {buffer, KernelConfig, KernelFunc, TensorInfo, Tile, TileAttrs, TileInputs, util} from
'@tensorflow/tfjs-core';\n\nimport {MathBackendWebGL} from '../backend_webgl';\nimport {tileImplCPU} from
'../kernel_utils/shared';\nimport {TileProgram} from '../tile_gpu';\n\nexport function tile(\n params: {inputs:
TileInputs, backend: MathBackendWebGL, attrs: TileAttrs});\n TensorInfo {\n const {inputs, backend, attrs} =
params;\n const {x} = inputs;\n const {reps} = attrs;\n\n if (x.dtype === 'string') {\n // Even though string tensor
is always on CPU, just to be consistent on how\n // to access tensor data.\n const data =
backend.readSync(x.dataId) as Uint8Array[];\n const decodedData = data.map(d => util.decodeString(d));\n const buf = buffer(x.shape,
x.dtype, decodedData);\n const outBuf = tileImplCPU(buf, reps);\n return
backend.makeTensorInfo(outBuf.shape, outBuf.dtype, outBuf.values);\n }\n\n const program = new
TileProgram(x.shape, reps);\n const output = backend.runWebGLProgram(program, [x], x.dtype);\n\n return
output;\n }\n\nexport const tileConfig: KernelConfig = {\n kernelName: Tile,\n backendName: 'webgl',\n kernelFunc: tile as { } as KernelFunc,\n }; \n ,"/**\n * @license\n * Copyright 2020 Google LLC. All Rights
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
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```
=====\n
*\n\nimport {KernelConfig, KernelFunc, NumericDataType, TensorInfo, TopK, TopKAttrs, TopKInputs,
TypedArray} from '@tensorflow/tfjs-core';\n\nimport {MathBackendWebGL} from '../backend_webgl';\nimport
{topKImplCPU} from '../kernel_utils/shared';\n\nexport function topK(\n args: {inputs: TopKInputs, backend:
MathBackendWebGL, attrs: TopKAttrs});\n TensorInfo[] {\n const {inputs, backend, attrs} = args;\n const {x} =
inputs;\n const {k, sorted} = attrs;\n\n const xVals = backend.readSync(x.dataId) as TypedArray;\n const
[allTopKVals, allTopKIndices] =\n topKImplCPU(xVals, x.shape, x.dtype as NumericDataType, k, sorted);\n\n return [\n backend.makeTensorInfo(\n allTopKVals.shape, allTopKVals.dtype, allTopKVals.values),\n backend.makeTensorInfo(\n allTopKIndices.shape, allTopKIndices.dtype, allTopKIndices.values)\n];\n }\n\nexport const topKConfig: KernelConfig = {\n kernelName: TopK,\n backendName: 'webgl',\n kernelFunc: topK as { } as KernelFunc,\n }; \n ,"/**\n * @license\n * Copyright 2020 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the License);\n * you may not use this file except in
compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an AS IS BASIS,\n * WITHOUT WARRANTIES OR
CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing
permissions and\n * limitations under the License.\n *
```

```
=====\n
*\n\nimport {KernelConfig, KernelFunc, TensorInfo, Unique, UniqueAttrs, UniqueInputs} from '@tensorflow/tfjs-
core';\n\nimport {MathBackendWebGL}
from '../backend_webgl';\nimport {uniqueImplCPU} from '../kernel_utils/shared';\nimport {assertNotComplex}
from '../webgl_util';\n\nexport function unique(\n args: {\n inputs: UniqueInputs, attrs: UniqueAttrs, backend:
MathBackendWebGL});\n TensorInfo[] {\n const {inputs, attrs, backend} = args;\n const {axis} = attrs;\n const
{x} = inputs;\n assertNotComplex(x, 'unique');\n\n // For now, always forward calculation to the CPU backend.\n console.warn(\n 'WARNING: ',\n 'UI might be locked temporarily as data is being downloaded');\n const
```

```

values = backend.readSync(x.dataId);\n const {outputValues, outputShape, indices} =\n uniqueImplCPU(values,\n axis, x.shape, x.dtype);\n return [\n backend.makeTensorInfo(outputShape, x.dtype, outputValues),\n backend.makeTensorInfo([indices.length], 'int32', indices),\n];\n}\n\nexport const uniqueConfig: KernelConfig =\n{\n kernelName: Unique,\n backendName: 'webgl',\n kernelFunc: unique as {\n as KernelFunc,\n};\n},"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under\n the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the\n License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed\n on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or\n implied.\n * See the License for the specific language governing permissions and\n * limitations under the\n License.\n *

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*\n\nimport {KernelConfig, KernelFunc, TensorInfo, Unpack, UnpackAttrs, UnpackInputs} from\n '@tensorflow/tfjs-core';\n\nimport {MathBackendWebGL} from '../backend_webgl';\n\nimport {reshape} from\n './Reshape';\n\nimport {slice} from './Slice';\n\nexport function\n unpack(\n args:\n {inputs: UnpackInputs, backend: MathBackendWebGL, attrs: UnpackAttrs});\n\nTensorInfo[] {\n const {inputs, backend, attrs} = args;\n const {value} = inputs;\n let {axis} = attrs;\n if (axis <\n 0) {\n axis += value.shape.length;\n }\n const x = value;\n const xRank = x.shape.length;\n const num =\n value.shape[axis];\n const outShape: number[] = new Array(xRank - 1);\n let outIndex = 0;\n for (let i = 0; i <\n xRank; i++) {\n if (i !== axis) {\n outShape[outIndex++] = x.shape[i];\n }\n }\n const toDispose = [];\n const begin = new Array(xRank).fill(0);\n const size = x.shape.slice();\n size[axis] = 1;\n const res: TensorInfo[] =\n new Array(num);\n for (let i = 0; i < res.length; i++) {\n begin[axis] = i;\n const sliced = slice({inputs: {x},\n backend, attrs: {begin, size}});\n const reshaped =\n reshape({inputs: {x: sliced}, backend, attrs: {shape:\n outShape}});\n res[i] = reshaped;\n toDispose.push(sliced);\n }\n toDispose.forEach(t => backend.disposeIntermediateTensorInfo(t));\n return res;\n}\n\nexport const\n unpackConfig: KernelConfig = {\n kernelName: Unpack,\n backendName: 'webgl',\n kernelFunc: unpack as {\n as KernelFunc\n};\n},"/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the\n Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the\n License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed\n on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or\n implied.\n * See the License for the specific language governing permissions and\n * limitations under the\n License.\n *

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*\n\nimport {backend_util} from\n '@tensorflow/tfjs-core';\n\nimport {GPGPUProgram} from '../gpgpu_math';\n\nexport class SegmentOpProgram\n implements GPGPUProgram {\n variableNames = ['x', 'segmentIds'];\n outputShape: number[];\n userCode:\n string;\n constructor(\n segOpInfo: backend_util.segment_util.SegOpInfo,\n segOpType:\n 'unsortedSegmentSum') {\n const windowSize = segOpInfo.windowSize;\n const batchSize =\n segOpInfo.batchSize;\n const inSize = segOpInfo.inSize;\n const numSegments = segOpInfo.numSegments;\n const outSize = numSegments * Math.ceil(inSize / windowSize);\n this.outputShape = [batchSize, outSize];\n const initializationValue = '0.0';\n const returnValue = `sumValue`;\n const windowSizeNearestVec4 =\n Math.floor(windowSize / 4) * 4;\n const windowSizeVec4Remainder = windowSize % 4;\n const\n updateSnippet = `\n sumValue += dot(values, segFilter);\n `;\n let checkValueOutOfBounds = `;\n if\n (inSize % windowSize > 0) {\n checkValueOutOfBounds\n = `\n if (inIdx < 0 || inIdx >= ${inSize}) {\n return initializationValue;\n }\n `;\n }\n let\n checkSegmentIdOutOfBounds = `;\n if (inSize % windowSize > 0) {\n checkSegmentIdOutOfBounds = `\n if (inIdx < 0 || inIdx >= ${inSize}) {\n return -1.0;\n }\n `;\n }\n this.userCode = `\n const float

```



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initializationValue = ${initializationValue};\n\n float getValue(int batch, int inIdx) {\n
${checkValueOutOfBounds}\n return getX(batch, inIdx);\n }\n\n float getSegmentIdAtIndex(int inIdx)
{\n ${checkSegmentIdOutOfBounds}\n return getSegmentIds(inIdx);\n }\n\n void main() {\n
ivec2 coords = getOutputCoords();\n int batch = coords[0];\n int outIdx = coords[1];\n int inOffset =
int(floor(float(outIdx) / float(\n ${numSegments})) * float(${windowSize}));\n int currentSeg =
int(mod(float(outIdx), float(${numSegments}))); \n\n
float sumValue = 0.0;\n\n for (int i = 0; i < ${windowSizeNearestVec4}; i += 4) {\n int inIdx =
inOffset + i;\n vec4 values = vec4(\n getValue(batch, inIdx),\n getValue(batch, inIdx + 1),\n
getValue(batch, inIdx + 2),\n getValue(batch, inIdx + 3)\n);\n\n vec4 segFilter = vec4(\n
int(getSegmentIdAtIndex(inIdx)) == currentSeg ? 1 : 0,\n int(getSegmentIdAtIndex(inIdx + 1)) ==
currentSeg ? 1 : 0,\n int(getSegmentIdAtIndex(inIdx + 2)) == currentSeg ? 1 : 0,\n
int(getSegmentIdAtIndex(inIdx + 3)) == currentSeg ? 1 : 0\n);\n\n ${updateSnippet}\n }\n\n int
inIdx = inOffset + ${windowSizeNearestVec4};\n if (${windowSizeVec4Remainder} == 1) {\n vec4
values = vec4(\n getValue(batch, inIdx),\n initializationValue,\n initializationValue,\n
initializationValue\n
);\n\n int inIdxSeg = int(getSegmentIdAtIndex(inIdx));\n\n vec4 segFilter = vec4(\n
int(getSegmentIdAtIndex(inIdx)) == currentSeg ? 1 : 0,\n 0,\n 0,\n 0\n);\n\n
${updateSnippet}\n } else if (${windowSizeVec4Remainder} == 2) {\n vec4 values = vec4(\n
getValue(batch, inIdx),\n getValue(batch, inIdx + 1),\n initializationValue,\n
initializationValue\n
);\n\n vec4 segFilter = vec4(\n int(getSegmentIdAtIndex(inIdx)) ==
currentSeg ? 1 : 0,\n int(getSegmentIdAtIndex(inIdx + 1)) == currentSeg ? 1 : 0,\n 0,\n 0\n
);\n\n ${updateSnippet}\n } else if (${windowSizeVec4Remainder} == 3) {\n vec4 values =
vec4(\n getValue(batch, inIdx),\n getValue(batch, inIdx + 1),\n getValue(batch, inIdx + 2),\n
initializationValue\n
);\n\n vec4 segFilter = vec4(\n int(getSegmentIdAtIndex(inIdx)) == currentSeg ? 1 : 0,\n
int(getSegmentIdAtIndex(inIdx + 1)) == currentSeg ? 1 : 0,\n int(getSegmentIdAtIndex(inIdx + 2)) ==
currentSeg ? 1 : 0,\n 0\n);\n\n ${updateSnippet}\n }\n\n setOutput(${returnValue});\n
}\n\n `;\n }\n\n", "/*\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the
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and\n * limitations under the License.\n *
===== \n
*/\n\nimport {backend_util, DataType, KernelConfig, KernelFunc, sumOutType, TensorInfo,
UnsortedSegmentSum, UnsortedSegmentSumAttrs, UnsortedSegmentSumInputs, util} from '@tensorflow/tfjs-
core';\n\nimport {MathBackendWebGL} from '../backend_webgl';\nimport {SegmentOpProgram} from
'./segment_gpu';\n\nimport {range} from './Range';\nimport {reshape} from './Reshape';\nimport {tile} from
'./Tile';\nimport {transpose} from './Transpose';\n\nexport function unsortedSegmentSum(args: {\n inputs:
UnsortedSegmentSumInputs,\n backend: MathBackendWebGL,\n attrs: UnsortedSegmentSumAttrs\n}):
TensorInfo {\n const {inputs, backend, attrs} = args;\n const {x, segmentIds} = inputs;\n const {numSegments} =
attrs;\n\n const xRank = x.shape.length;\n\n const toDispose = [];\n\n let axis = 0;\n const permutation =
backend_util.getAxesPermutation([axis], xRank);\n\n let
permutedX = x;\n if (permutation != null) {\n permutedX = transpose({inputs: {x}, backend, attrs: {perm:
permutation}});\n toDispose.push(permutedX);\n axis = backend_util.getInnerMostAxes(1, xRank)[0];\n }\n\n
const outShape = backend_util.segment_util.computeOutShape(\n permutedX.shape, axis, numSegments);\n
const inSize = util.sizeFromShape([permutedX.shape[axis]]);\n const a2D =\n reshape({inputs: {x: permutedX},

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backend, attrs: {shape: [-1, inSize] }));\n toDispose.push(a2D);\n\n const outputDType =
sumOutType(x.dtype);\n\n const segOpCompute =\n (x: TensorInfo, segOpType: 'unsortedSegmentSum',
segmentIds: TensorInfo,\n dtype: DataType, numSegments: number): TensorInfo => {\n const batchSize =
x.shape[0];\n const inSize = x.shape[1];\n const windowSize =\nbackend_util.segment_util.segOpComputeOptimalWindowSize(\n inSize, numSegments);\n const
segOpInfo = {windowSize, inSize, batchSize, numSegments};\n\n const program = new SegmentOpProgram(segOpInfo, segOpType);\n const output =
backend.compileAndRun(program, [x, segmentIds], dtype);\n toDispose.push(output);\n // No need to run
another GPGPU program.\n if (output.shape[1] === numSegments) {\n return output;\n }\n const
rangeInfo = range({\n backend,\n attrs: {start: 0, stop: numSegments, step: 1, dtype: 'float32'}\n });\n\n const tileInfo = tile({\n inputs: {x: rangeInfo},\n backend,\n attrs: {reps: [inSize /
windowSize]}\n });\n\n toDispose.push(rangeInfo);\n toDispose.push(tileInfo);\n\n const result =\n segOpCompute(output, segOpType, tileInfo, dtype, numSegments);\n return result;\n });\n\n const
segOpResult = segOpCompute(\n a2D, 'unsortedSegmentSum', segmentIds, outputDType, numSegments);\n\n const reshaped =\n reshape({inputs: {x: segOpResult},
backend, attrs: {shape: outShape} }));\n\n let result = reshaped;\n if (permutation != null) {\n
toDispose.push(reshaped);\n const perm = backend_util.getUndoAxesPermutation(permutation);\n result =
transpose({inputs: {x: result}, backend, attrs: {perm} }));\n }\n\n toDispose.forEach(t =>
backend.disposeIntermediateTensorInfo(t));\n return result;\n}\n\nexport const unsortedSegmentSumConfig:
KernelConfig = {\n kernelName: UnsortedSegmentSum,\n backendName: 'webgl',\n kernelFunc:
unsortedSegmentSum as {} as KernelFunc\n};\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights
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http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
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for the specific language governing permissions and\n * limitations under the License.\n *\n
=====
*/\nimport {KernelConfig, registerKernel} from '@tensorflow/tfjs-core';\n\nimport {_fusedMatMulConfig} from
'./kernels/_FusedMatMul';\nimport {absConfig} from './kernels/Abs';\nimport {acosConfig} from
'./kernels/Acos';\nimport {acoshConfig} from './kernels/Acosh';\nimport {addConfig} from './kernels/Add';\nimport
{addNConfig} from './kernels/AddN';\nimport {allConfig} from './kernels/All';\nimport {anyConfig} from
'./kernels/Any';\nimport {argMaxConfig} from './kernels/ArgMax';\nimport {argMinConfig} from
'./kernels/ArgMin';\nimport {asinConfig} from './kernels/Asin';\nimport {asinhConfig} from
'./kernels/Asinh';\nimport {atanConfig} from './kernels/Atan';\nimport {atan2Config} from
'./kernels/Atan2';\nimport {atanhConfig}
from './kernels/Atanh';\nimport {avgPoolConfig} from './kernels/AvgPool';\nimport {avgPool3DConfig} from
'./kernels/AvgPool3D';\nimport {avgPoolGrad3DConfig} from './kernels/AvgPool3DGrad';\nimport
{avgPoolGradConfig} from './kernels/AvgPoolGrad';\nimport {batchMatMulConfig} from
'./kernels/BatchMatMul';\nimport {batchNormConfig} from './kernels/BatchNorm';\nimport
{batchToSpaceNDConfig} from './kernels/BatchToSpaceND';\nimport {bincountConfig} from
'./kernels/Bincount';\nimport {castConfig} from './kernels/Cast';\nimport {ceilConfig} from './kernels/Ceil';\nimport
{clipByValueConfig} from './kernels/ClipByValue';\nimport {complexConfig} from './kernels/Complex';\nimport
{complexAbsConfig} from './kernels/ComplexAbs';\nimport {concatConfig} from './kernels/Concat';\nimport
{conv2DConfig} from './kernels/Conv2D';\nimport {conv2DBackpropFilterConfig} from
'./kernels/Conv2DBackpropFilter';\nimport {conv2DBackpropInputConfig} from
'./kernels/Conv2DBackpropInput';\nimport {conv3DConfig} from

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'./kernels/Conv3D';\nimport {conv3DBackpropFilterV2Config} from './kernels/Conv3DBackpropFilterV2';\nimport
{conv3DBackpropInputConfig} from './kernels/Conv3DBackpropInputV2';\nimport {cosConfig} from
'./kernels/Cos';\nimport {coshConfig} from './kernels/Cosh';\nimport {cropAndResizeConfig} from
'./kernels/CropAndResize';\nimport {cumsumConfig} from './kernels/Cumsum';\nimport {denseBincountConfig}
from './kernels/DenseBincount';\nimport {depthToSpaceConfig} from './kernels/DepthToSpace';\nimport
{depthwiseConv2dNativeConfig} from './kernels/DepthwiseConv2dNative';\nimport
{depthwiseConv2dNativeBackpropFilterConfig} from './kernels/DepthwiseConv2dNativeBackpropFilter';\nimport
{depthwiseConv2dNativeBackpropInputConfig} from './kernels/DepthwiseConv2dNativeBackpropInput';\nimport
{diagConfig} from './kernels/Diag';\nimport {dilation2DConfig} from './kernels/Dilation2D';\nimport {eluConfig}
from './kernels/Elu';\nimport {eluGradConfig} from './kernels/EluGrad';\nimport {equalConfig}
from './kernels/Equal';\nimport {erfConfig} from './kernels/Erf';\nimport {expConfig} from './kernels/Exp';\nimport
{expandDimsConfig} from './kernels/ExpandDims';\nimport {expm1Config} from './kernels/Expm1';\nimport
{fftConfig} from './kernels/FFT';\nimport {fillConfig} from './kernels/Fill';\nimport {flipLeftRightConfig} from
'./kernels/FlipLeftRight';\nimport {floorConfig} from './kernels/Floor';\nimport {floorDivConfig} from
'./kernels/FloorDiv';\nimport {fromPixelsConfig} from './kernels/FromPixels';\nimport {fusedConv2DConfig} from
'./kernels/FusedConv2D';\nimport {fusedDepthwiseConv2DConfig} from
'./kernels/FusedDepthwiseConv2D';\nimport {gatherNdConfig} from './kernels/GatherNd';\nimport
{gatherV2Config} from './kernels/GatherV2';\nimport {greaterConfig} from './kernels/Greater';\nimport
{greaterEqualConfig} from './kernels/GreaterEqual';\nimport {identityConfig} from './kernels/Identity';\nimport
{ifftConfig} from './kernels/IFFT';\nimport {imagConfig} from './kernels/Imag';\nimport
{isFiniteConfig} from './kernels/IsFinite';\nimport {isInfConfig} from './kernels/IsInf';\nimport {isNaNConfig}
from './kernels/IsNaN';\nimport {leakyReluConfig} from './kernels/LeakyRelu';\nimport {lessConfig} from
'./kernels/Less';\nimport {lessEqualConfig} from './kernels/LessEqual';\nimport {linSpaceConfig} from
'./kernels/LinSpace';\nimport {logConfig} from './kernels/Log';\nimport {log1pConfig} from
'./kernels/Log1p';\nimport {logicalAndConfig} from './kernels/LogicalAnd';\nimport {logicalNotConfig} from
'./kernels/LogicalNot';\nimport {logicalOrConfig} from './kernels/LogicalOr';\nimport {LRNConfig} from
'./kernels/LRN';\nimport {LRNGradConfig} from './kernels/LRNGrad';\nimport {maxConfig} from
'./kernels/Max';\nimport {maximumConfig} from './kernels/Maximum';\nimport {maxPoolConfig} from
'./kernels/MaxPool';\nimport {maxPool3DConfig} from './kernels/MaxPool3D';\nimport {maxPoolGrad3DConfig}
from './kernels/MaxPool3DGrad';\nimport {maxPoolGradConfig} from './kernels/MaxPoolGrad';\nimport
{maxPoolWithArgmaxConfig} from './kernels/MaxPoolWithArgmax';\nimport {meanConfig} from
'./kernels/Mean';\nimport {minConfig} from './kernels/Min';\nimport {minimumConfig} from
'./kernels/Minimum';\nimport {mirrorPadConfig} from './kernels/MirrorPad';\nimport {modConfig} from
'./kernels/Mod';\nimport {multinomialConfig} from './kernels/Multinomial';\nimport {multiplyConfig} from
'./kernels/Multiply';\nimport {negConfig} from './kernels/Neg';\nimport {nonMaxSuppressionV3Config} from
'./kernels/NonMaxSuppressionV3';\nimport {nonMaxSuppressionV4Config} from
'./kernels/NonMaxSuppressionV4';\nimport {nonMaxSuppressionV5Config} from
'./kernels/NonMaxSuppressionV5';\nimport {notEqualConfig} from './kernels/NotEqual';\nimport {oneHotConfig}
from './kernels/OneHot';\nimport {onesLikeConfig} from './kernels/OnesLike';\nimport {packConfig} from
'./kernels/Pack';\nimport {padV2Config} from './kernels/PadV2';\nimport {powConfig} from
'./kernels/Pow';\nimport {preluConfig} from './kernels/Prelu';\nimport
{prodConfig} from './kernels/Prod';\nimport {rangeConfig} from './kernels/Range';\nimport {realConfig} from
'./kernels/Real';\nimport {realDivConfig} from './kernels/RealDiv';\nimport {reciprocalConfig} from
'./kernels/Reciprocal';\nimport {reluConfig} from './kernels/Relu';\nimport {relu6Config} from
'./kernels/Relu6';\nimport {reshapeConfig} from './kernels/Reshape';\nimport {resizeBilinearConfig} from
'./kernels/ResizeBilinear';\nimport {resizeBilinearGradConfig} from './kernels/ResizeBilinearGrad';\nimport
{resizeNearestNeighborConfig} from './kernels/ResizeNearestNeighbor';\nimport
{resizeNearestNeighborGradConfig} from './kernels/ResizeNearestNeighborGrad';\nimport {reverseConfig} from

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'./kernels/Reverse';\nimport {rotateWithOffsetConfig} from './kernels/RotateWithOffset';\nimport {roundConfig}
from './kernels/Round';\nimport {rsqrtConfig} from './kernels/Rsqrt';\nimport {scatterNdConfig} from
'./kernels/ScatterNd';\nimport {selectConfig} from './kernels/Select';\nimport
{seluConfig} from './kernels/Selu';\nimport {sigmoidConfig} from './kernels/Sigmoid';\nimport {signConfig} from
'./kernels/Sign';\nimport {sinConfig} from './kernels/Sin';\nimport {sinhConfig} from './kernels/Sinh';\nimport
{sliceConfig} from './kernels/Slice';\nimport {softmaxConfig} from './kernels/Softmax';\nimport {softplusConfig}
from './kernels/Softplus';\nimport {spaceToBatchNDConfig} from './kernels/SpaceToBatchND';\nimport
{sparseToDenseConfig} from './kernels/SparseToDense';\nimport {splitVConfig} from './kernels/SplitV';\nimport
{sqrtConfig} from './kernels/Sqrt';\nimport {squareConfig} from './kernels/Square';\nimport
{squaredDifferenceConfig} from './kernels/SquaredDifference';\nimport {stepConfig} from './kernels/Step';\nimport
{stridedSliceConfig} from './kernels/StridedSlice';\nimport {subConfig} from './kernels/Sub';\nimport {sumConfig}
from './kernels/Sum';\nimport {tanConfig} from './kernels/Tan';\nimport {tanhConfig} from './kernels/Tanh';\nimport
{tileConfig}
from './kernels/Tile';\nimport {topKConfig} from './kernels/TopK';\nimport {transposeConfig} from
'./kernels/Transpose';\nimport {uniqueConfig} from './kernels/Unique';\nimport {unpackConfig} from
'./kernels/Unpack';\nimport {unsortedSegmentSumConfig} from './kernels/UnsortedSegmentSum';\nimport
{zerosLikeConfig} from './kernels/ZerosLike';\n\n// List all kernel configs here\nconst kernelConfigs:
KernelConfig[] = [\n LRNConfig,\n LRNGradConfig,\n _fusedMatMulConfig,\n absConfig,\n acosConfig,\n acoshConfig,\n addConfig,\n addNConfig,\n allConfig,\n anyConfig,\n argMaxConfig,\n argMinConfig,\n asinConfig,\n asinhConfig,\n atan2Config,\n atanConfig,\n atanhConfig,\n avgPool3DConfig,\n avgPoolConfig,\n avgPoolGrad3DConfig,\n avgPoolGradConfig,\n batchMatMulConfig,\n batchNormConfig,\n batchToSpaceNDConfig,\n bincountConfig,\n castConfig,\n ceilConfig,\n clipByValueConfig,\n complexAbsConfig,\n complexConfig,\n concatConfig,\n conv2DBackpropFilterConfig,\n conv2DBackpropInputConfig,\n conv2DConfig,\n conv3DBackpropFilterV2Config,\n conv3DBackpropInputConfig,\n conv3DConfig,\n cosConfig,\n coshConfig,\n cropAndResizeConfig,\n cumsumConfig,\n denseBincountConfig,\n depthToSpaceConfig,\n depthwiseConv2dNativeBackpropFilterConfig,\n depthwiseConv2dNativeBackpropInputConfig,\n depthwiseConv2dNativeConfig,\n diagConfig,\n dilation2DConfig,\n eluConfig,\n eluGradConfig,\n equalConfig,\n erfConfig,\n expConfig,\n expandDimsConfig,\n expm1Config,\n fftConfig,\n fillConfig,\n flipLeftRightConfig,\n floorConfig,\n floorDivConfig,\n fromPixelsConfig,\n fusedConv2DConfig,\n fusedDepthwiseConv2DConfig,\n gatherNdConfig,\n gatherV2Config,\n greaterConfig,\n greaterEqualConfig,\n identityConfig,\n ifftConfig,\n imagConfig,\n isFiniteConfig,\n isInfConfig,\n isNaNConfig,\n leakyReluConfig,\n lessConfig,\n lessEqualConfig,\n linSpaceConfig,\n log1pConfig,\n logConfig,\n logicalAndConfig,\n logicalNotConfig,\n logicalOrConfig,\n maxConfig,\n maxPool3DConfig,\n maxPoolConfig,\n maxPoolGrad3DConfig,\n maxPoolGradConfig,\n maxPoolWithArgmaxConfig,\n maximumConfig,\n meanConfig,\n minConfig,\n minimumConfig,\n mirrorPadConfig,\n modConfig,\n multinomialConfig,\n multiplyConfig,\n negConfig,\n nonMaxSuppressionV3Config,\n nonMaxSuppressionV4Config,\n nonMaxSuppressionV5Config,\n notEqualConfig,\n oneHotConfig,\n onesLikeConfig,\n packConfig,\n padV2Config,\n powConfig,\n preluConfig,\n prodConfig,\n rangeConfig,\n realConfig,\n realDivConfig,\n reciprocalConfig,\n relu6Config,\n reluConfig,\n reshapeConfig,\n resizeBilinearConfig,\n resizeBilinearGradConfig,\n resizeNearestNeighborConfig,\n resizeNearestNeighborGradConfig,\n reverseConfig,\n rotateWithOffsetConfig,\n roundConfig,\n rsqrtConfig,\n scatterNdConfig,\n selectConfig,\n seluConfig,\n sigmoidConfig,\n signConfig,\n sinConfig,\n sinhConfig,\n sliceConfig,\n softmaxConfig,\n softplusConfig,\n spaceToBatchNDConfig,\n sparseToDenseConfig,\n splitVConfig,\n sqrtConfig,\n squareConfig,\n squaredDifferenceConfig,\n stepConfig,\n stridedSliceConfig,\n subConfig,\n sumConfig,\n tanConfig,\n tanhConfig,\n tileConfig,\n topKConfig,\n transposeConfig,\n uniqueConfig,\n unpackConfig,\n unsortedSegmentSumConfig,\n zerosLikeConfig\n];\n\nfor (const kernelConfig of kernelConfigs) {\n

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registerKernel(kernelConfig);\n\n", "/"**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n *
Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in
compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the
License for the specific language governing permissions and\n * limitations under the License.\n *\n *
=====
\n\n/ tslint:disable */\n\n/** Properties of an Any. */\nexport declare interface IAny {\n /** Any typeUrl */\n typeUrl?: (string|null);\n\n /** Any value */\n value?: (Uint8Array|null);\n}\n\n/** DataType enum. */\nexport
enum DataType {\n 'DT_INVALID' = 0,\n 'DT_FLOAT' = 1,\n 'DT_DOUBLE' = 2,\n 'DT_INT32' = 3,\n
DT_UINT8' = 4,\n 'DT_INT16' = 5,\n 'DT_INT8' = 6,\n 'DT_STRING' = 7,\n 'DT_COMPLEX64' = 8,\n
'DT_INT64' = 9,\n 'DT_BOOL' = 10,\n 'DT_QINT8' = 11,\n 'DT_QUINT8' = 12,\n 'DT_QINT32' = 13,\n
'DT_BFLOAT16' = 14,\n 'DT_FLOAT_REF' = 101,\n 'DT_DOUBLE_REF' = 102,\n 'DT_INT32_REF' = 103,\n
'DT_UINT8_REF' = 104,\n 'DT_INT16_REF' = 105,\n 'DT_INT8_REF' = 106,\n 'DT_STRING_REF' = 107,\n
'DT_COMPLEX64_REF' = 108,\n 'DT_INT64_REF' = 109,\n 'DT_BOOL_REF' = 110,\n 'DT_QINT8_REF'
= 111,\n 'DT_QUINT8_REF' = 112,\n 'DT_QINT32_REF' = 113,\n 'DT_BFLOAT16_REF' = 114\n}\n\n/**
Properties of a TensorShape. */\nexport declare interface ITensorShape {\n /** TensorShape dim */\n dim?:
(TensorShape.IDim[]|null);\n\n /** TensorShape unknownRank */\n unknownRank?: (boolean|null);\n}\n\nexport
namespace TensorShape {\n /** Properties of a Dim. */\n export declare interface IDim {\n /** Dim size */\n
size?: (number|string|null);\n\n /** Dim name */\n name?: (string|null);\n }\n}\n\n/** Properties of a Tensor.
*/\nexport declare interface ITensor {\n /** Tensor dtype */\n dtype?: (DataType|null);\n\n /** Tensor tensorShape
*/\n tensorShape?: (ITensorShape|null);\n\n /** Tensor versionNumber */\n versionNumber?: (number|null);\n\n
/** Tensor tensorContent */\n tensorContent?: (Uint8Array|null);\n\n /** Tensor floatVal */\n floatVal?:
(number[]|null);\n\n /** Tensor doubleVal */\n doubleVal?: (number[]|null);\n\n /** Tensor intVal */\n intVal?:
(number[]|null);\n\n /** Tensor stringVal */\n stringVal?: (Uint8Array[]|null);\n\n /** Tensor scomplexVal */\n
scomplexVal?: (number[]|null);\n\n /** Tensor int64Val */\n int64Val?: ((number | string)[]|null);\n\n /** Tensor
boolVal */\n boolVal?: (boolean[]|null);\n\n /** Tensor uint32Val */\n uint32Val?: (number[]|null);\n\n /**
Tensor uint64Val */\n uint64Val?: ((number | string)[]|null);\n}\n\n/** Properties of an AttrValue. */\nexport
declare interface IAttrValue {\n /** AttrValue list */\n list?: (AttrValue.IListValue|null);\n\n /** AttrValue s */\n
s?: (string|null);\n\n /** AttrValue i */\n i?: (number|string|null);\n\n /** AttrValue f */\n f?: (number|null);\n\n
/** AttrValue b */\n b?: (boolean|null);\n\n /** AttrValue type */\n type?: (DataType|null);\n\n /** AttrValue
shape */\n shape?: (ITensorShape|null);\n\n /** AttrValue tensor */\n tensor?: (ITensor|null);\n\n /** AttrValue
placeholder */\n placeholder?: (string|null);\n\n /** AttrValue
func */\n func?: (INameAttrList|null);\n}\n\nexport namespace AttrValue {\n /** Properties of a ListValue. */\n
export declare interface IListValue {\n /** ListValue s */\n s?: (string[]|null);\n\n /** ListValue i */\n i?:
((number | string)[]|null);\n\n /** ListValue f */\n f?: (number[]|null);\n\n /** ListValue b */\n b?:
(boolean[]|null);\n\n /** ListValue type */\n type?: (DataType[]|null);\n\n /** ListValue shape */\n shape?:
(ITensorShape[]|null);\n\n /** ListValue tensor */\n tensor?: (ITensor[]|null);\n\n /** ListValue func */\n
func?: (INameAttrList[]|null);\n }\n}\n\n/** Properties of a NameAttrList. */\nexport declare interface
INameAttrList {\n /** NameAttrList name */\n name?: (string|null);\n\n /** NameAttrList attr */\n attr?: ({[k:
string]: IAttrValue}|null);\n}\n\n/** Properties of a NodeDef. */\nexport declare interface INodeDef {\n /**
NodeDef name */\n name?: (string|null);\n\n /** NodeDef op */\n op?:
(string|null);\n\n /** NodeDef input */\n input?: (string[]|null);\n\n /** NodeDef device */\n device?:
(string|null);\n\n /** NodeDef attr */\n attr?: ({[k: string]: IAttrValue}|null);\n}\n\n/** Properties of a VersionDef.
*/\nexport declare interface IVersionDef {\n /** VersionDef producer */\n producer?: (number|null);\n\n /**
VersionDef minConsumer */\n minConsumer?: (number|null);\n\n /** VersionDef badConsumers */\n
badConsumers?: (number[]|null);\n}\n\n/** Properties of a GraphDef. */\nexport declare interface IGraphDef {\n

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/** GraphDef node */\n node?: (INodeDef[]|null);\n\n /** GraphDef versions */\n versions?:
(IVersionDef|null);\n\n /** GraphDef library */\n library?: (IFunctionDefLibrary|null);\n\n\n /** Properties of a
CollectionDef. */\n\nexport declare interface ICollectionDef {\n /** CollectionDef nodeList */\n nodeList?:
(CollectionDef.INodeList|null);\n\n /** CollectionDef bytesList */\n bytesList?:
(CollectionDef.IBytesList|null);\n\n /** CollectionDef
int64List */\n int64List?: (CollectionDef.IInt64List|null);\n\n /** CollectionDef floatList */\n floatList?:
(CollectionDef.IFloatList|null);\n\n /** CollectionDef anyList */\n anyList?:
(CollectionDef.IAnyList|null);\n\n\n\nexport namespace CollectionDef {\n /** Properties of a NodeList. */\n export
declare interface INodeList {\n /** NodeList value */\n value?: (string[]|null);\n }\n\n /** Properties of a
BytesList. */\n export declare interface IBytesList {\n /** BytesList value */\n value?: (Uint8Array[]|null);\n
}\n\n /** Properties of an Int64List. */\n export declare interface IInt64List {\n /** Int64List value */\n value?:
((number | string)[]|null);\n }\n\n /** Properties of a FloatList. */\n export declare interface IFloatList {\n /**
FloatList value */\n value?: (number[]|null);\n }\n\n /** Properties of an AnyList. */\n export declare interface
IAnyList {\n /** AnyList value */\n value?: (IAny[]|null);\n }\n}\n\n\n /** Properties
of a SaverDef. */\n\nexport declare interface ISaverDef {\n /** SaverDef filenameTensorName */\n
filenameTensorName?: (string|null);\n\n /** SaverDef saveTensorName */\n saveTensorName?: (string|null);\n\n\n
/** SaverDef restoreOpName */\n restoreOpName?: (string|null);\n\n /** SaverDef maxToKeep */\n
maxToKeep?: (number|null);\n\n /** SaverDef sharded */\n sharded?: (boolean|null);\n\n /** SaverDef
keepCheckpointEveryNHours */\n keepCheckpointEveryNHours?: (number|null);\n\n /** SaverDef version */\n
version?: (SaverDef.CheckpointFormatVersion|null);\n}\n\n\nexport namespace SaverDef {\n /**
CheckpointFormatVersion enum. */\n export enum CheckpointFormatVersion {'LEGACY' = 0, 'V1' = 1, 'V2' =
2}\n}\n\n\n /** Properties of a TensorInfo. */\n\nexport declare interface ITensorInfo {\n /** TensorInfo name */\n
name?: (string|null);\n\n /** TensorInfo cooSparse */\n cooSparse?: (TensorInfo.ICooSparse|null);\n\n /**
TensorInfo dtype */\n dtype?: (DataType|null);\n\n /**
TensorInfo tensorShape */\n tensorShape?: (ITensorShape|null);\n}\n\n\nexport namespace TensorInfo {\n /**
Properties of a CooSparse. */\n export declare interface ICooSparse {\n /** CooSparse valuesTensorName */\n
valuesTensorName?: (string|null);\n\n /** CooSparse indicesTensorName */\n indicesTensorName?:
(string|null);\n\n /** CooSparse denseShapeTensorName */\n denseShapeTensorName?: (string|null);\n
}\n}\n\n\n /** Properties of a SignatureDef. */\n\nexport declare interface ISignatureDef {\n /** SignatureDef inputs
*/\n inputs?: ({[k: string]: ITensorInfo})|null);\n\n /** SignatureDef outputs */\n outputs?: ({[k: string]:
ITensorInfo})|null);\n\n /** SignatureDef methodName */\n methodName?: (string|null);\n}\n\n\n\n /** Properties of an
AssetFileDef. */\n\nexport declare interface IAssetFileDef {\n /** AssetFileDef tensorInfo */\n tensorInfo?:
(ITensorInfo|null);\n\n /** AssetFileDef filename */\n filename?: (string|null);\n}\n\n\n\n /** Properties of an OpDef.
*/\n\nexport
declare interface IOpDef {\n /** OpDef name */\n name?: (string|null);\n\n /** OpDef inputArg */\n inputArg?:
(OpDef.IArgDef[]|null);\n\n /** OpDef outputArg */\n outputArg?: (OpDef.IArgDef[]|null);\n\n /** OpDef attr
*/\n attr?: (OpDef.IAttrDef[]|null);\n\n /** OpDef deprecation */\n deprecation?:
(OpDef.IOpDeprecation|null);\n\n /** OpDef summary */\n summary?: (string|null);\n\n /** OpDef description
*/\n description?: (string|null);\n\n /** OpDef isCommutative */\n isCommutative?: (boolean|null);\n\n /** OpDef
isAggregate */\n isAggregate?: (boolean|null);\n\n /** OpDef isStateful */\n isStateful?: (boolean|null);\n\n\n
OpDef allowsUninitializedInput */\n allowsUninitializedInput?: (boolean|null);\n}\n\n\n\nexport namespace OpDef {\n
/** Properties of an ArgDef. */\n export declare interface IArgDef {\n /** ArgDef name */\n name?:
(string|null);\n\n /** ArgDef description */\n description?: (string|null);\n\n /** ArgDef type */\n type?:
(DataType|null);\n\n /** ArgDef typeAttr */\n typeAttr?: (string|null);\n\n /** ArgDef numberAttr */\n
numberAttr?: (string|null);\n\n /** ArgDef typeListAttr */\n typeListAttr?: (string|null);\n\n /** ArgDef isRef
*/\n isRef?: (boolean|null);\n }\n\n\n /** Properties of an AttrDef. */\n export declare interface IAttrDef {\n /**
AttrDef name */\n name?: (string|null);\n\n /** AttrDef type */\n type?: (string|null);\n\n /** AttrDef
defaultValue */\n defaultValue?: (IAttrValue|null);\n\n /** AttrDef description */\n description?:

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(string|null);\n\n /** AttrDef hasMinimum */\n hasMinimum?: (boolean|null);\n\n /** AttrDef minimum */\n minimum?: (number|string|null);\n\n /** AttrDef allowedValues */\n allowedValues?: (IAttrValue|null);\n }\n\n /** Properties of an OpDeprecation. */\n export declare interface IOpDeprecation {\n /** OpDeprecation version */\n version?: (number|null);\n\n /** OpDeprecation explanation */\n explanation?: (string|null);\n }\n\n /** Properties of an OpList. */\n export declare interface IOpList {\n /** OpList op */\n op?: (IOpDef[]|null);\n }\n\n /** Properties of a MetaGraphDef. */\n export declare interface IMetaGraphDef {\n /** MetaGraphDef metaInfoDef */\n metaInfoDef?: (MetaGraphDef.IMetaInfoDef|null);\n\n /** MetaGraphDef graphDef */\n graphDef?: (IGraphDef|null);\n\n /** MetaGraphDef saverDef */\n saverDef?: (ISaverDef|null);\n\n /** MetaGraphDef collectionDef */\n collectionDef?: ({[k: string]: ICollectionDef}|null);\n\n /** MetaGraphDef signatureDef */\n signatureDef?: ({[k: string]: ISignatureDef}|null);\n\n /** MetaGraphDef assetFileDef */\n assetFileDef?: (IAssetFileDef[]|null);\n }\n\n namespace MetaGraphDef {\n /** Properties of a MetaInfoDef. */\n export declare interface IMetaInfoDef {\n /** MetaInfoDef metaGraphVersion */\n metaGraphVersion?: (string|null);\n\n /** MetaInfoDef strippedOpList */\n strippedOpList?: (IOpList|null);\n\n /** MetaInfoDef anyInfo */\n anyInfo?: (IAny|null);\n\n /** MetaInfoDef tags */\n tags?: (string[]|null);\n\n /** MetaInfoDef tensorflowVersion */\n tensorflowVersion?: (string|null);\n\n /** MetaInfoDef tensorflowGitVersion */\n tensorflowGitVersion?: (string|null);\n }\n }\n\n /** Properties of a SavedModel. */\n export declare interface ISavedModel {\n /** SavedModel savedModelSchemaVersion */\n savedModelSchemaVersion?: (number|string|null);\n\n /** SavedModel metaGraphs */\n metaGraphs?: (IMetaGraphDef[]|null);\n }\n\n /** Properties of a FunctionDefLibrary. */\n export declare interface IFunctionDefLibrary {\n /** FunctionDefLibrary function */\n 'function': (IFunctionDef[]|null);\n\n /** FunctionDefLibrary gradient */\n gradient?: (IGradientDef[]|null);\n }\n\n /** Properties of a FunctionDef. */\n export declare interface IFunctionDef {\n /** FunctionDef signature */\n signature?: (IOpDef|null);\n\n /** FunctionDef attr */\n attr?: ({[k: string]: IAttrValue}|null);\n\n /** FunctionDef nodeDef */\n nodeDef?: (INodeDef[]|null);\n\n /** FunctionDef ret */\n ret?: ({[k: string]: string}|null);\n }\n\n /** Properties of a GradientDef. */\n export declare interface IGradientDef {\n /** GradientDef functionName */\n functionName?: (string|null);\n\n /** GradientDef gradientFunc */\n gradientFunc?: (string|null);\n }\n\n \"\"/>\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,\n * software distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n *\n * limitations under the License.\"\"/>\n\n=====\n\n*/\n\nimport {OpExecutor, OpMapper} from './types';\n\nconst CUSTOM_OPS: {[key: string]: OpMapper} = {};\n\n/** Register an Op for graph model executor. This allow you to register TensorFlow custom op or override existing op.\n\n * Here is an example of registering a new MatMul Op.\n```\njs\nconst customMatmul = (node) => {\n tf.matMul(\n node.inputs[0], node.inputs[1],\n node.attrs['transpose_a'],\n node.attrs['transpose_b']);\n}\n\n * tf.registerOp('MatMul', customMatmul);\n```\n\n * The inputs and attrs of the node object is based on the TensorFlow op registry.\n\n * @param name The Tensorflow Op name.\n\n * @param opFunc An op function which is called with the current graph node during execution and needs to return a tensor or a list of tensors. The node has the following attributes:\n\n * - attr: A map from attribute name to its value\n\n * - inputs: A list of input tensors\n\n * @doc {heading: 'Models', subheading: 'Op Registry'}\n\n */\nexport function registerOp(name: string, opFunc: OpExecutor) {\n const opMapper: OpMapper = {\n tfOpName: name,\n category: 'custom',\n inputs: [],\n attrs: [],\n customExecutor: opFunc\n };\n\n CUSTOM_OPS[name] = opMapper;\n}\n\n/** Retrieve the OpMapper object for the registered op.\n\n * @param name The Tensorflow Op name.\n\n * @doc {heading: 'Models', subheading: 'Op Registry'}\n\n */\nexport
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function getRegisteredOp(name: string): OpMapper {\n return CUSTOM_OPS[name];\n}\n\n/**\n * Deregister the
Op for graph model executor.\n *\n * @param name The Tensorflow Op name.\n *\n * @doc {heading: 'Models',
subheading: 'Op Registry'}\n */\nexport function deregisterOp(name: string) {\n delete
CUSTOM_OPS[name];\n}\n\n"/**\n *\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n *\n
Licensed under the Apache License, Version 2.0 (the
"License");\n *\n you may not use this file except in compliance with the License.\n *\n You may obtain a copy of the
License at\n *\n http://www.apache.org/licenses/LICENSE-2.0\n *\n Unless required by applicable law or
agreed to in writing, software\n *\n distributed under the License is distributed on an "AS IS" BASIS,\n *\n
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n *\n See the License for
the specific language governing permissions and\n *\n limitations under the License.\n */
=====
\n
*/\n\nimport {clone, Tensor, util} from '@tensorflow/tfjs-core';\n\nimport {NamedTensorsMap} from
'../data/types';\n\nimport {ExecutionContext} from '../executor/execution_context';\n\nimport {ResourceManager}
from '../executor/resource_manager';\n\nimport {Node, ValueType} from './types';\n\nexport function
getParamValue(\n paramName: string, node: Node, tensorMap: NamedTensorsMap,\n context:
ExecutionContext, resourceManager?: ResourceManager): ValueType {\n const inputParam =
node.inputParams[paramName];\n if (inputParam && inputParam.inputIndexStart !== undefined) {\n const start
= inputParam.inputIndexStart;\n const end = inputParam.inputIndexEnd === 0 ?\n undefined : \n (inputParam.inputIndexEnd === undefined ? start + 1 :\n inputParam.inputIndexEnd);\n if (inputParam.type === 'tensor') {\n return getTensor(\n node.inputNames[inputParam.inputIndexStart], tensorMap, context,\n resourceManager);\n }\n if
(inputParam.type === 'tensors') {\n const inputs = node.inputNames.slice(start, end);\n return inputs.map(\n name => getTensor(name, tensorMap, context, resourceManager));\n }\n const tensor = getTensor(\n node.inputNames.slice(start)[0], tensorMap, context, resourceManager);\n const data = tensor.dataSync();\n return inputParam.type
=== 'number' ?\n data[0] :\n util.toNestedArray(tensor.shape, data);\n }\n const attrParam =
node.attrParams[paramName];\n return attrParam && attrParam.value;\n}\n\n/**\n * Retrieve the tensor from
tensorsMap based on input name.\n *\n * @param name Node input name\n *\n * @param tensorsMap Tensors map keyed
by the node\n *\n * @param context contains tensors and information for running the current node.\n *\n * @param
resourceManager Optional. Contains global resources of the model.\n */\nexport function getTensor(\n name:
string, tensorsMap: NamedTensorsMap, context: ExecutionContext,\n resourceManager?: ResourceManager):
Tensor {\n const [nodeName, index] = parseNodeName(name);\n if (resourceManager !== null) {\n const tensor
= resourceManager.getHashTableHandleByName(nodeName);\n if (tensor !== null) {\n return tensor;\n }\n }\n const contextId = context.currentContextIds.find(contextId => {\n return
!!tensorsMap[getNodeNameWithContextId(nodeName,
contextId)];\n });\n if (contextId !== undefined) {\n return tensorsMap[getNodeNameWithContextId(nodeName,
contextId)][index] :\n undefined;\n }\n\n /**\n * Retrieve the tensors based on input name for current context.\n *\n * @param name Node input name\n *\n * @param tensorsMap Tensors map keyed by the node\n */\n export function
getTensorsForCurrentContext(\n name: string, tensorsMap: NamedTensorsMap,\n context: ExecutionContext):
Tensor[] {\n return tensorsMap[getNodeNameWithContextId(name, context.currentContextId)];\n }\n\n /**\n * Returns the node name and index from the Node input name.\n *\n * @param inputName The input name of the node,
in format of\n * node_name:output_index, i.e. MatMul:0, if the output_index is not set, it is\n * default to 0.\n */\n export function getNodeNameAndIndex(\n inputName: string, context?: ExecutionContext): [string, number]
{\n const [nodeName, index] = parseNodeName(inputName);\n return [\n getNodeNameWithContextId(nodeName, context
&& context.currentContextId),\n index\n];\n }\n\n function getNodeNameWithContextId(name: string,
contextId?: string): string {\n return `!contextId ? ${name}-${contextId}` : name;\n }\n\n export function
parseNodeName(name: string): [string, number] {\n const parts = name.split(':');\n if (parts.length === 1) {\n

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'notSupported': true}\n]\n },\n {\n 'tfOpName':
'Minimum',\n 'category': 'arithmetic',\n 'inputs': [\n {'start': 0, 'name': 'a', 'type': 'tensor'},\n {'start': 1,
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'../types';\n\n/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the
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for the specific language governing permissions and\n * limitations under the License.\n *
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under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
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License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY
KIND, either express or implied.\n * See the License for the specific language governing permissions and\n *
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{OpMapper} from './types';\n\n/**\n * @license\n * Copyright
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you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
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All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *\n * \n\nexport const json: OpMapper[] = [\n {\n 'tfOpName': 'NonMaxSuppressionV2',\n 'category': 'dynamic',\n 'inputs': [\n {\n 'start': 0,\n 'name': 'boxes',\n 'type': 'tensor'\n },\n {\n 'start': 1,\n 'name': 'scores',\n 'type': 'tensor'\n },\n {\n 'start': 2,\n 'name': 'maxOutputSize',\n 'type': 'number'\n },\n {\n 'start': 3,\n 'name': 'iouThreshold',\n 'type': 'number'\n }\n]\n },\n {\n 'tfOpName': 'NonMaxSuppressionV3',\n 'category': 'dynamic',\n 'inputs': [\n {\n 'start': 0,\n 'name': 'boxes',\n 'type': 'tensor'\n },\n {\n 'start': 1,\n 'name': 'scores',\n 'type': 'tensor'\n },\n {\n 'start': 2,\n 'name': 'maxOutputSize',\n 'type': 'number'\n },\n {\n 'start': 3,\n 'name': 'iouThreshold',\n 'type': 'number'\n },\n {\n 'start': 4,\n 'name': 'scoreThreshold',\n 'type': 'number'\n }\n]\n },\n {\n 'tfOpName': 'NonMaxSuppressionV4',\n 'category': 'dynamic',\n 'inputs': [\n {\n 'start': 0,\n 'name': 'boxes',\n 'type': 'tensor'\n },\n {\n 'start': 1,\n 'name': 'scores',\n 'type': 'tensor'\n },\n {\n 'start': 2,\n 'name': 'maxOutputSize',\n 'type': 'number'\n },\n {\n 'start': 3,\n 'name': 'iouThreshold',\n 'type': 'number'\n },\n {\n 'start': 4,\n 'name': 'scoreThreshold',\n 'type': 'number'\n }\n],\n 'attrs': [\n {\n 'tfName': 'T',\n 'name': 'dtype',\n 'type': 'dtype',\n 'notSupported': true\n },\n {\n 'tfName': 'T_threshold',\n 'name': 'threshold',\n 'type': 'dtype',\n 'notSupported': true\n },\n {\n 'tfName': 'pad_to_max_output_size',\n 'name': 'padToMaxOutputSize',\n 'type': 'bool'\n }\n]\n },\n {\n 'tfOpName': 'NonMaxSuppressionV5',\n 'category': 'dynamic',\n 'inputs': [\n {\n 'start': 0,\n 'name': 'boxes',\n 'type': 'tensor'\n },\n {\n 'start': 1,\n 'name': 'scores',\n 'type': 'tensor'\n },\n {\n 'start': 2,\n 'name': 'maxOutputSize',\n 'type': 'number'\n },\n {\n 'start': 3,\n 'name': 'iouThreshold',\n 'type': 'number'\n },\n {\n 'start': 4,\n 'name': 'scoreThreshold',\n 'type': 'number'\n },\n {\n 'start': 5,\n 'name': 'softNmsSigma',\n 'type': 'number'\n }\n]\n },\n {\n 'tfOpName': 'Where',\n 'category': 'dynamic',\n 'inputs': [\n {\n 'start': 0,\n 'name': 'condition',\n 'type': 'tensor'\n },\n],\n 'attrs': [\n {\n 'tfName': 'T',\n 'name': 'dtype',\n 'type': 'dtype',\n 'notSupported': true\n }\n]\n },\n {\n 'tfOpName': 'ListDiff',\n 'category': 'dynamic',\n 'inputs': [\n {\n 'start': 0,\n 'name': 'x',\n 'type': 'tensor'\n },\n {\n 'start': 1,\n 'name': 'y',\n 'type': 'tensor'\n },\n],\n 'attrs': [{\n 'tfName': 'T',\n 'name': 'dtype',\n 'type': 'dtype',\n 'notSupported': true\n }]\n }\n]\n };\n\n",\nimport {OpMapper} from '../types';\n\n/**\n * @license\n * Copyright 2018 Google LLC. 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the specific language governing permissions and\n \* limitations under the License.\n \*

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'dtype',\\n 'notSupported': true\\n }\\n]\\n }\\n];\\n\\n","/*\\n * @license\\n * Copyright 2018 Google LLC. All Rights
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except in compliance with the License.\\n * You may obtain a copy of the License at\\n *
http://www.apache.org/licenses/LICENSE-2.0\\n * Unless required by applicable law or agreed to in writing,
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the License is distributed on an "AS IS" BASIS,\\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY
KIND, either express or implied.\\n * See the License for the specific language governing permissions and\\n *
limitations under the License.\\n *
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=====\n\n*\\n\\nexport const json: OpMapper[] = [\\n {\\n 'tfOpName': 'Bincount',\\n 'category': 'reduction',\\n 'inputs': [\\n\n {start: 0, name: 'x', type: 'tensor'},\\n\n {start: 1, name: 'size', type: 'number'},\\n\n {start: 2, name: 'weights',\n type: 'tensor'}\\n\n]\\n },\\n {\\n 'tfOpName': 'DenseBincount',\\n 'category': 'reduction',\\n 'inputs': [\\n\n {start: 0, name: 'x', type: 'tensor'},\\n\n {start: 1, name: 'size', type: 'number'},\\n\n {start: 2, name: 'weights', type: 'tensor'}\\n\n],\\n 'attrs': [\\n\n [{tfName: 'binary_output', name: 'binaryOutput', type:\n 'bool'}]\\n\n],\\n {\\n 'tfOpName': 'Max',\\n 'category': 'reduction',\\n 'inputs': [\\n\n {start: 0, name: 'x', type:\n 'tensor'},\\n\n {start: 1, name: 'axis', type: 'number[]'},\\n\n],\\n 'attrs': [{tfName: 'keep_dims', name:\n 'keepDims', type: 'bool'}]\\n\n },\\n {\\n 'tfOpName': 'Mean',\\n 'category': 'reduction',\\n 'inputs': [\\n\n {start: 0, name: 'x', type: 'tensor'},\\n\n {start: 1, name: 'axis', type: 'number[]'},\\n\n],\\n 'attrs': [{tfName: 'keep_dims',\n name: 'keepDims', type: 'bool'}]\\n\n },\\n {\\n 'tfOpName': 'Min',\\n 'category': 'reduction',\\n 'inputs': [\\n\n {start: 0, name: 'x', type: 'tensor'},\\n\n {start: 1, name: 'axis', type: 'number[]'},\\n\n],\\n 'attrs': [{tfName:\n 'keep_dims', name: 'keepDims', type: 'bool'}]\\n\n },\\n {\\n 'tfOpName': 'Sum',\\n\n 'category': 'reduction',\\n 'inputs': [\\n\n {start: 0, name: 'x', type: 'tensor'},\\n\n {start: 1, name: 'axis', type:\n 'number[]'},\\n\n],\\n 'attrs': [{tfName: 'keep_dims', name: 'keepDims', type: 'bool'}]\\n\n },\\n {\\n 'tfOpName':\n 'All',\\n 'category': 'reduction',\\n 'inputs': [\\n\n {start: 0, name: 'x', type: 'tensor'},\\n\n {start: 1, name: 'axis',\n type: 'number[]'},\\n\n],\\n 'attrs': [{tfName: 'keep_dims', name: 'keepDims', type: 'bool'}]\\n\n },\\n {\\n\n 'tfOpName': 'Any',\\n 'category': 'reduction',\\n 'inputs': [\\n\n {start: 0, name: 'x', type: 'tensor'},\\n\n {start: 1,\n name: 'axis', type: 'number[]'},\\n\n],\\n 'attrs': [{tfName: 'keep_dims', name: 'keepDims', type: 'bool'}]\\n\n },\\n\n {\\n 'tfOpName': 'ArgMax',\\n 'category': 'reduction',\\n 'inputs': [\\n\n {start: 0, name: 'x', type: 'tensor'},\\n\n {start: 1, name: 'axis', type: 'number'}\\n\n]\\n },\\n\n {\\n 'tfOpName': 'ArgMin',\\n 'category': 'reduction',\\n 'inputs': [\\n\n {start: 0, name: 'x', type: 'tensor'},\\n\n {start: 1, name: 'axis', type: 'number'}\\n\n]\\n },\\n {\\n 'tfOpName': 'Prod',\\n 'category': 'reduction',\\n 'inputs':\n [\\n\n {start: 0, name: 'x', type: 'tensor'},\\n\n {start: 1, name: 'axis', type: 'number[]'},\\n\n],\\n 'attrs':\n [\\n\n [{tfName: 'keep_dims', name: 'keepDims', type: 'bool'}]\\n\n],\\n {\\n 'tfOpName': 'Cumsum',\\n 'category':\n 'reduction',\\n 'inputs': [\\n\n {start: 0, name: 'x', type: 'tensor'},\\n\n {start: 1, name: 'axis', type: 'number'},\\n\n],\\n 'attrs': [\\n\n {tfName: 'exclusive', name: 'exclusive', type: 'bool'},\\n\n {tfName: 'reverse', name: 'reverse',\n type: 'bool'}\\n\n]\\n }]\n";\n", "import {OpMapper} from './types';\n\n/**\n * @license\n * Copyright 2018 Google\n LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in\n writing, software\n * distributed under the License is distributed on an "AS IS"\n BASIS,\n * WITHOUT\n WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific\n language governing permissions and\n * limitations under the License.\n *
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=====\n\n*\\n\\nexport const json: OpMapper[] = [\\n {\\n 'tfOpName': 'ConcatV2',\\n 'category': 'slice_join',\\n 'inputs': [\\n\n {start: 0, end: -1, name: 'tensors', type: 'tensors'},\\n\n {start: -1, name: 'axis', type: 'number'}\\n\n]\\n },\\n\n 'attrs': [\\n\n [{tfName: 'N', name: 'n', type: 'number', defaultValue: 2}]\\n\n],\\n {\\n 'tfOpName': 'Concat',\\n\n 'category': 'slice_join',\\n
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'start': 1,\n 'name': 'fft_length',\n 'type': 'number',\n 'notSupported': true\n }\n]\n
}]\n];\n", "import {OpMapper} from './types';\n\n**\n * @license\n * Copyright 2018 Google LLC. All Rights
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not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
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OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
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[\n {\n 'start': 0, 'name': 'x', 'type': 'tensor'},\n {\n 'start': 1, 'name': 'padding', 'type': 'number[]'},\n],\n 'attrs': [{\n
'tfName': 'constant_value',\n 'name': 'constantValue',\n 'type': 'number',\n 'defaultValue': 0\n }\n]\n },\n
{\n 'tfOpName': 'PadV2',\n 'category': 'transformation',\n 'inputs': [\n {\n 'start': 0, 'name': 'x', 'type': 'tensor'},\n
{\n 'start': 1, 'name': 'padding', 'type': 'number[]'},\n {\n 'start': 2,\n 'name': 'constantValue',\n 'type': 'number',\n
'defaultValue': 0\n }\n]\n },\n {\n 'tfOpName': 'Reshape',\n 'category': 'transformation',\n 'inputs': [\n {\n 'start': 0, 'name': 'x', 'type':
'tensor'},\n {\n 'start': 1, 'name': 'shape', 'type': 'number[]'}\n]\n },\n {\n 'tfOpName': 'Squeeze',\n 'category':
'transformation',\n 'inputs': [\n {\n 'start': 0, 'name': 'x', 'type': 'tensor'},\n],\n 'attrs': [{\n 'tfName': 'axis',\n
'tfDeprecatedName': 'squeeze_dims',\n 'name': 'axis',\n 'type': 'number[]'}]\n },\n {\n 'tfOpName':
'SpaceToBatchND',\n 'category': 'transformation',\n 'inputs': [\n {\n 'start': 0, 'name': 'x', 'type': 'tensor'},\n
{\n 'start': 1, 'name': 'blockShape', 'type': 'number[]'},\n {\n 'start': 2, 'name': 'paddings', 'type': 'number[]'}\n]\n },\n
{\n 'tfOpName': 'BatchToSpaceND',\n 'category': 'transformation',\n 'inputs':
[\n {\n 'start': 0, 'name': 'x', 'type': 'tensor'},\n {\n 'start': 1, 'name': 'blockShape', 'type': 'number[]'},\n {\n 'start': 2,
'name': 'crops', 'type': 'number[]'}\n]\n },\n {\n 'tfOpName': 'DepthToSpace',\n 'category': 'transformation',\n
'inputs': [\n {\n 'start': 0, 'name': 'x', 'type': 'tensor'},\n],\n 'attrs': [\n {\n 'tfName': 'block_size',\n 'name':
'blockSize',\n 'type': 'number'},\n {\n 'tfName': 'data_format',\n 'name': 'dataFormat',\n 'type': 'string'}\n]\n },\n {\n
'tfOpName': 'BroadcastTo',\n 'category': 'transformation',\n 'inputs': [\n {\n 'start': 0, 'name': 'x', 'type': 'tensor'},\n
{\n 'start': 1, 'name': 'shape', 'type': 'number[]'},\n],\n 'attrs': [\n]\n]\n};\n", "**\n * @license\n * Copyright 2018
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language governing permissions and\n \* limitations under the License.\n \*

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=====\\n
*\\n\\nimport {DataType, env} from '@tensorflow/tfjs-core';\\n\\nimport * as tensorflow from
'./data/compiled_api';\\n\\nimport {getRegisteredOp} from './custom_op/register';\\nimport {getNodeNameAndIndex}
from './executors/utils';\\nimport * as arithmetic from './op_list/arithmetic';\\nimport * as basicMath from
'./op_list/basic_math';\\nimport * as control from './op_list/control';\\nimport * as convolution from
'./op_list/convolution';\\nimport * as creation from './op_list/creation';\\nimport * as dynamic from
'./op_list/dynamic';\\nimport
* as evaluation from './op_list/evaluation';\\nimport * as graph from './op_list/graph';\\nimport * as hashTable from
'./op_list/hash_table';\\nimport * as image from './op_list/image';\\nimport * as logical from './op_list/logical';\\nimport
* as matrices from './op_list/matrices';\\nimport * as normalization from './op_list/normalization';\\nimport * as
reduction from './op_list/reduction';\\nimport * as sliceJoin from './op_list/slice_join';\\nimport * as spectral from
'./op_list/spectral';\\nimport * as transformation from './op_list/transformation';\\nimport {Graph, InputParamValue,
Node, OpMapper, ParamValue} from './types';\\n\\nexport class OperationMapper {\\n private static _instance:
OperationMapper;\\n\\n private opMappers: {[key: string]: OpMapper};\\n\\n // Singleton instance for the mapper\\n
public static get Instance() {\\n return this._instance || (this._instance = new this());\\n }\\n\\n // Loads the op
mapping from the JSON file.\\n private constructor() {\\n const ops
= [\\n arithmetic, basicMath, control, convolution, creation, dynamic,\\n evaluation, logical, image, graph,
matrices, normalization, reduction,\\n sliceJoin, spectral, transformation, hashTable\\n];\\n const mappersJson:
OpMapper[] = [].concat(...ops.map(op => op.json));\\n\\n this.opMappers = mappersJson.reduce<{[key: string]:
OpMapper}>((n, (map, mapper: OpMapper)) => {\\n map[mapper.tfOpName] = mapper;\\n return
map;\\n }, \\n {});\\n }\\n\\n // Converts the model inference graph from Tensorflow GraphDef to local\\n //
representation for TensorFlow.js API\\n transformGraph(\\n graph: tensorflow.IGraphDef,\\n signature:
tensorflow.ISignatureDef = {}): Graph {\\n const tfNodes = graph.node;\\n const placeholders: Node[] = [];\\n
const weights: Node[] = [];\\n const initNodes: Node[] = [];\\n const nodes = tfNodes.reduce<{[key: string]:
Node}>((map, node) => {\\n map[node.name] = this.mapNode(node);\\n if (node.op.startsWith('Placeholder'))
{\\n placeholders.push(map[node.name]);\\n } else if (node.op === 'Const') {\\n
weights.push(map[node.name]);\\n } else if (node.input == null || node.input.length === 0) {\\n
initNodes.push(map[node.name]);\\n }\\n return map;\\n }, {});\\n let inputs: Node[] = [];\\n const outputs:
Node[] = [];\\n let inputNodeNameToKey: {[key: string]: string} = {};\\n let outputNodeNameToKey: {[key:
string]: string} = {};\\n if (signature != null) {\\n inputNodeNameToKey =
this.mapSignatureEntries(signature.inputs);\\n outputNodeNameToKey =
this.mapSignatureEntries(signature.outputs);\\n }\\n const allNodes = Object.keys(nodes);\\n
allNodes.forEach(key => {\\n const node = nodes[key];\\n node.inputNames.forEach(name => {\\n const
[nodeName,] = getNodeNameAndIndex(name);\\n node.inputs.push(nodes[nodeName]);\\n
nodes[nodeName].children.push(node);\\n });\\n });\\n\\n // if
signature has not outputs set, add any node that does not have\\n // outputs.\\n if
(Object.keys(outputNodeNameToKey).length === 0) {\\n allNodes.forEach(key => {\\n const node =
nodes[key];\\n if (node.children.length === 0) {\\n outputs.push(node);\\n }\\n });\\n } else {\\n
Object.keys(outputNodeNameToKey).forEach(name => {\\n const [nodeName,] =
getNodeNameAndIndex(name);\\n const node = nodes[nodeName];\\n if (node != null) {\\n
node.signatureKey = outputNodeNameToKey[name];\\n outputs.push(node);\\n }\\n });\\n\\n if
(Object.keys(inputNodeNameToKey).length > 0) {\\n Object.keys(inputNodeNameToKey).forEach(name => {\\n
const [nodeName,] = getNodeNameAndIndex(name);\\n const node = nodes[nodeName];\\n if (node) {\\n
node.signatureKey = inputNodeNameToKey[name];\\n inputs.push(node);\\n }\\n });\\n } else {\\n
inputs = placeholders;\\n }\\n\\n let functions = {};\\n if (graph.library != null && graph.library.function != null) {\\n functions =
graph.library.function.reduce((functions, func) => {\\n functions[func.signature.name] =
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this.mapFunction(func);\n return functions;\n }, { } as {[key: string]: Graph});\n }\n\n const result: Graph
=\n { nodes, inputs, outputs, weights, placeholders, signature, functions};\n\n if (initNodes.length > 0) {\n
result.initNodes = initNodes;\n }\n\n return result;\n }\n\n private mapSignatureEntries(entries: {[k: string]:
tensorflow.ITensorInfo}) {\n return Object.keys(entries || {})\n .reduce<{[key: string]: string}>((prev, curr)
=> {\n prev[entries[curr].name] = curr;\n return prev;\n }, {});\n }\n\n private mapNode(node:
tensorflow.INodeDef): Node {\n // Unsupported ops will cause an error at run-time (not parse time), since\n //
they may not be used by the actual execution subgraph.\n
 const mapper =\n getRegisteredOp(node.op) || this.opMappers[node.op] || { } as OpMapper;\n if (node.attr
== null) {\n node.attr = { };\n }\n\n const newNode: Node = {\n name: node.name,\n op: node.op,\n
category: mapper.category,\n inputNames:\n (node.input ||\n []).map(input => input.startsWith('^') ?
input.substr(1) : input),\n inputs: [],\n children: [],\n inputParams: { },\n attrParams: { },\n rawAttrs:
node.attr\n };\n\n if (mapper.inputs != null) {\n newNode.inputParams =\n mapper.inputs.reduce<{[key:
string]: InputParamValue}>((\n (map, param) => {\n map[param.name] = {\n type:
param.type,\n inputIndexStart: param.start,\n inputIndexEnd: param.end\n };\n
 return map;\n },\n { });\n }\n\n if (mapper.attrs != null) {\n newNode.attrParams
=\n mapper.attrs.reduce<{[key: string]: ParamValue}>((map, param) => {\n const type = param.type;\n
 let value = undefined;\n switch (param.type) {\n case 'string':\n value =
getStringParam(\n node.attr, param.tfName, param.defaultValue as string);\n if (value ===
undefined && !!param.tfDeprecatedName) {\n value = getStringParam(\n node.attr,
param.tfDeprecatedName,\n param.defaultValue as string);\n }\n break;\n
 case 'string[]':\n value = getStringArrayParam(\n node.attr, param.tfName, param.defaultValue
as string[]);\n if (value === undefined && !!param.tfDeprecatedName) {\n value =
getStringArrayParam(\n node.attr, param.tfDeprecatedName,\n param.defaultValue as
string[]);\n }\n break;\n case 'number':\n value = getNumberParam(\n node.attr,
param.tfName,\n (param.defaultValue || 0) as number);\n if (value === undefined &&
!!param.tfDeprecatedName) {\n value = getNumberParam(\n node.attr,
param.tfDeprecatedName,\n param.defaultValue as number);\n }\n break;\n
 case 'number[]':\n value = getNumericArrayParam(\n node.attr, param.tfName,
param.defaultValue as number[]);\n if (value === undefined && !!param.tfDeprecatedName) {\n value =
getNumericArrayParam(\n node.attr, param.tfDeprecatedName,\n param.defaultValue as number[]);\n
 }\n break;\n case 'bool':\n value =
getBoolParam(\n node.attr, param.tfName, param.defaultValue as boolean);\n if (value === undefined &&
!!param.tfDeprecatedName) {\n value = getBoolParam(\n node.attr,
param.tfDeprecatedName,\n param.defaultValue as boolean);\n }\n break;\n
 case 'bool[]':\n value = getBoolArrayParam(\n node.attr, param.tfName, param.defaultValue as
boolean[]);\n if (value === undefined && !!param.tfDeprecatedName) {\n value =
getBoolArrayParam(\n node.attr, param.tfDeprecatedName,\n param.defaultValue as
boolean[]);\n }\n break;\n case 'shape':\n value = getTensorShapeParam(\n node.attr, param.tfName, param.defaultValue as number[]);\n if (value === undefined &&
!!param.tfDeprecatedName) {\n value = getTensorShapeParam(\n node.attr, param.tfDeprecatedName,\n param.defaultValue as number[]);\n }\n break;\n case 'shape[]':\n value =
getTensorShapeArrayParam(\n node.attr, param.tfName, param.defaultValue as number[][]);\n if (value === undefined &&
!!param.tfDeprecatedName) {\n value = getTensorShapeArrayParam(\n node.attr, param.tfDeprecatedName,\n param.defaultValue as number[][]);\n }\n break;\n case 'dtype':\n value = getDtypeParam(\n node.attr, param.tfName,

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param.default as Data Type);\n if (value === undefined && !param.tfDeprecatedName) {\n value = getDtypeParam(\n node.attr, param.tfDeprecatedName,\n param.defaultValue\n as Data Type);\n }\n break;\n case 'dtype':\n value = getDtypeArrayParam(\n node.attr, param.tfName, param.defaultValue as Data Type);\n if (value === undefined &&\n !param.tfDeprecatedName) {\n value = getDtypeArrayParam(\n node.attr,\n param.tfDeprecatedName,\n param.defaultValue as Data Type);\n }\n break;\n case 'func':\n value = getFuncParam(\n node.attr, param.tfName, param.defaultValue as\n string);\n if (value === undefined && !param.tfDeprecatedName) {\n value = getFuncParam(\n node.attr, param.tfDeprecatedName,\n param.defaultValue as string);\n }\n break;\n case 'tensor':\n case 'tensors':\n break;\n default:\n throw new Error(\n `Unsupported param type: ${param.type} for op:\n ${node.op}`);\n }\n map[param.name] = { value, type};\n return map;\n }, {});\n}\n\nreturn newNode;\n}\n\n// map the TFunctionDef to TFJS graph object\nprivate mapFunction(functionDef:\n tensorflow.IFunctionDef): Graph {\n const tfNodes = functionDef.nodeDef;\n const placeholders: Node[] = [];\n const weights: Node[] = [];\n let nodes: {[key: string]: Node} = {};\n if (tfNodes != null) {\n nodes =\n tfNodes.reduce<{[key: string]: Node}>((map, node) => {\n map[node.name] = this.mapNode(node);\n if\n (node.op === 'Const') {\n weights.push(map[node.name]);\n }\n return map;\n }, {});\n }\n const inputs: Node[] = [];\n const outputs: Node[] = [];\n functionDef.signature.inputArg.forEach(arg => {\n const [nodeName,] = getNodeNameAndIndex(arg.name);\n const node: Node = {\n name: nodeName,\n op: 'Placeholder',\n inputs: [],\n inputNames: [],\n category: 'graph',\n inputParams: {},\n attrParams: {dtype: {value: parseDtypeParam(arg.type), type:\n 'dtype'}},\n children: []\n };\n node.signatureKey = arg.name;\n inputs.push(node);\n nodes[nodeName] = node;\n });\n const allNodes = Object.keys(nodes);\n allNodes.forEach(key => {\n const node = nodes[key];\n node.inputNames.forEach(name => {\n const [nodeName,] =\n getNodeNameAndIndex(name);\n node.inputs.push(nodes[nodeName]);\n nodes[nodeName].children.push(node);\n });\n });\n const returnNodeMap = functionDef.ret;\n functionDef.signature.outputArg.forEach(output => {\n const [nodeName, index] =\n getNodeNameAndIndex(returnNodeMap[output.name]);\n const node = nodes[nodeName];\n if (node != null)\n {\n node.defaultOutput\n = index;\n outputs.push(node);\n }\n });\n const signature = this.mapArgsToSignature(functionDef);\n return {nodes, inputs, outputs, weights, placeholders, signature};\n}\n\nprivate\n mapArgsToSignature(functionDef: tensorflow.IFunctionDef):\n tensorflow.ISignatureDef {\n return {\n methodName: functionDef.signature.name,\n inputs: functionDef.signature.inputArg.reduce(\n (map, arg)\n => {\n map[arg.name] = this.mapArgToTensorInfo(arg);\n return map;\n },\n {} as {[key:\n string]: tensorflow.ITensorInfo}),\n outputs: functionDef.signature.outputArg.reduce(\n (map, arg) => {\n map[arg.name] = this.mapArgToTensorInfo(arg, functionDef.ret);\n return map;\n },\n {} as\n {[key: string]: tensorflow.ITensorInfo}),\n };\n }\n\n private mapArgToTensorInfo(\n arg:\n tensorflow.OpDef.IArgDef,\n nameMap?: {[key: string]: string}): tensorflow.ITensorInfo\n {\n let name = arg.name;\n if (nameMap != null) {\n name = nameMap[name];\n }\n return {name,\n dtype: arg.type};\n }\n}\n\nexport function decodeBase64(text: string): string {\n const global = env().global;\n if\n (typeof global.atob !== 'undefined') {\n return global.atob(text);\n }\n else if (typeof Buffer !== 'undefined') {\n return new Buffer(text, 'base64').toString();\n }\n else {\n throw new Error(\n 'Unable to decode base64 in this\n environment. ' +\n 'Missing built-in atob() or Buffer()');\n }\n }\n}\n\nexport function parseStringParam(s: []|string,\n keepCase: boolean): string {\n const value =\n Array.isArray(s) ? String.fromCharCode.apply(null, s) :\n decodeBase64(s);\n return keepCase ? value : value.toLowerCase();\n}\n\nexport function getStringParam(\n attrs: {[key: string]: tensorflow.IAttrValue}, name: string, def: string,\n keepCase = false): string {\n const param\n = attrs[name];\n if (param != null) {\n return
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 parseStringParam(param.s, keepCase);\n } \n return def;\n}\n\nexport function getBoolParam(\n attrs: {[key:
string]: tensorflow.IAttrValue}, name: string,\n def: boolean): boolean {\n const param = attrs[name];\n return
param ? param.b : def;\n}\n\nexport function getNumberParam(\n attrs: {[key: string]: tensorflow.IAttrValue},
name: string,\n def: number): number {\n const param = attrs[name] || {};\n const value =\n param['i'] != null ?
param['i'] : (param['f'] != null ? param['f'] : def);\n return (typeof value === 'number') ? value : parseInt(value,
10);\n}\n\nexport function parseDtypeParam(value: string|tensorflow.DataType): DataType {\n if (typeof (value)
=== 'string') {\n // tslint:disable-next-line:no-any\n value = tensorflow.DataType[value as any];\n }\n switch
(value) {\n case tensorflow.DataType.DT_FLOAT:\n return 'float32';\n case
tensorflow.DataType.DT_INT32:\n case tensorflow.DataType.DT_INT64:\n case
tensorflow.DataType.DT_INT8:\n
 case tensorflow.DataType.DT_UINT8:\n return 'int32';\n case tensorflow.DataType.DT_BOOL:\n return
'bool';\n case tensorflow.DataType.DT_DOUBLE:\n return 'float32';\n case
tensorflow.DataType.DT_STRING:\n return 'string';\n default:\n // Unknown dtype error will happen at
runtime (instead of parse time),\n // since these nodes might not be used by the actual subgraph execution.\n
return null;\n }\n}\n\nexport function getFuncParam(\n attrs: {[key: string]: tensorflow.IAttrValue}, name:
string,\n def: string): string {\n const param = attrs[name];\n if (param && param.func) {\n return
param.func.name;\n }\n return def;\n}\n\nexport function getDtypeParam(\n attrs: {[key: string]:
tensorflow.IAttrValue}, name: string,\n def: DataType): DataType {\n const param = attrs[name];\n if (param
&& param.type) {\n return parseDtypeParam(param.type);\n }\n return def;\n}\n\nexport function
getDtypeArrayParam(\n attrs: {[key: string]: tensorflow.IAttrValue}, name: string,\n def: DataType[]): DataType[] {\n const param =
attrs[name];\n if (param && param.list && param.list.type) {\n return param.list.type.map(v =>
parseDtypeParam(v));\n }\n return def;\n}\n\nexport function parseTensorShapeParam(shape:
tensorflow.ITensorShape): number[]|\n undefined {\n if (shape.unknownRank) {\n return undefined;\n }\n if
(shape.dim != null) {\n return shape.dim.map(\n dim =>\n (typeof dim.size === 'number') ? dim.size :
parseInt(dim.size, 10);\n);\n }\n return [];\n}\n\nexport function getTensorShapeParam(\n attrs: {[key: string]:
tensorflow.IAttrValue}, name: string,\n def?: number[]): number[]|undefined {\n const param = attrs[name];\n if
(param && param.shape) {\n return parseTensorShapeParam(param.shape);\n }\n return def;\n}\n\nexport
function getNumericArrayParam(\n attrs: {[key: string]: tensorflow.IAttrValue}, name: string,\n def: number[]):
number[] {\n const param = attrs[name];\n if (param) {\n return ((param.list.f && param.list.f.length ?
param.list.f :\n param.list.i) ||\n [])\n .map(v => (typeof v === 'number') ?
v : parseInt(v, 10));\n }\n return def;\n}\n\nexport function getStringArrayParam(\n attrs: {[key: string]:
tensorflow.IAttrValue}, name: string, def: string[],\n keepCase = false): string[] {\n const param = attrs[name];\n
if (param && param.list && param.list.s) {\n return param.list.s.map((v) => {\n return
parseStringParam(v,
keepCase);\n });\n }\n return def;\n}\n\nexport function getTensorShapeArrayParam(\n attrs: {[key: string]:
tensorflow.IAttrValue}, name: string,\n def: number[][]): number[][] {\n const param = attrs[name];\n if (param
&& param.list && param.list.shape) {\n return param.list.shape.map((v) => {\n return
parseTensorShapeParam(v);\n });\n }\n return def;\n}\n\nexport function
getBoolArrayParam(\n attrs: {[key: string]: tensorflow.IAttrValue}, name: string,\n def: boolean[]): boolean[]
{\n const param = attrs[name];\n if (param && param.list && param.list.b) {\n return param.list.b;\n }\n
return
def;\n}\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache
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by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS"
BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the
License for the specific language governing permissions and\n * limitations under the License.\n *
===== \n
*/\n\nimport {DataType, Tensor}

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from '@tensorflow/tfjs-core';\n\nimport {NamedTensorsMap} from '../data/types';\nimport {ExecutionContext}
from '../executor/execution_context';\nimport {getTensor} from '../executors/utils';\nimport {getBoolArrayParam,
getBoolParam, getDtypeArrayParam, getDtypeParam, getNumberParam, getNumericArrayParam,
getStringArrayParam, getStringParam, getTensorShapeArrayParam, getTensorShapeParam} from
'./operation_mapper';\nimport {GraphNode, Node, ValueType} from './types';\n\n/**\n * Helper class for lookup
inputs and params for nodes in the model graph.\n */\nexport class NodeValueImpl implements GraphNode {\n
public readonly inputs: Tensor[] = [];\n public readonly attrs: {[key: string]: ValueType} = {};\n constructor(\n
private node: Node, private tensorMap: NamedTensorsMap,\n private context: ExecutionContext) {\n
this.inputs = node.inputNames.map(name => this.getInput(name));\n if (node.rawAttrs != null) {\n this.attrs =
Object.keys(node.rawAttrs)\n
.reduce((attrs: {[key: string]: ValueType}, key) => {\n attrs[key] = this.getAttr(key);\n
return attrs;\n }, {});\n }\n }\n\n /**\n * Return the value of the attribute or input
param.\n * @param name String: name of attribute or input param.\n */\n private getInput(name: string): Tensor
{\n return getTensor(name, this.tensorMap, this.context);\n }\n\n /**\n * Return the value of the attribute or
input param.\n * @param name String: name of attribute or input param.\n */\n private getAttr(name: string,
defaultValue?: ValueType): ValueType {\n const value = this.node.rawAttrs[name];\n if (value.tensor != null)
{\n return getTensor(name, this.tensorMap, this.context);\n }\n if (value.i != null || value.f != null) {\n
return getNumberParam(this.node.rawAttrs, name, defaultValue as number);\n }\n if (value.s != null) {\n
return getStringParam(this.node.rawAttrs,
name, defaultValue as string);\n }\n if (value.b != null) {\n return getBoolParam(this.node.rawAttrs, name,
defaultValue as boolean);\n }\n if (value.shape != null) {\n return getTensorShapeParam(\n
this.node.rawAttrs, name, defaultValue as number[]);\n }\n if (value.type != null) {\n return
getDtypeParam(this.node.rawAttrs, name, defaultValue as DataType);\n }\n if (value.list != null) {\n if
(value.list.i != null || value.list.f != null) {\n return getNumericArrayParam(\n this.node.rawAttrs, name,
defaultValue as number[]);\n }\n if (value.list.s != null) {\n return getStringArrayParam(\n
this.node.rawAttrs, name, defaultValue as string[]);\n }\n if (value.list.shape != null) {\n return
getTensorShapeArrayParam(\n this.node.rawAttrs, name, defaultValue as number[][]);\n }\n if
(value.list.b != null) {\n return getBoolArrayParam(\n
this.node.rawAttrs, name, defaultValue as boolean[]);\n }\n if (value.list.type != null) {\n return
getDtypeArrayParam(\n this.node.rawAttrs, name, defaultValue as DataType[]);\n }\n }\n\n return
defaultValue;\n }\n}\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed
under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless
required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n */
=====
*/\n\n/**\n * This file exports ops used by the converters executors. By default it\n * re-exports all ops. In a custom build this
is aliased to a file that will\n * only exports ops for a given model.json.\n */\nexport * from './ops';\n\n"/**\n *
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2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific
language governing permissions and\n * limitations under the License.\n */
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*\n\nimport { Tensor } from '@tensorflow/tfjs-core';\n//
tslint:disable-next-line: no-imports-from-dist\nimport * as tfOps from '@tensorflow/tfjs-
core/dist/ops/ops_for_converter';\n\nimport { NamedTensorsMap } from '../data/types';\nimport
{ ExecutionContext } from '../executor/execution_context';\nimport { InternalOpExecutor, Node } from
'../types';\n\nimport { getParamValue } from './utils';\n\nexport const executeOp: InternalOpExecutor =\n (node:
Node, tensorMap: NamedTensorsMap,\n context: ExecutionContext): Tensor[] => {\n switch (node.op) {\n
case 'BiasAdd':\n case 'AddV2':\n case 'Add': {\n return [tfOps.add(\n (getParamValue('a',
node, tensorMap, context) as Tensor),\n getParamValue('b', node, tensorMap, context) as Tensor)];\n
}\n case 'AddN': {\n return [tfOps.addN((\n getParamValue('tensors', node, tensorMap, context) as
Tensor[]))];\n }\n case 'FloorMod':\n case 'Mod':\n return [tfOps.mod(\n
getParamValue('a', node, tensorMap, context) as Tensor,\n getParamValue('b', node, tensorMap,
context) as Tensor)];\n case 'Mul':\n return [tfOps.mul(\n getParamValue('a', node, tensorMap,
context) as Tensor,\n getParamValue('b', node, tensorMap, context) as Tensor)];\n case 'RealDiv':\n
case 'Div': {\n return [tfOps.div(\n getParamValue('a', node, tensorMap, context) as Tensor,\n
getParamValue('b', node, tensorMap, context) as Tensor)];\n }\n case 'DivNoNaN': {\n return
[tfOps.divNoNaN(\n getParamValue('a', node, tensorMap, context) as Tensor,\n getParamValue('b',
node, tensorMap, context) as Tensor)];\n }\n case 'FloorDiv': {\n return [tfOps.floorDiv(\n
getParamValue('a', node, tensorMap, context) as Tensor,\n getParamValue('b', node, tensorMap, context) as
Tensor)];\n }\n case 'Sub': {\n return [tfOps.sub(\n getParamValue('a', node, tensorMap, context) as
Tensor,\n getParamValue('b', node, tensorMap, context) as Tensor)];\n }\n case 'Minimum': {\n
return [tfOps.minimum(\n getParamValue('a', node, tensorMap, context) as Tensor,\n
getParamValue('b', node, tensorMap, context) as Tensor)];\n }\n case 'Maximum': {\n return
[tfOps.maximum(\n getParamValue('a', node, tensorMap, context) as Tensor,\n getParamValue('b',
node, tensorMap, context) as Tensor)];\n }\n case 'Pow': {\n return [tfOps.pow(\n
getParamValue('a', node, tensorMap, context) as Tensor,\n getParamValue('b', node, tensorMap, context) as
Tensor)];\n }\n case 'SquaredDifference': {\n return [tfOps.squaredDifference(\n
getParamValue('a', node, tensorMap, context)
as Tensor,\n getParamValue('b', node, tensorMap, context) as Tensor)];\n }\n default:\n throw
TypeError(`Node type ${node.op} is not implemented`);\n }\n };\n\nexport const CATEGORY =
'arithmetic';\n", "/*\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations under the
License.\n */
=====

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*\n\nimport { Tensor } from '@tensorflow/tfjs-core';\n//
tslint:disable-next-line: no-imports-from-dist\nimport * as tfOps from '@tensorflow/tfjs-
core/dist/ops/ops_for_converter';\n\nimport { NamedTensorsMap } from '../data/types';\nimport
{ ExecutionContext } from '../executor/execution_context';\nimport { InternalOpExecutor, Node } from
'../types';\n\nimport { getParamValue, getTensor } from './utils';\n\nexport const executeOp: InternalOpExecutor =\n (node: Node, tensorMap: NamedTensorsMap,\n context: ExecutionContext): Tensor[] => {\n switch (node.op)
{\n case 'Abs':\n case 'ComplexAbs':\n return [tfOps.abs(\n getParamValue('x', node,
tensorMap, context) as Tensor)];\n case 'Acos':\n return [tfOps.acos(\n getParamValue('x', node,
tensorMap, context) as Tensor)];\n case 'Acosh':\n return [tfOps.acosh(\n getParamValue('x', node,
tensorMap, context) as Tensor)];\n case 'Asin':\n return [tfOps.asin(\n

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 getParamValue('x', node, tensorMap, context) as Tensor));\n case 'Asinh':\n return [tfOps.asinh(\n
 getParamValue('x', node, tensorMap, context) as Tensor));\n case 'Atan':\n return [tfOps.atan(\n
 getParamValue('x', node, tensorMap, context) as Tensor));\n case 'Atan2':\n return [tfOps.atan2(\n
 getParamValue('x', node, tensorMap, context) as Tensor,\n getParamValue('y', node, tensorMap, context)
as Tensor));\n case 'Atanh':\n return [tfOps.atanh(\n getParamValue('x', node, tensorMap, context)
as Tensor));\n case 'Ceil':\n return [tfOps.ceil(\n getParamValue('x', node, tensorMap, context) as
Tensor));\n case 'Complex':\n return [tfOps.complex(\n getParamValue('real', node, tensorMap,
context) as Tensor,\n getParamValue('imag', node, tensorMap, context) as Tensor));\n case
'Cos':\n return [tfOps.cos(\n getParamValue('x', node, tensorMap, context) as Tensor));\n case
'Cosh':\n return [tfOps.cosh(\n getParamValue('x', node, tensorMap, context) as Tensor));\n case
'Elu':\n return [tfOps.elu(\n getParamValue('x', node, tensorMap, context) as Tensor));\n case
'Erf':\n return [tfOps.erf(\n getParamValue('x', node, tensorMap, context) as Tensor));\n case
'Exp':\n return [tfOps.exp(\n getParamValue('x', node, tensorMap, context) as Tensor));\n case
'Expml': {\n return [tfOps.expml(\n getParamValue('x', node, tensorMap, context) as Tensor));\n
}\n case 'Floor':\n return [tfOps.floor(\n getParamValue('x', node, tensorMap, context) as
Tensor));\n case 'Log':\n return [tfOps.log(\n getParamValue('x', node, tensorMap, context) as
Tensor));\n
 case 'Log1p': {\n return [tfOps.log1p(\n getParamValue('x', node, tensorMap, context) as
Tensor));\n }\n case 'Imag':\n return [tfOps.imag(\n getParamValue('x', node, tensorMap,
context) as Tensor));\n case 'Neg':\n return [tfOps.neg(\n getParamValue('x', node, tensorMap,
context) as Tensor));\n case 'Reciprocal': {\n return [tfOps.reciprocal(\n getParamValue('x', node,
tensorMap, context) as Tensor));\n }\n case 'Real':\n return [tfOps.real(\n getParamValue('x',
node, tensorMap, context) as Tensor));\n case 'Relu':\n return [tfOps.relu(\n getParamValue('x',
node, tensorMap, context) as Tensor));\n case 'Round': {\n return [tfOps.round(\n
 getParamValue('x', node, tensorMap, context) as Tensor));\n }\n case 'Selu':\n return [tfOps.selu(\n
 getParamValue('x', node, tensorMap, context) as Tensor));\n case 'Sigmoid':\n return
[tfOps.sigmoid(\n getParamValue('x', node, tensorMap, context) as Tensor));\n case 'Sin':\n return
[tfOps.sin(\n getParamValue('x', node, tensorMap, context) as Tensor));\n case 'Sign': {\n return
[tfOps.sign(\n getParamValue('x', node, tensorMap, context) as Tensor));\n }\n case 'Sinh': {\n
 return [tfOps.sinh(\n getParamValue('x', node, tensorMap, context) as Tensor));\n }\n case
'Softplus': {\n return [tfOps.softplus(\n getParamValue('x', node, tensorMap, context) as Tensor));\n
}\n case 'Sqrt': {\n return [tfOps.sqrt(\n getParamValue('x', node, tensorMap, context) as
Tensor));\n }\n case 'Square': {\n return [tfOps.square(\n getParamValue('x', node, tensorMap,
context)
as Tensor));\n }\n case 'Tanh': {\n return [tfOps.tanh(\n getParamValue('x', node, tensorMap,
context) as Tensor));\n }\n case 'Tan':\n return [tfOps.tan(\n getParamValue('x', node,
tensorMap, context) as Tensor));\n case 'ClipByValue':\n return [tfOps.clipByValue(\n
 getParamValue('x', node, tensorMap, context) as Tensor,\n getParamValue('clipValueMin', node,
tensorMap, context) as number,\n getParamValue('clipValueMax', node, tensorMap, context) as \n
number));\n case 'Relu6':\n return [tfOps.relu6(\n getParamValue('x', node, tensorMap, context) as
Tensor));\n case 'Rsqrt':\n return [tfOps.rsqrt(\n getTensor(node.inputNames[0], tensorMap,
context));\n case 'Prod':\n return [tfOps.prod(\n getParamValue('x', node, tensorMap, context) as
Tensor,\n
 getParamValue('axes', node, tensorMap, context) as number[]));\n case 'LeakyRelu':\n return
[tfOps.leakyRelu(\n getParamValue('x', node, tensorMap, context) as Tensor,\n
 getParamValue('alpha', node, tensorMap, context) as number));\n case 'Prelu':\n return [tfOps.prelu(\n
 getParamValue('x', node, tensorMap, context) as Tensor,\n getParamValue('alpha', node, tensorMap,
context) as Tensor));\n default:\n throw TypeError(`Node type ${node.op} is not implemented`);\n }\n

```

};\n\nexport const CATEGORY = 'basic\_math';\n", "\n/\*\*\n \* @license\n \* Copyright 2020 Google LLC. All Rights Reserved.\n \* Licensed under the Apache License, Version 2.0 (the \"License\");\n \* you may not use this file except in compliance with the License.\n \* You may obtain a copy of the License at\n \* \n \* http://www.apache.org/licenses/LICENSE-2.0\n \* \n \* Unless required by applicable law or agreed to in writing, software\n \* distributed under the License is distributed on an \"AS IS\" BASIS,\n \* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*

=====\n\n\*/\n/\*\*\n \* This differs from util.assertShapesMatch in that it allows values of\n \* negative one, an undefined size of a dimension, in a shape to match\n \* anything.\n \*/\nimport {Tensor, util} from '@tensorflow/tfjs-core';\n\n/\*\*\n \* Used by TensorList and TensorArray to verify if elementShape matches, support\n \* negative value as the dimension.\n \*/\n@param shapeA\n \* @param shapeB\n \* @param errorMessagePrefix\n \*/\nexport function assertShapesMatchAllowUndefinedSize(\n shapeA: number|number[], shapeB: number|number[],\n errorMessagePrefix = \"\"): void {\n // constant shape means unknown rank\n if (typeof shapeA === 'number' ||\n typeof shapeB === 'number') {\n return;\n }\n util.assert(\n shapeA.length === shapeB.length,\n () =>\n errorMessagePrefix + `Shapes \${shapeA} and \${shapeB} must match`);\n for (let i = 0; i < shapeA.length; i++) {\n const dim0 = shapeA[i];\n const dim1 = shapeB[i];\n util.assert(\n dim0 < 0 || dim1 < 0 || dim0 === dim1,\n () =>\n errorMessagePrefix + `Shapes \${shapeA} and \${shapeB} must match`);\n }\n}\n\nexport function fullDefinedShape(elementShape: number|number[]): boolean {\n if (typeof elementShape === 'number' ||\n elementShape.some(dim => dim < 0)) {\n return false;\n }\n return true;\n}\n\n/\*\*\n \* Generate the output element shape from the list elementShape, list tensors\n \* and input param.\n \*/\n@param listElementShape\n \* @param tensors\n \* @param elementShape\n \*/\nexport function inferElementShape(\n listElementShape: number|number[], tensors: Tensor[],\n elementShape: number|number[]): number[] {\n let partialShape =\n mergeElementShape(listElementShape, elementShape);\n const notfullDefinedShape =\n !fullDefinedShape(partialShape);\n if (notfullDefinedShape && tensors.length === 0) {\n throw new Error(\n `Tried to calculate elements of an empty list` +\n ` with non-fully-defined elementShape: \${partialShape}`);\n }\n if (notfullDefinedShape) {\n tensors.forEach(tensor => {\n partialShape =\n mergeElementShape(tensor.shape, partialShape);\n });\n }\n if (!fullDefinedShape(partialShape)) {\n throw new Error(`Non-fully-defined elementShape: \${partialShape}`);\n }\n return partialShape as number[];\n}\n\nexport function mergeElementShape(\n elementShapeA: number|number[], elementShapeB: number|number[]): number|\n number[] {\n if (typeof elementShapeA === 'number') {\n return elementShapeB;\n }\n if (typeof elementShapeB === 'number') {\n return elementShapeA;\n }\n if (elementShapeA.length !== elementShapeB.length) {\n throw new Error(`Incompatible ranks during merge: \${elementShapeA} vs. \${elementShapeB}`);\n }\n const result: number[] = [];\n for (let i = 0; i < elementShapeA.length; ++i) {\n const dim0 = elementShapeA[i];\n const dim1 = elementShapeB[i];\n if (dim0 >= 0 && dim1 >= 0 && dim0 !== dim1) {\n throw new Error(`Incompatible shape during merge: \${elementShapeA} vs. \${elementShapeB}`);\n }\n result[i] = dim0 >= 0 ? dim0 : dim1;\n }\n return result;\n}\n", "\n/\*\*\n \* @license\n \* Copyright 2018 Google LLC. All Rights Reserved.\n \* Licensed under the Apache License, Version 2.0 (the \"License\");\n \* you may not use this file except in compliance with the License.\n \* You may obtain a copy of the License at\n \* \n \* http://www.apache.org/licenses/LICENSE-2.0\n \* \n \* Unless required by applicable law or agreed to in writing, software\n \* distributed under the License is distributed on an \"AS IS\" BASIS,\n \* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n \* See the License for the specific language governing permissions and\n \* limitations under the License.\n \*

=====\n\n\*/\n\nimport {concat, DataType, keep, reshape, scalar, slice, stack, Tensor, tensor, tidy, unstack} from '@tensorflow/tfjs-core';\nimport {assertShapesMatchAllowUndefinedSize} from './tensor\_utils';\n\nexport



```

interface TensorWithState {\n tensor?: Tensor;\n written?: boolean;\n read?: boolean;\n cleared?:
boolean;\n}\n/**\n * The TensorArray object keeps an array of Tensors. It\n * allows reading from the array and
writing to the array.\n */\nexport class TensorArray {\n private tensors: TensorWithState[] = [];\n private closed_ =
false;\n readonly idTensor: Tensor;\n constructor(\n readonly name: string, readonly dtype: DataType, private
maxSize: number,\n private elementShape: number[], readonly identicalElementShapes: boolean,\n readonly
dynamicSize: boolean,\n readonly clearAfterRead: boolean) {\n this.idTensor = scalar(0);\n keep(this.idTensor);\n }\n get id() {\n
return this.idTensor.id;\n }\n get closed() {\n return this.closed_;\n }\n /**\n * Dispose the tensors and
idTensor and mark the TensorArray as closed.\n */\n clearAndClose(keepIds?: Set<number>) {\n
this.tensors.forEach(tensor => {\n if (keepIds == null || !keepIds.has(tensor.tensor.id)) {\n
tensor.tensor.dispose();\n }\n });\n this.tensors = [];\n this.closed_ = true;\n this.idTensor.dispose();\n
}\n size(): number {\n return this.tensors.length;\n }\n /**\n * Read the value at location index in the
TensorArray.\n * @param index Number the index to read from.\n */\n read(index: number): Tensor {\n if
(this.closed_) {\n throw new Error(`TensorArray ${this.name} has already been closed.`);\n }\n if (index <
0 || index >= this.size()) {\n throw new Error(`Tried to read from index
${index}, but array size is: ${this.size()}`);\n }\n const tensorWithState = this.tensors[index];\n if
(tensorWithState.cleared) {\n throw new Error(`TensorArray ${this.name}: Could not read index ${\n
index} twice because it was cleared after a previous read` +\n `(perhaps try setting clear_after_read =
false?).`);\n }\n if (this.clearAfterRead) {\n tensorWithState.cleared = true;\n }\n tensorWithState.read
= true;\n return tensorWithState.tensor;\n }\n /**\n * Helper method to read multiple tensors from the
specified indices.\n */\n readMany(indices: number[]): Tensor[] {\n return indices.map(index =>
this.read(index));\n }\n /**\n * Write value into the index of the TensorArray.\n * @param index number the
index to write to.\n * @param tensor\n */\n write(index: number, tensor: Tensor) {\n if (this.closed_) {\n
throw new Error(`TensorArray ${this.name} has already
been closed.`);\n }\n if (index < 0 || !this.dynamicSize && index >= this.maxSize) {\n throw new
Error(`Tried to write to index ${\n index}, but array is not resizeable and size is: ${this.maxSize}`);\n }\n
const t = this.tensors[index] || {};\n if (tensor.dtype !== this.dtype) {\n throw new Error(`TensorArray ${\n
this.name}: Could not write to TensorArray index ${index},\n because the value dtype is ${\n
tensor.dtype}, but TensorArray dtype is ${this.dtype}.`);\n }\n // Set the shape for the first time write to
unknow shape tensor array\n if (this.size() === 0 &&\n (this.elementShape == null || this.elementShape.length
=== 0)) {\n this.elementShape = tensor.shape;\n }\n assertShapesMatchAllowUndefinedSize(\n
this.elementShape, tensor.shape,\n `TensorArray ${this.name}: Could not write to TensorArray index ${\n
index}.`);\n if (t.read) {\n throw new Error(\n
`TensorArray ${this.name}: Could not write to TensorArray index ${\n index}, because it has already
been read.`);\n }\n if (t.written) {\n throw new Error(\n `TensorArray ${this.name}: Could not write
to TensorArray index ${\n index}, because it has already been written.`);\n }\n t.tensor = tensor;\n
keep(tensor);\n t.written = true;\n this.tensors[index] = t;\n }\n /**\n * Helper method to write multiple
tensors to the specified indices.\n */\n writeMany(indices: number[], tensors: Tensor[]) {\n if (indices.length !==
tensors.length) {\n throw new Error(\n `TensorArray ${this.name}: could not write multiple tensors,`\n
 `because the index size: ${\n indices.length} is not the same as tensors size: ${\n
tensors.length}.`);\n }\n indices.forEach((i, index) => this.write(i, tensors[index]));\n }\n /**\n * Return
selected values in the
TensorArray as a packed Tensor. All of\n * selected values must have been written and their shapes must all
match.\n * @param [indices] number[] Optional. Taking values in [0, max_value). If the\n * TensorArray is not
dynamic, max_value=size(). If not specified returns\n * all tensors in the original order.\n * @param [dtype]\n
*/\n gather(indices?: number[], dtype?: DataType): Tensor {\n if (!dtype && dtype !== this.dtype) {\n throw
new Error(`TensorArray dtype is ${\n this.dtype} but gather requested dtype ${dtype}`);\n }\n if
(!indices) {\n indices = [];\n for (let i = 0; i < this.size(); i++) {\n indices.push(i);\n }\n }
else {\n

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indices = indices.slice(0, this.size());\n }\n if (indices.length === 0) {\n return tensor([],\n[0].concat(this.elementShape));\n }\n\n // Read all the PersistentTensors into a vector to keep track of\n // their memory.\n const tensors = this.readMany(indices);\n\n assertShapesMatchAllowUndefinedSize(\n this.elementShape, tensors[0].shape, 'TensorArray shape mismatch:');\n return stack(tensors, 0);\n }\n\n /**\n * Return the values in the TensorArray as a concatenated Tensor.\n *\n * @param dtype? : DataType\n * @return Tensor\n */\n concat(dtype?: DataType): Tensor {\n if (!dtype && dtype !== this.dtype) {\n throw new Error(`TensorArray dtype is ${this.dtype} but concat requested dtype ${dtype}`);\n }\n\n if (this.size() === 0) {\n return tensor([], [0].concat(this.elementShape));\n }\n\n const indices = [];\n for (let i = 0; i < this.size(); i++) {\n indices.push(i);\n }\n\n // Collect all the tensors from the tensors array.\n const tensors = this.readMany(indices);\n\n assertShapesMatchAllowUndefinedSize(\n this.elementShape, tensors[0].shape,\n `TensorArray shape mismatch: tensor array shape (${this.elementShape}) vs first tensor shape (${tensors[0].shape})`);\n\n return concat(tensors, 0);\n }\n\n /**\n * Scatter the values of a Tensor in specific indices of a TensorArray.\n *\n * @param indices number[] values in [0, max_value). If the\n * TensorArray is not dynamic, max_value=size().\n * @param tensor Tensor input tensor.\n */\n scatter(indices: number[], tensor: Tensor) {\n if (tensor.dtype !== this.dtype) {\n throw new Error(`TensorArray dtype is ${this.dtype} but tensor has dtype ${tensor.dtype}`);\n }\n\n if (indices.length !== tensor.shape[0]) {\n throw new Error(`Expected len(indices) == tensor.shape[0], but saw: ${indices.length} vs. ${tensor.shape[0]}`);\n }\n\n const maxIndex = Math.max(...indices);\n\n if (!this.dynamicSize && maxIndex >= this.maxSize) {\n throw new Error(`Max index must be < array size (${maxIndex} vs. ${this.maxSize})`);\n }\n\n this.writeMany(indices, unstack(tensor, 0));\n }\n\n /**\n * Split the values of a Tensor into the TensorArray.\n *\n * @param length number[] with the lengths to use when splitting value along\n * its first dimension.\n * @param tensor Tensor, the tensor to split.\n */\n split(length: number[], tensor: Tensor) {\n if (tensor.dtype !== this.dtype) {\n throw new Error(`TensorArray dtype is ${this.dtype} but tensor has dtype ${tensor.dtype}`);\n }\n\n let totalLength = 0;\n const cumulativeLengths = length.map(len => {\n totalLength += len;\n return totalLength;\n });\n\n if (totalLength !== tensor.shape[0]) {\n throw new Error(`Expected sum of lengths to be equal to\n tensor.shape[0], but sum of lengths is\n ${totalLength}, and tensor's shape is: ${tensor.shape}`);\n }\n\n if (!this.dynamicSize && length.length !== this.maxSize) {\n throw new Error(`TensorArray's size is not equal to the size of lengths (${this.maxSize} vs. ${length.length}),\n 'and the TensorArray is not marked as dynamically resizable');\n }\n\n const elementPerRow = totalLength === 0 ? 0 : tensor.size / totalLength;\n const tensors: Tensor[] = [];\n tidy(() => {\n tensor = reshape(tensor, [1, totalLength, elementPerRow]);\n for (let i = 0; i < length.length; ++i) {\n const previousLength = (i === 0) ? 0 : cumulativeLengths[i - 1];\n const indices = [0, previousLength, 0];\n const sizes = [1, length[i], elementPerRow];\n tensors[i] = reshape(slice(tensor, indices, sizes), this.elementShape);\n }\n return tensors;\n });\n const indices = [];\n for (let i = 0; i < length.length; i++) {\n indices[i] = i;\n }\n\n this.writeMany(indices, tensors);\n }\n}\n\n"/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n\nimport {concat, DataType, keep, reshape, scalar, slice, stack, Tensor, tensor, tidy, unstack} from '@tensorflow/tfjs-core';\nimport {assertShapesMatchAllowUndefinedSize, inferElementShape, mergeElementShape} from './tensor_utils';\n\n/**\n * TensorList stores a container of `tf.Tensor` objects, which are accessible via tensors field.\n *\n * In order to get a copy of the underlying list, use the copy method:\n */
```

```

TensorList b = a.copy();\n * b.tensors().pushBack(t); // This does not modify a.tensors().\n
* ```\n * \n * Note that this is not a deep copy: the memory locations of the underlying\n * tensors will still point to the same locations of the corresponding tensors\n * in the original.\n * \n\nexport class TensorList {\n readonly\n idTensor: Tensor;\n maxNumElements: number;\n\n get id() {\n return this.idTensor.id;\n }\n /**\n * \n * @param tensors list of tensors\n * @param elementShape shape of each tensor, this can be a single number (any\n * shape is allowed) or partial shape (dim = -1).\n * @param elementDtype data type of each tensor\n * @param maxNumElements The maximum allowed size of `tensors`. Defaults to -1\n * meaning that the size of `tensors` is unbounded.\n * \n * constructor(\n readonly tensors: Tensor[], readonly elementShape: number|number[],\n readonly elementDtype: DataType, maxNumElements = -1) {\n if (tensors !== null) {\n tensors.forEach(tensor\n=> {\n if (elementDtype !== tensor.dtype) {\n throw new Error(`Invalid\n data types; op elements ${\n elementDtype}, but list elements ${tensor.dtype}`);\n }\n });\n }\n assertShapesMatchAllowUndefinedSize(\n elementShape, tensor.shape, 'TensorList shape mismatch: ');\n keep(tensor);\n });\n }\n this.idTensor = scalar(0);\n this.maxNumElements = maxNumElements;\n keep(this.idTensor);\n}\n\n/**\n * Get a new TensorList containing a copy of the underlying tensor container.\n * \n * copy(): TensorList {\n return new TensorList(\n [...this.tensors], this.elementShape,\n this.elementDtype);\n}\n\n/**\n * Dispose the tensors and idTensor and clear the tensor list.\n * \n * clearAndClose(keepIds?: Set<number>) {\n this.tensors.forEach(tensor => {\n if (keepIds == null ||\n !keepIds.has(tensor.id)) {\n tensor.dispose();\n }\n });\n this.tensors.length = 0;\n this.idTensor.dispose();\n}\n\n/**\n * The size of the tensors in the tensor list.\n * \n * size() {\n return this.tensors.length;\n}\n\n/**\n * Return a tensor that stacks a list of rank-R tf.Tensors into\n one rank-(R+1)\n * tf.Tensor.\n * @param elementShape shape of each tensor\n * @param elementDtype data\n type of each tensor\n * @param numElements the number of elements to stack\n * \n * stack(elementShape:\n number[], elementDtype: DataType, numElements = -1):\n Tensor {\n if (elementDtype !== this.elementDtype)\n {\n throw new Error(`Invalid data types; op elements ${\n elementDtype}, but list elements\n ${this.elementDtype}`);\n }\n if (numElements !== -1 && this.tensors.length !== numElements) {\n throw\n new Error(`Operation expected a list with ${\n numElements} elements but got a list with ${\n this.tensors.length} elements.`);\n }\n assertShapesMatchAllowUndefinedSize(\n elementShape,\n this.elementShape, 'TensorList shape mismatch: ');\n const outputElementShape =\n inferElementShape(this.elementShape,\n this.tensors, elementShape);\n return tidy(() => {\n const reshapedTensors =\n this.tensors.map(tensor =>\n reshape(tensor, outputElementShape));\n return stack(reshapedTensors, 0);\n });\n }\n\n /**\n * Pop a tensor\n from the end of the list.\n * @param elementShape shape of the tensor\n * @param elementDtype data type of the\n tensor\n * \n * popBack(elementShape: number[], elementDtype: DataType): Tensor {\n if (elementDtype !==\n this.elementDtype) {\n throw new Error(`Invalid data types; op elements ${\n elementDtype}, but list\n elements ${this.elementDtype}`);\n }\n if (this.size() === 0) {\n throw new Error('Trying to pop from an\n empty list.);\n }\n const outputElementShape =\n inferElementShape(this.elementShape, this.tensors,\n elementShape);\n const tensor = this.tensors.pop();\n assertShapesMatchAllowUndefinedSize(\n tensor.shape, elementShape, 'TensorList shape mismatch:\n ');\n return reshape(tensor, outputElementShape);\n }\n\n /**\n * Push a tensor to the end of the list.\n * \n * @param tensor Tensor to be pushed.\n * \n * pushBack(tensor: Tensor) {\n if (tensor.dtype !==\n this.elementDtype) {\n throw new Error(`Invalid data types; op elements ${\n tensor.dtype}, but list\n elements ${this.elementDtype}`);\n }\n assertShapesMatchAllowUndefinedSize(\n tensor.shape,\n this.elementShape, 'TensorList shape mismatch: ');\n if (this.maxNumElements === this.size()) {\n throw\n new Error(`Trying to push element into a full list.`);\n }\n keep(tensor);\n this.tensors.push(tensor);\n }\n\n /**\n * Update the size of the list.\n * @param size the new size of the list.\n * \n * resize(size: number) {\n if\n (size < 0) {\n throw new Error(`\n `TensorListResize expects size to be non-negative. Got: ${size}`);\n }\n if (this.maxNumElements !== -1 && size > this.maxNumElements) {\n
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 throw new Error(`TensorListResize input size ${\n size} is greater maxNumElement
 ${this.maxNumElements}.`);\n }\n this.tensors.length = size;\n }\n\n /**\n * Retrieve the element at the
 provided index\n * @param elementShape shape of the tensor\n * @param elementDtype dtype of the tensor\n *
 @param elementIndex index of the tensor\n */\n getItem(elementIndex: number, elementShape: number[],
 elementDtype: DataType):\n Tensor {\n if (elementDtype !== this.elementDtype) {\n throw new
 Error(`Invalid data types; op elements ${\n elementDtype}, but list elements ${this.elementDtype}`);\n }\n
 if (elementIndex < 0 || elementIndex > this.tensors.length) {\n throw new Error(`Trying to access element ${\n
 elementIndex} in a list with ${this.tensors.length} elements.`);\n }\n\n if (this.tensors[elementIndex] == null)\n {\n throw new Error(`element at index ${elementIndex} is null.`);\n }\n\n
 assertShapesMatchAllowUndefinedSize(\n this.tensors[elementIndex].shape, elementShape,\n '\n 'TensorList shape mismatch: ');\n const
 outputElementShape =\n inferElementShape(this.elementShape, this.tensors, elementShape);\n return
 reshape(this.tensors[elementIndex], outputElementShape);\n }\n\n /**\n * Set the tensor at the index\n *
 @param elementIndex index of the tensor\n * @param tensor the tensor to be inserted into the list\n */\n setItem(elementIndex: number, tensor: Tensor) {\n if (tensor.dtype !== this.elementDtype) {\n throw new
 Error(`Invalid data types; op elements ${\n tensor.dtype}, but list elements ${this.elementDtype}`);\n }\n\n
 if (elementIndex < 0 ||\n this.maxNumElements !== -1 && elementIndex >= this.maxNumElements) {\n throw new
 Error(`Trying to set element ${\n elementIndex} in a list with max ${this.maxNumElements}
 elements.`);\n }\n\n assertShapesMatchAllowUndefinedSize(\n this.elementShape,
 tensor.shape, 'TensorList shape mismatch: ');\n keep(tensor);\n this.tensors[elementIndex] = tensor;\n }\n\n
 /**\n * Return selected values in the TensorList as a stacked Tensor. All of\n * selected values must have been
 written and their shapes must all match.\n * @param indices indices of tensors to gather\n * @param
 elementDtype output tensor dtype\n * @param elementShape output tensor element shape\n */\n gather(indices:
 number[], elementDtype: DataType, elementShape: number[]):\n Tensor {\n if (elementDtype !==
 this.elementDtype) {\n throw new Error(`Invalid data types; op elements ${\n elementDtype}, but list
 elements ${this.elementDtype}`);\n }\n\n assertShapesMatchAllowUndefinedSize(\n this.elementShape,
 elementShape, 'TensorList shape mismatch: ');\n\n // When indices is greater than the size of the list, indices
 beyond the\n // size of the list are ignored.\n indices = indices.slice(0, this.size());\n const
 outputElementShape =\n inferElementShape(this.elementShape, this.tensors, elementShape);\n if
 (indices.length === 0) {\n return tensor([], [0].concat(outputElementShape));\n }\n\n return tidy(() => {\n
 const tensors =\n indices.map(i => reshape(this.tensors[i], outputElementShape));\n return
 stack(tensors,
 0);\n });\n }\n\n /**\n * Return the values in the TensorList as a concatenated Tensor.\n * @param
 elementDtype output tensor dtype\n * @param elementShape output tensor element shape\n */\n concat(elementDtype:
 DataType, elementShape: number[]): Tensor {\n if (!elementDtype && elementDtype !==
 this.elementDtype) {\n throw new Error(`TensorList dtype is ${\n this.elementDtype} but concat requested
 dtype ${elementDtype}`);\n }\n\n assertShapesMatchAllowUndefinedSize(\n this.elementShape,
 elementShape, 'TensorList shape mismatch: ');\n const outputElementShape =\n inferElementShape(this.elementShape,
 this.tensors, elementShape);\n\n if (this.size() === 0) {\n return tensor([], [0].concat(outputElementShape));\n
 }\n\n return tidy(() => {\n const tensors = this.tensors.map(t => reshape(t, outputElementShape));\n
 return
 concat(tensors, 0);\n });\n }\n }\n\n /**\n * Creates a TensorList which, when stacked, has the value of tensor.\n *
 @param tensor from tensor\n * @param elementShape output tensor element shape\n */\n nextExport function
 fromTensor(\n tensor: Tensor, elementShape: number[], elementDtype: DataType) {\n const dtype =
 tensor.dtype;\n if (tensor.shape.length < 1) {\n throw new Error(`\n `Tensor must be at least a vector, but saw
 shape: ${tensor.shape}`);\n }\n if (tensor.dtype !== elementDtype) {\n throw new Error(`Invalid data types; op
 elements ${\n tensor.dtype}, but list elements ${elementDtype}`);\n }\n const tensorElementShape =
 tensor.shape.slice(1);\n assertShapesMatchAllowUndefinedSize(\n tensorElementShape,

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elementShape, 'TensorList shape mismatch: ');
\n const tensorList: Tensor[] = unstack(tensor);
\n return new
TensorList(tensorList, elementShape, dtype);
\n }
\n /**
\n * Return a TensorList of the given size with empty
elements.
\n * @param elementShape the shape of the future elements of the list
\n * @param elementType the desired type of elements in the list
\n * @param numElements the number of elements to reserve
\n */
\nexport
function reserve(
\n elementShape: number[], elementType: DataType, numElements: number) {
\n return new
TensorList([], elementShape, elementType, numElements);
\n }
\n /**
\n * Put tensors at specific indices of a
stacked tensor into a TensorList.
\n * @param indices list of indices on how to scatter the tensor.
\n * @param tensor
input tensor.
\n * @param elementShape the shape of the future elements of the list
\n * @param numElements the
number of elements to scatter
\n */
\nexport function scatter(
\n tensor: Tensor, indices: number[], elementShape:
number[],
\n numElements?: number): TensorList {
\n if (indices.length !== tensor.shape[0]) {
\n throw new Error('Expected
len(indices) == tensor.shape[0], but saw: ${
\n indices.length} vs. ${tensor.shape[0]}');
\n }
\n \n const maxIndex
= Math.max(...indices);
\n \n if (numElements != null && numElements !== -1 && maxIndex >= numElements) {
\n throw new Error(`Max index must be < array size (${maxIndex} vs. ${numElements})`);
\n }
\n \n const list
= new TensorList([], elementShape, tensor.dtype, numElements);
\n const tensors = unstack(tensor, 0);
\n indices.forEach((value, index) => {
\n list.setItem(value, tensors[index]);
\n });
\n return list;
\n }
\n /**
\n * Split the
values of a Tensor into a TensorList.
\n * @param length the lengths to use when splitting value along
\n * its first
dimension.
\n * @param tensor the tensor to split.
\n * @param elementShape the shape of the future elements of the
list
\n */
\nexport function split(
\n tensor: Tensor, length: number[],
\n elementShape: number[]) {
\n let totalLength = 0;
\n const cumulativeLengths = length.map(len => {
\n totalLength += len;
\n return totalLength;
\n });
\n \n if (totalLength !== tensor.shape[0]) {
\n throw new
Error('Expected sum of lengths to be equal to
\n tensor.shape[0], but sum of lengths is
\n ${totalLength},
and tensor's shape is: ${tensor.shape}');
\n }
\n \n const shapeWithoutFirstDim = tensor.shape.slice(1);
\n const
outputElementShape =
\n mergeElementShape(shapeWithoutFirstDim, elementShape);
\n const elementPerRow =
totalLength === 0 ? 0 : tensor.size / totalLength;
\n const tensors: Tensor[] = tidy(() => {
\n const tensors = [];
\n tensor = reshape(tensor, [1, totalLength, elementPerRow]);
\n for (let i = 0; i < length.length; ++i) {
\n const
previousLength = (i === 0) ? 0 : cumulativeLengths[i - 1];
\n const indices = [0, previousLength, 0];
\n const
sizes = [1, length[i], elementPerRow];
\n tensors[i] = reshape(
\n slice(tensor, indices, sizes), outputElementShape as number[]);
\n }
\n tensor.dispose();
\n return tensors;
\n });
\n \n const list = new TensorList([], elementShape, tensor.dtype, length.length);
\n for (let i = 0; i <
tensors.length; i++) {
\n list.setItem(i, tensors[i]);
\n }
\n return list;
\n }
\n "/*
\n * @license
\n * Copyright 2018
Google LLC. All Rights Reserved.
\n * Licensed under the Apache License, Version 2.0 (the "License");
\n * you
may not use this file except in compliance with the License.
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\n http://www.apache.org/licenses/LICENSE-2.0
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\n * Unless required by applicable law or agreed to in writing,
software
\n * distributed under the License is distributed on an "AS IS" BASIS,
\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.
\n * See the License for the specific language
governing permissions and
\n * limitations under the License.
\n */
\n
=====
\n
*/
\nimport {DataType, scalar, Tensor} from '@tensorflow/tfjs-core';
\nimport {NamedTensorsMap} from
'./../data/types';
\nimport {ExecutionContext} from './../executor/execution_context';
\nimport {TensorArray} from
'./../executor/tensor_array';
\nimport {fromTensor, reserve, scatter, split} from './../executor/tensor_list';
\nimport
{InternalOpAsyncExecutor, Node} from './types';
\nimport {cloneTensor, getParamValue, getTensor} from
'/utils';
\nexport const executeOp: InternalOpAsyncExecutor = async(
\n node: Node, tensorMap:
NamedTensorsMap,
\n context: ExecutionContext): Promise<Tensor[]> => {
\n switch (node.op) {
\n case 'If':
\n case 'StatelessIf':
\n {
\n const thenFunc =
\n getParamValue('thenBranch', node, tensorMap, context) as
string;
\n const elseFunc =
\n getParamValue('elseBranch', node, tensorMap, context) as string;
\n const
cond = getParamValue('cond', node, tensorMap, context) as Tensor;
\n

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const args = getParamValue('args', node, tensorMap, context) as Tensor[];\n const condValue = await
cond.data();\n if (condValue[0]) {\n return context.functionMap[thenFunc].executeFunctionAsync(\nargs, context.tensorArrayMap, context.tensorListMap);\n } else {\n return
context.functionMap[elseFunc].executeFunctionAsync(\n args, context.tensorArrayMap,
context.tensorListMap);\n }\n}\n case 'While':\n case 'StatelessWhile': {\n const bodyFunc =\ngetParamValue('body', node, tensorMap, context) as string;\n const condFunc =\n getParamValue('cond',
node, tensorMap, context) as string;\n const args = getParamValue('args', node, tensorMap, context) as
Tensor[];\n // Calculate the condition of the loop\n const condResult =\n (await
context.functionMap[condFunc].executeFunctionAsync(\n args, context.tensorArrayMap,
context.tensorListMap));\n const argIds =
args.map(tensor => tensor.id);\n let condValue = await condResult[0].data();\n // Dispose the intermediate
tensors for condition function\n condResult.forEach(tensor => {\n if (!tensor.kept &&
argIds.indexOf(tensor.id) === -1) {\n tensor.dispose();\n }\n });\n let result: Tensor[] = args;\n while (condValue[0]) {\n // Record the previous result for intermediate tensor tracking\n const origResult =
result;\n // Execution the body of the loop\n result = await
context.functionMap[bodyFunc].executeFunctionAsync(\n result, context.tensorArrayMap,
context.tensorListMap);\n const resultIds = result.map(tensor => tensor.id);\n // Dispose the intermediate
tensor for body function that is not global\n // kept, not input/output of the body function\n origResult.forEach(tensor => {\n if (!tensor.kept && argIds.indexOf(tensor.id) === -1 &&\nresultIds.indexOf(tensor.id)
=== -1) {\n tensor.dispose();\n }\n });\n // Recalculate the condition of the loop using the
latest results.\n const condResult =\n (await context.functionMap[condFunc].executeFunctionAsync(\n result, context.tensorArrayMap, context.tensorListMap));\n condValue = await condResult[0].data();\n // Dispose the intermediate tensors for condition function\n condResult.forEach(tensor => {\n if
(!tensor.kept && argIds.indexOf(tensor.id) === -1 &&\n resultIds.indexOf(tensor.id) === -1) {\n tensor.dispose();\n }\n });\n }\n return result;\n}\n case 'LoopCond': {\n const pred =
getParamValue('pred', node, tensorMap, context) as Tensor;\n return [cloneTensor(pred)];\n}\n case 'Switch':
{\n const pred = getParamValue('pred', node, tensorMap, context) as Tensor;\n let data =
getParamValue('data', node,
tensorMap, context) as Tensor;\n if (!data.kept) {\n data = cloneTensor(data);\n }\n // Outputs nodes
:0 => false, :1 => true\n return (await pred.data())[0] ? [undefined, data] : [data, undefined];\n}\n case
'Merge': {\n const inputName = node.inputNames.find(\n name => getTensor(name, tensorMap, context)
!== undefined);\n if (inputName) {\n const data = getTensor(inputName, tensorMap, context);\n return
[cloneTensor(data)];\n }\n return undefined;\n}\n case 'Enter': {\n const frameId =\ngetParamValue('frameName', node, tensorMap, context) as string;\n const data = getParamValue('tensor', node,
tensorMap, context) as Tensor;\n context.enterFrame(frameId);\n return [cloneTensor(data)];\n}\n case
'Exit': {\n const data = getParamValue('tensor', node, tensorMap, context) as Tensor;\n context.exitFrame();\n return [cloneTensor(data)];\n}\n case 'NextIteration':
{\n const data = getParamValue('tensor', node, tensorMap, context) as Tensor;\n context.nextIteration();\n return [cloneTensor(data)];\n}\n case 'TensorArrayV3': {\n const size = getParamValue('size', node,
tensorMap, context) as number;\n const dtype =\n getParamValue('dtype', node, tensorMap, context) as
DataType;\n const elementShape =\n getParamValue('elementShape', node, tensorMap, context) as
number[];\n const dynamicSize =\n getParamValue('dynamicSize', node, tensorMap, context) as boolean;\n const clearAfterRead =\n getParamValue('clearAfterRead', node, tensorMap, context) as boolean;\n const
identicalElementShapes =\n getParamValue('identicalElementShapes', node, tensorMap, context) as\nboolean;\n const name = getParamValue('name', node, tensorMap, context) as string;\n const tensorArray =
new TensorArray(\n name, dtype, size, elementShape,

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 identicalElementShapes, dynamicSize, \n clearAfterRead); \n context.addTensorArray(tensorArray); \n
return [tensorArray.idTensor, scalar(1.0)]; \n } \n case 'TensorArrayWriteV3': { \n const id = \n
getParamValue('tensorArrayId', node, tensorMap, context) as Tensor; \n const index = getParamValue('index',
node, tensorMap, context) as number; \n const writeTensor = \n getParamValue('tensor', node, tensorMap,
context) as Tensor; \n const writeTensorArray = context.getTensorArray(id.id); \n
writeTensorArray.write(index, writeTensor); \n return [writeTensorArray.idTensor]; \n } \n case
'TensorArrayReadV3': { \n const readId = \n getParamValue('tensorArrayId', node, tensorMap, context) as
Tensor; \n const readIndex = \n getParamValue('index', node, tensorMap, context) as number; \n const
readTensorArray = context.getTensorArray(readId.id); \n return [readTensorArray.read(readIndex)]; \n } \n
 case 'TensorArrayGatherV3': { \n const gatherId = \n getParamValue('tensorArrayId', node, tensorMap,
context) as Tensor; \n const gatherIndices = \n getParamValue('indices', node, tensorMap, context) as
number[]; \n const gatherDtype = \n getParamValue('dtype', node, tensorMap, context) as DataType; \n
const gatherTensorArray = context.getTensorArray(gatherId.id); \n return
[gatherTensorArray.gather(gatherIndices, gatherDtype)]; \n } \n case 'TensorArrayScatterV3': { \n const
scatterId = \n getParamValue('tensorArrayId', node, tensorMap, context) as Tensor; \n const scatterIndices
= \n getParamValue('indices', node, tensorMap, context) as number[]; \n const scatterTensor = \n
getParamValue('tensor', node, tensorMap, context) as Tensor; \n const scatterTensorArray =
context.getTensorArray(scatterId.id); \n scatterTensorArray.scatter(scatterIndices, scatterTensor); \n return
[scatterTensorArray.idTensor]; \n
 } \n case 'TensorArrayConcatV3': { \n const concatId = \n getParamValue('tensorArrayId', node,
tensorMap, context) as Tensor; \n const concatTensorArray = context.getTensorArray(concatId.id); \n const
concatDtype = \n getParamValue('dtype', node, tensorMap, context) as DataType; \n return
[concatTensorArray.concat(concatDtype)]; \n } \n case 'TensorArraySplitV3': { \n const splitId = \n
getParamValue('tensorArrayId', node, tensorMap, context) as Tensor; \n const splitTensor = \n
getParamValue('tensor', node, tensorMap, context) as Tensor; \n const lengths = \n getParamValue('lengths',
node, tensorMap, context) as number[]; \n const splitTensorArray = context.getTensorArray(splitId.id); \n
splitTensorArray.split(lengths, splitTensor); \n return [splitTensorArray.idTensor]; \n } \n case
'TensorArraySizeV3': { \n const sizeId = \n getParamValue('tensorArrayId', node,
tensorMap, context) as Tensor; \n const sizeTensorArray = context.getTensorArray(sizeId.id); \n return
[scalar(sizeTensorArray.size(), 'int32')]; \n } \n case 'TensorArrayCloseV3': { \n const closeId = \n
getParamValue('tensorArrayId', node, tensorMap, context) as Tensor; \n const closeTensorArray =
context.getTensorArray(closeId.id); \n closeTensorArray.clearAndClose(); \n return
[closeTensorArray.idTensor]; \n } \n case 'TensorListSetItem': { \n const idTensor = \n
getParamValue('tensorListId', node, tensorMap, context) as Tensor; \n const index = getParamValue('index', node,
tensorMap, context) as number; \n const writeTensor = \n getParamValue('tensor', node, tensorMap, context)
as Tensor; \n const tensorList = context.getTensorList(idTensor.id); \n tensorList.setItem(index,
writeTensor); \n return [tensorList.idTensor]; \n } \n case 'TensorListGetItem': { \n const idTensor = \n
getParamValue('tensorListId',
node, tensorMap, context) as Tensor; \n const readIndex = \n getParamValue('index', node, tensorMap,
context) as number; \n const elementShape = \n getParamValue('elementShape', node, tensorMap, context)
as number[]; \n const elementDType = \n getParamValue('elementDType', node, tensorMap, context) as
DataType; \n const tensorList = context.getTensorList(idTensor.id); \n return [tensorList.getItem(readIndex,
elementShape, elementDType)]; \n } \n case 'TensorListScatterV2': \n case 'TensorListScatter': { \n const
scatterIndices = \n getParamValue('indices', node, tensorMap, context) as number[]; \n const scatterTensor
= \n getParamValue('tensor', node, tensorMap, context) as Tensor; \n const elementShape = \n
getParamValue('elementShape', node, tensorMap, context) as number[]; \n const numElements = \n
getParamValue('numElements', node, tensorMap, context) as number; \n

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const tensorList =\n scatter(scatterTensor, scatterIndices, elementShape, numElements);\ncontext.addTensorList(tensorList);\n return [tensorList.idTensor];\n}\n case 'TensorListReserve':\n case 'EmptyTensorList': {\n const elementShape =\n getParamValue('elementShape', node, tensorMap, context) as number[];\n const elementDType =\n getParamValue('elementDType', node, tensorMap, context) as\n DataType;\n let numElementsParam;\n if (node.op === 'TensorListReserve') {\n numElementsParam =\n 'numElements';\n } else {\n numElementsParam = 'maxNumElements';\n }\n const numElements =\n getParamValue(numElementsParam, node, tensorMap, context) as number;\n const tensorList =\n reserve(elementShape, elementDType, numElements);\n context.addTensorList(tensorList);\n return\n [tensorList.idTensor];\n}\n case 'TensorListGather': {\n const gatherId =\n getParamValue('tensorListId', node, tensorMap, context) as Tensor;\n const gatherIndices =\n getParamValue('indices', node, tensorMap, context) as number[];\n const elementShape =\n getParamValue('elementShape', node, tensorMap, context) as number[];\n const elementDType =\n getParamValue('elementDType', node, tensorMap, context) as DataType;\n const tensorList =\n context.getTensorList(gatherId.id);\n return [tensorList.gather(gatherIndices, elementDType, elementShape)];\n}\n case 'TensorListStack': {\n const idTensor =\n getParamValue('tensorListId', node, tensorMap,\n context) as Tensor;\n const elementShape =\n getParamValue('elementShape', node, tensorMap, context) as\n number[];\n const elementDType =\n getParamValue('elementDType', node, tensorMap, context) as\n DataType;\n const numElements =\n getParamValue('numElements', node, tensorMap, context) as\n number;\n const\n tensorList = context.getTensorList(idTensor.id);\n return [tensorList.stack(elementShape, elementDType,\n numElements)];\n}\n case 'TensorListFromTensor': {\n const tensor =\n getParamValue('tensor', node,\n tensorMap, context) as Tensor;\n const elementShape =\n getParamValue('elementShape', node, tensorMap,\n context) as number[];\n const elementDType =\n getParamValue('elementDType', node, tensorMap, context)\n as DataType;\n const tensorList = fromTensor(tensor, elementShape, elementDType);\n context.addTensorList(tensorList);\n return [tensorList.idTensor];\n}\n case 'TensorListConcat': {\n const\n concatId =\n getParamValue('tensorListId', node, tensorMap, context) as Tensor;\n const tensorList =\n context.getTensorList(concatId.id);\n const concatDType =\n getParamValue('dtype', node, tensorMap,\n context) as DataType;\n const elementShape =\n getParamValue('elementShape',\n node, tensorMap, context) as number[];\n return [tensorList.concat(concatDType, elementShape)];\n}\n case\n 'TensorListPushBack': {\n const idTensor =\n getParamValue('tensorListId', node, tensorMap, context) as\n Tensor;\n const writeTensor =\n getParamValue('tensor', node, tensorMap, context) as Tensor;\n const\n tensorList = context.getTensorList(idTensor.id);\n tensorList.pushBack(writeTensor);\n return\n [tensorList.idTensor];\n}\n case 'TensorListPopBack': {\n const idTensor =\n getParamValue('tensorListId', node, tensorMap, context) as Tensor;\n const elementShape =\n getParamValue('elementShape', node, tensorMap, context) as number[];\n const elementDType =\n getParamValue('elementDType', node, tensorMap, context) as\n DataType;\n const tensorList =\n context.getTensorList(idTensor.id);\n return [tensorList.popBack(elementShape, elementDType)];\n}\n case\n 'TensorListSplit':\n {\n const splitTensor =\n getParamValue('tensor', node, tensorMap, context) as Tensor;\n const\n elementShape =\n getParamValue('elementShape', node, tensorMap, context) as\n number[];\n const lengths\n =\n getParamValue('lengths', node, tensorMap, context) as\n number[];\n const tensorList =\n split(splitTensor, lengths, elementShape);\n context.addTensorList(tensorList);\n return\n [tensorList.idTensor];\n}\n default:\n throw TypeError('Node type ${node.op} is not implemented');\n}\n};\n\nexport const CATEGORY = 'control';\n\n/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under

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=====
*/
import {Rank, Tensor, Tensor3D, Tensor4D, Tensor5D} from '@tensorflow/tfjs-core';
/* tslint:disable-next-line: no-imports-from-dist */
import * as tfOps from '@tensorflow/tfjs-core/dist/ops/ops_for_converter';
import {NamedTensorsMap} from '../data/types';
import {ExecutionContext} from '../executor/execution_context';
import {InternalOpExecutor, Node} from '../types';
import {getPadding, getParamValue} from './utils';

function fusedConvAndDepthWiseParams(
 node: Node, tensorMap: NamedTensorsMap, context: ExecutionContext) {
 const [extraOp, activationFunc] =
 (getParamValue('fusedOps', node, tensorMap, context) as string[]);
 const isBiasAdd = extraOp === 'biasadd';
 const isPrelu = activationFunc === 'prelu';
 const isBatchNorm = extraOp === 'fusedbatchnorm';

 const numArgs = (getParamValue('numArgs', node, tensorMap, context) as number);
 if (isBiasAdd) {
 if (isPrelu && numArgs !== 2) {
 throw new Error('FusedConv2d and DepthwiseConv2d with BiasAdd and Prelu ' +
 'must have two extra arguments: bias and alpha.');
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activationFunc as tfOps.fused.Activation,\n preluActivationWeights: preluArg,\n leakyreluAlpha\n));\n }\n\n case 'FusedDepthwiseConv2dNative': {\n const {\n stride,\n pad,\n dataFormat,\n dilations,\n biasArg,\n preluArg,\n activationFunc,\n leakyreluAlpha,\n } = fusedConvAndDepthWiseParams(node, tensorMap, context);\n return\n [tfOps.fused.depthwiseConv2d({\n x: getParamValue('x', node, tensorMap, context) as Tensor3D\n | Tensor4D,\n filter: getParamValue('filter', node, tensorMap, context) as\n Tensor4D,\n strides: [stride[1], stride[2]],\n pad: pad as 'valid' | 'same',\n dataFormat: dataFormat as 'NHWC' |\n 'NCHW',\n dilations: [dilations[1], dilations[2]],\n bias: biasArg,\n activation: activationFunc\n as tfOps.fused.Activation,\n preluActivationWeights: preluArg,\n leakyreluAlpha\n }));\n }\n\n case 'Conv2DBackpropInput':\n case 'Conv2dTranspose': {\n const shape = getParamValue(\n 'outputShape', node, tensorMap,\n context) as [number, number, number] |\n [number, number, number, number];\n const stride =\n getParamValue('strides', node, tensorMap,\n context) as number[];\n const pad = getPadding(node, tensorMap, context);\n return\n [tfOps.conv2dTranspose(\n getParamValue('x', node, tensorMap, context) as Tensor3D\n | Tensor4D,\n getParamValue('filter', node, tensorMap, context) as Tensor4D,\n shape, [stride[1],\n stride[2]], pad as 'valid' | 'same'));\n }\n\n case 'DepthwiseConv2dNative':\n case 'DepthwiseConv2d': {\n const stride =\n getParamValue('strides', node, tensorMap, context) as number[];\n const pad = getPadding(node,\n tensorMap, context);\n const dilations =\n getParamValue('dilations', node, tensorMap, context) as\n number[];\n const dataFormat =\n (getParamValue('dataFormat', node, tensorMap, context) as string)\n .toUpperCase();\n return [tfOps.depthwiseConv2d(\n getParamValue('input', node,\n tensorMap, context) as Tensor3D\n | Tensor4D,\n getParamValue('filter', node, tensorMap,\n context) as Tensor4D,\n [stride[1], stride[2]], pad as 'valid' | 'same',\n dataFormat as 'NHWC' |\n 'NCHW', [dilations[1], dilations[2]]);\n }\n\n case 'Conv3D': {\n const stride =\n getParamValue('strides', node, tensorMap, context) as number[];\n const pad = getParamValue('pad', node,\n tensorMap, context);\n const dataFormat\n =\n (getParamValue('dataFormat', node, tensorMap, context) as string)\n .toUpperCase();\n const dilations =\n getParamValue('dilations', node, tensorMap, context) as number[];\n return\n [tfOps.conv3d(\n getParamValue('x', node, tensorMap, context) as Tensor4D\n | Tensor<Rank.R5>,\n getParamValue('filter', node, tensorMap, context) as\n Tensor<Rank.R5>,\n [stride[1], stride[2], stride[3]], pad as 'valid' | 'same',\n dataFormat as 'NDHWC' | 'NCDHW',\n [dilations[1], dilations[2], dilations[3]]);\n }\n\n case 'AvgPool': {\n const stride =\n getParamValue('strides', node, tensorMap, context) as number[];\n const pad = getParamValue('pad', node,\n tensorMap, context);\n const kernelSize =\n getParamValue('kernelSize', node, tensorMap, context) as\n number[];\n return\n [tfOps.avgPool(\n getParamValue('x', node, tensorMap, context) as Tensor3D\n | Tensor4D,\n [kernelSize[1], kernelSize[2]], [stride[1], stride[2]],\n pad as 'valid' | 'same'));\n }\n\n case\n 'MaxPool': {\n const stride =\n getParamValue('strides', node, tensorMap, context) as number[];\n const pad = getParamValue('pad', node, tensorMap, context);\n const kernelSize =\n getParamValue('kernelSize', node, tensorMap, context) as number[];\n return [tfOps.maxPool(\n getParamValue('x', node, tensorMap, context) as Tensor3D\n | Tensor4D,\n [kernelSize[1],\n kernelSize[2]], [stride[1], stride[2]],\n pad as 'valid' | 'same'));\n }\n\n case 'MaxPoolWithArgmax':\n {\n const stride =\n getParamValue('strides', node, tensorMap, context) as number[];\n const pad\n = getParamValue('pad',\n node, tensorMap, context);\n const kernelSize =\n getParamValue('kernelSize', node, tensorMap,\n context) as number[];\n const includeBatchInIndex =\n getParamValue('includeBatchInIndex', node,\n tensorMap, context) as\n boolean;\n const {result, indexes} = tfOps.maxPoolWithArgmax(\n getParamValue('x', node, tensorMap, context) as Tensor4D,\n [kernelSize[1], kernelSize[2]], [stride[1],

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stride[2]],\n pad as 'valid' | 'same', includeBatchInIndex);\n return [result, indexes];\n }\n case 'AvgPool3D': {\n const stride =\n getParamValue('strides', node, tensorMap, context) as number[];\n const pad = getParamValue('pad', node, tensorMap, context);\n const kernelSize =\n getParamValue('kernelSize', node, tensorMap, context) as number[];\n return [tfOps.avgPool3d(\n getParamValue('x',\n node, tensorMap, context) as Tensor5D,\n [kernelSize[1], kernelSize[2], kernelSize[3]],\n [stride[1], stride[2], stride[3]], pad as 'valid' | 'same'))];\n }\n case 'MaxPool3D': {\n const stride =\n getParamValue('strides', node, tensorMap, context) as number[];\n const pad = getParamValue('pad',\n node, tensorMap, context);\n const kernelSize =\n getParamValue('kernelSize', node, tensorMap,\n context) as number[];\n return [tfOps.maxPool3d(\n getParamValue('x', node, tensorMap, context) as\n Tensor5D,\n [kernelSize[1], kernelSize[2], kernelSize[3]],\n [stride[1], stride[2], stride[3]], pad as\n 'valid' | 'same'))];\n }\n case 'Dilation2D': {\n const strides =\n getParamValue('strides', node,\n tensorMap, context) as number[];\n const pad = getParamValue('pad', node, tensorMap, context);\n const dilations\n =\n getParamValue('dilations', node, tensorMap, context) as number[];\n // strides: [1, stride_height,\n stride_width, 1].\n const strideHeight = strides[1];\n const strideWidth = strides[2];\n // dilations:\n [1, dilation_height, dilation_width, 1].\n const dilationHeight = dilations[1];\n const dilationWidth =\n dilations[2];\n return [tfOps.dilation2d(\n getParamValue('x', node, tensorMap, context) as Tensor3D\n |\n Tensor4D,\n getParamValue('filter', node, tensorMap, context) as Tensor3D,\n [strideHeight, strideWidth], pad as 'valid' | 'same',\n [dilationHeight, dilationWidth], 'NHWC' /* dataFormat\n */);\n }\n default:\n throw TypeError(`Node type ${node.op} is not implemented`);\n }\n};\n\nexport const CATEGORY = 'convolution';\n\n"/**\n * @license\n * Copyright 2018 Google LLC. All Rights\n * Reserved.\n *\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in\n * compliance with the License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES\n * OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n * governing permissions and\n * limitations under the License.\n *\n *=====\n *\n */\n\nimport {DataType, Tensor, Tensor1D} from '@tensorflow/tfjs-core';\n// tslint:disable-next-line: no-imports-\nfrom-dist\nimport * as tfOps from '@tensorflow/tfjs-core/dist/ops/ops_for_converter';\n\nimport\n {NamedTensorsMap} from '../data/types';\nimport {ExecutionContext} from\n '../executor/execution_context';\nimport {InternalOpExecutor, Node}\n from '../types';\n\nimport {getParamValue} from '../utils';\n\nexport const executeOp: InternalOpExecutor =\n (node: Node, tensorMap: NamedTensorsMap,\n context: ExecutionContext): Tensor[] => {\n switch (node.op)\n {\n case 'Fill': {\n const shape =\n getParamValue('shape', node, tensorMap, context) as\n number[];\n const dtype =\n getParamValue('dtype', node, tensorMap, context) as\n DataType;\n const value =\n getParamValue('value', node, tensorMap, context) as\n number;\n return\n [tfOps.fill(shape, value, dtype)];\n }\n case 'LinSpace': {\n const start =\n getParamValue('start', node, tensorMap, context) as\n number;\n const stop =\n getParamValue('stop',\n node, tensorMap, context) as number;\n const num = getParamValue('num', node, tensorMap, context) as\n number;\n return [tfOps.linspace(start, stop, num)];\n }\n case 'Multinomial': {\n const logits =\n getParamValue('logits', node, tensorMap, context) as\n Tensor1D;\n const numSamples =\n getParamValue('numSamples', node, tensorMap, context) as\n number;\n const seed =\n getParamValue('seed', node, tensorMap, context) as\n number;\n return\n [tfOps.multinomial(logits, numSamples, seed)];\n }\n case 'OneHot': {\n const indices =\n getParamValue('indices', node, tensorMap, context) as\n Tensor1D;\n const depth =\n
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getParamValue('depth', node, tensorMap, context) as number;\n const onValue =\ngetParamValue('onValue', node, tensorMap, context) as number;\n const offValue =\ngetParamValue('offValue', node, tensorMap, context) as number;\n return [tfOps.oneHot(indices, depth,\nonValue, offValue)];\n }\n case 'Ones': {\n return [tfOps.ones(\n getParamValue('shape', node, tensorMap, context) as number[],\n getParamValue('dtype', node, tensorMap, context) as DataType)];\n }\n case 'OnesLike': {\n return [tfOps.onesLike(\n getParamValue('x', node, tensorMap, context) as Tensor)];\n }\n case 'RandomUniform': {\n return [tfOps.randomUniform(\n // tslint:disable-next-line:no-any\n getParamValue('shape', node, tensorMap, context) as any,\n getParamValue('minval', node, tensorMap, context) as number,\n getParamValue('maxval', node, tensorMap, context) as number,\n getParamValue('dtype', node, tensorMap, context) as DataType)];\n }\n case 'Range': {\n const start =\n getParamValue('start', node, tensorMap, context) as number;\n const stop =\n getParamValue('stop', node, tensorMap, context) as number;\n const step =\n getParamValue('step', node, tensorMap, context) as number;\n return [tfOps.range(\n start, stop, step,\n getParamValue('dtype', node, tensorMap, context) as 'float32' |\n 'int32')];\n }\n case 'TruncatedNormal': {\n const shape =\n getParamValue('shape', node, tensorMap, context) as number[];\n const mean =\n getParamValue('mean', node, tensorMap, context) as number;\n const stdDev =\n getParamValue('stdDev', node, tensorMap, context) as number;\n const seed =\n getParamValue('seed', node, tensorMap, context) as number;\n return [tfOps.truncatedNormal(\n shape, mean, stdDev,\n getParamValue('dtype', node, tensorMap, context) as 'float32' |\n 'int32',\n seed)];\n }\n case 'Zeros': {\n return [tfOps.zeros(\n getParamValue('shape', node, tensorMap, context) as number[],\n getParamValue('dtype', node, tensorMap, context) as DataType)];\n }\n case 'ZerosLike': {\n return [tfOps.zerosLike(\n getParamValue('x', node, tensorMap, context) as Tensor)];\n }\n default:\n throw TypeError(`Node type ${node.op} is not implemented`);\n }\n}\n\nexport const CATEGORY = 'creation';\n\n/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n\nimport {Tensor, Tensor1D, Tensor2D} from '@tensorflow/tfjs-core';\n// tslint:disable-next-line: no-imports-from-dist\nimport * as tfOps from '@tensorflow/tfjs-core/dist/ops/ops_for_converter';\nimport {NamedTensorsMap} from '../data/types';\nimport {ExecutionContext} from '../executor/execution_context';\nimport {InternalOpAsyncExecutor, Node} from '../types';\nimport {getParamValue} from './utils';\n\nfunction nmsParams(\n node: Node, tensorMap: NamedTensorsMap, context: ExecutionContext) {\n const boxes = getParamValue('boxes', node, tensorMap, context) as Tensor;\n const scores = getParamValue('scores', node, tensorMap, context) as Tensor;\n const maxOutputSize =\n getParamValue('maxOutputSize', node, tensorMap, context) as number;\n const iouThreshold =\n getParamValue('iouThreshold', node, tensorMap, context) as number;\n const scoreThreshold =\n getParamValue('scoreThreshold', node, tensorMap, context) as number;\n const softNmsSigma =\n getParamValue('softNmsSigma', node, tensorMap, context) as number;\n\n return {\n boxes,\n scores,\n maxOutputSize,\n iouThreshold,\n scoreThreshold,\n softNmsSigma\n };\n}\n\nexport const executeOp: InternalOpAsyncExecutor = async(\n node: Node, tensorMap: NamedTensorsMap, context: ExecutionContext): Promise<Tensor[]> => {\n switch (node.op) {\n case 'NonMaxSuppressionV5': {\n const {\n boxes,\n scores,\n maxOutputSize,\n iouThreshold,\n scoreThreshold,\n softNmsSigma\n } = nmsParams(node, tensorMap, context);\n return [tfOps.nonMaxSuppression(\n boxes, scores, maxOutputSize, iouThreshold, scoreThreshold, softNmsSigma,\n 'scores', 'keepTopK', true, false, false)];\n }\n }\n}\n

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scoreThreshold,\n softNmsSigma)\n } = nmsParams(node, tensorMap, context);\n const result = await
tfOps.image.nonMaxSuppressionWithScoreAsync(\n boxes as Tensor2D, scores as Tensor1D, maxOutputSize,
iouThreshold,\n scoreThreshold, softNmsSigma);\n return [result.selectedIndices,
result.selectedScores];\n
 }\n case 'NonMaxSuppressionV4': {\n const { boxes, scores, maxOutputSize, iouThreshold, scoreThreshold }
 = nmsParams(node, tensorMap, context);\n const padToMaxOutputSize =\n getParamValue('padToMaxOutputSize', node, tensorMap, context) as\n boolean;\n const result = await
tfOps.image.nonMaxSuppressionPaddedAsync(\n boxes as Tensor2D, scores as Tensor1D, maxOutputSize,
iouThreshold,\n scoreThreshold, padToMaxOutputSize);\n return [result.selectedIndices,
result.validOutputs];\n }\n case 'NonMaxSuppressionV3':\n case 'NonMaxSuppressionV2': {\n const
{ boxes, scores, maxOutputSize, iouThreshold, scoreThreshold } =\n nmsParams(node, tensorMap,
context);\n return [await tfOps.image.nonMaxSuppressionAsync(\n boxes as Tensor2D, scores as
Tensor1D, maxOutputSize, iouThreshold,\n scoreThreshold)];\n }\n case 'Where': {\n const condition =
tfOps.cast(\n (getParamValue('condition', node, tensorMap, context) as Tensor),\n 'bool');\n const result = [await
tfOps.whereAsync(condition)];\n condition.dispose();\n return result;\n }\n case 'ListDiff': {\n return
tfOps.setdiff1dAsync(\n getParamValue('x', node, tensorMap, context) as Tensor,\n getParamValue('y',
node, tensorMap, context) as Tensor);\n }\n default:\n throw TypeError(`Node type ${node.op} is not
implemented`);\n }\n};\n\nexport const CATEGORY = 'dynamic';\n\n"/**\n * @license\n * Copyright 2018 Google
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use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
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the specific language governing permissions and\n * limitations under the License.\n *\n *
=====*\n\nimport { Tensor } from '@tensorflow/tfjs-core';\n// tslint:disable-next-line: no-imports-from-dist\nimport * as
tfOps from '@tensorflow/tfjs-core/dist/ops/ops_for_converter';\nimport { NamedTensorsMap } from
'../data/types';\nimport { ExecutionContext } from '../executor/execution_context';\nimport { InternalOpExecutor,
Node } from '../types';\nimport { getParamValue } from '../utils';\n\nexport const executeOp: InternalOpExecutor =\n(node: Node, tensorMap: NamedTensorsMap, context: ExecutionContext):\n Tensor[] => {\n switch
(node.op) {\n case 'TopKV2': {\n const x = getParamValue('x', node, tensorMap, context) as
Tensor;\n const k = getParamValue('k', node, tensorMap,
context) as number;\n const sorted =\n getParamValue('sorted', node, tensorMap, context) as
boolean;\n const result = tfOps.topk(x, k, sorted);\n return [result.values, result.indices];\n }\n case 'Unique': {\n const x = getParamValue('x', node, tensorMap, context) as Tensor;\n const
result = tfOps.unique(x);\n return [result.values, result.indices];\n }\n case 'UniqueV2': {\n const x = getParamValue('x', node, tensorMap, context) as Tensor;\n const axis =\n getParamValue('axis', node, tensorMap, context) as number;\n const result = tfOps.unique(x, axis);\n return [result.values, result.indices];\n }\n default:\n throw TypeError(`Node type ${node.op}
is not implemented`);\n }\n }\n };\n\nexport const CATEGORY = 'evaluation';\n\n"/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version
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law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n *\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n *\n *
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*/\n\nimport {Tensor} from '@tensorflow/tfjs-core';\n// tslint:disable-next-line: no-imports-from-dist\nimport * as tfOps from '@tensorflow/tfjs-core/dist/ops/ops_for_converter';\n\nimport {NamedTensorsMap} from './../data/types';\nimport {ExecutionContext} from './../executor/execution_context';\nimport {InternalOpExecutor, Node} from './types';\nimport {cloneTensor, getParamValue, getTensor} from './utils';\n\nexport const executeOp: InternalOpExecutor = (\n node: Node, tensorMap: NamedTensorsMap,\n context: ExecutionContext): Tensor[] => {\n switch (node.op) {\n case 'Const': {\n return tensorMap[node.name];\n }\n case 'PlaceholderWithDefault': {\n const def = getParamValue('default', node, tensorMap, context) as Tensor;\n return [getTensor(node.name, tensorMap, context) || def];\n }\n case 'Placeholder':\n return [getTensor(node.name, tensorMap, context)];\n case 'Identity':\n case 'StopGradient':\n case 'FakeQuantWithMinMaxVars': { // This op is currently ignored.\n const data = getParamValue('x', node, tensorMap, context) as Tensor;\n return [cloneTensor(data)];\n }\n case 'IdentityN':\n return (getParamValue('x', node, tensorMap, context) as Tensor[]).\n map((t: Tensor) => cloneTensor(t));\n case 'Snapshot':\n const snapshot = (getParamValue('x', node, tensorMap, context) as Tensor);\n return [cloneTensor(snapshot)];\n case 'Shape':\n return [tfOps.tensor1d((getParamValue('x', node, tensorMap, context) as Tensor).shape,\n 'int32')];\n case 'ShapeN':\n return (getParamValue('x', node, tensorMap, context) as Tensor[]).\n map((t: Tensor) => tfOps.tensor1d(t.shape));\n case 'Size':\n return [tfOps.scalar((getParamValue('x', node, tensorMap, context) as Tensor).size,\n 'int32')];\n case 'Rank':\n return [tfOps.scalar((getParamValue('x', node, tensorMap, context) as Tensor).rank,\n 'int32')];\n case 'NoOp':\n return [tfOps.scalar(1)];\n case 'Print':\n const input = getParamValue('x', node, tensorMap, context) as Tensor;\n const data = getParamValue('data', node, tensorMap, context) as Tensor[];\n const message = getParamValue('message', node, tensorMap, context) as string;\n const summarize = getParamValue('summarize', node, tensorMap, context) as number;\n console.warn('The graph has a tf.print() operation, ' +\n 'usually used for debugging, which slows down performance.);\n console.log(message);\n for (let i = 0; i < data.length; i++) {\n console.log(Array.prototype.slice.call(data[i].dataSync()).\n .slice(0, summarize));\n }\n return [input];\n default:\n throw TypeError('Node type ${node.op} is not implemented');\n }\n};\n\nexport const CATEGORY = 'graph';\n\n/**\n * @license\n * Copyright 2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing,\n * software distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n\nimport {DataType, keep, scalar, stack, Tensor, tidy, unstack, util} from '@tensorflow/tfjs-core';\n\n/**\n * Hashtable contains a set of tensors, which can be accessed by key.\n */\nexport class HashTable {\n readonly handle: Tensor;\n\n // tslint:disable-next-line: no-any\n private tensorMap: Map<any, Tensor>;\n\n get id() {\n return this.handle.id;\n }\n\n /**\n * Constructor of HashTable. Creates a hash table.\n * @param keyDType `dtype` of the table keys.\n * @param valueDType `dtype` of the table values.\n */\n constructor(readonly keyDType: DataType, readonly valueDType: DataType) {\n this.handle = scalar(0);\n // tslint:disable-next-line: no-any\n this.tensorMap = new Map<any, Tensor>();\n keep(this.handle);\n }\n\n /**\n * Dispose the tensors and handle and clear the hashtable.\n */\n clearAndClose() {\n this.tensorMap.forEach(value => value.dispose());\n this.tensorMap.clear();\n this.handle.dispose();\n }\n\n /**\n * The number of items in the hash table.\n */\n size(): number {\n return this.tensorMap.size;\n }\n\n /**\n * Replaces the contents of the table with the specified keys and values.\n * @param keys Keys to store in the hashtable.\n * @param values Values to store in the hashtable.\n */\n async import(keys: Tensor, values:

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Tensor): Promise<Tensor> {\n this.checkKeyAndValueTensor(keys, values);\n\n // We only store the primitive
values of the keys, this allows lookup\n // to be O(1).\n const $keys = await keys.data();\n\n // Clear the
hashTable before inserting new values.\n this.tensorMap.forEach(value => value.dispose());\n
this.tensorMap.clear();\n\n return tidy(() => {\n const $values = unstack(values);\n\n const keysLength =
$keys.length;\n const valuesLength = $values.length;\n\n util.assert(\n keysLength === valuesLength,\n
 () => `The number of elements doesn't match, keys has ` +\n `${keysLength} elements, the values has
${valuesLength} ` +\n `elements.`);\n\n for (let i = 0; i < keysLength; i++) {\n const key =
$keys[i];\n const value = $values[i];\n keep(value);\n this.tensorMap.set(key, value);\n }\n\n
return this.handle;\n });\n}\n\n/**\n * Looks up
keys in a hash table, outputs the corresponding values.\n *\n * Performs batch lookups, for every element in the
key tensor, `find`\n * stacks the corresponding value into the return tensor.\n *\n * If an element is not present in
the table, the given `defaultValue` is\n * used.\n *\n * @param keys Keys to look up. Must have the same type
as the keys of the\n * table.\n * @param defaultValue The scalar `defaultValue` is the value output for keys\n
* not present in the table. It must also be of the same type as the\n * table values.\n */\n async find(keys:
Tensor, defaultValue: Tensor): Promise<Tensor> {\n this.checkKeyAndValueTensor(keys, defaultValue);\n\n
const $keys = await keys.data();\n\n return tidy(() => {\n const result: Tensor[] = [];\n\n for (let i = 0; i <
$keys.length; i++) {\n const key = $keys[i];\n const value = this.findWithDefault(key, defaultValue);\n
result.push(value);\n }\n\n
return stack(result);\n });\n}\n\n// tslint:disable-next-line: no-any\n private findWithDefault(key: any,
defaultValue: Tensor): Tensor {\n const result = this.tensorMap.get(key);\n return result != null ? result :
defaultValue;\n}\n\n private checkKeyAndValueTensor(key: Tensor, value: Tensor) {\n if (key.dtype !==
this.keyDType) {\n throw new Error(\n `Expect key dtype ${this.keyDType}, but got ` +\n
`${key.dtype}`);\n }\n\n if (value.dtype !== this.valueDType) {\n throw new Error(\n `Expect value
dtype ${this.valueDType}, but got ` +\n `${value.dtype}`);\n }\n}\n\n"/**\n * @license\n * Copyright
2020 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the `License`);\n
* you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n
*\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law
or agreed to in writing, software\n * distributed under the License is distributed on an `AS IS` BASIS,\n
*\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for
the specific language governing permissions and\n * limitations under the License.\n */\n
=====*\n\nimport {DataType, Tensor} from '@tensorflow/tfjs-core';\n\nimport {NamedTensorsMap} from
'../data/types';\nimport {ExecutionContext} from '../executor/execution_context';\nimport {HashTable} from
'../executor/hash_table';\nimport {ResourceManager} from '../executor/resource_manager';\nimport
{InternalOpAsyncExecutor, Node} from '../types';\n\nimport {getParamValue} from './utils';\n\nexport const
executeOp: InternalOpAsyncExecutor = async(\n node: Node, tensorMap: NamedTensorsMap, context:
ExecutionContext,\n resourceManager: ResourceManager): Promise<Tensor[]> => {\n switch (node.op) {\n
case 'HashTable':\n case 'HashTableV2': {\n const keyDType =\n getParamValue('keyDType', node,
tensorMap, context) as DataType;\n const valueDType =\n getParamValue('valueDType', node, tensorMap,
context) as DataType;\n\n const hashTable = new HashTable(keyDType, valueDType);\n
resourceManager.addHashTable(node.name, hashTable);\n return [hashTable.handle];\n }\n case
'LookupTableImport':\n case 'LookupTableImportV2': {\n const handle = getParamValue(\n
'tableHandle', node, tensorMap, context,\n resourceManager) as Tensor;\n const keys =
getParamValue('keys', node, tensorMap, context) as Tensor;\n const values =\n getParamValue('values',
node, tensorMap, context) as Tensor;\n\n const hashTable = resourceManager.getHashTableById(handle.id);\n
return [await hashTable.import(keys, values)];\n }\n case 'LookupTableFind':\n case 'LookupTableFindV2':
{\n const handle = getParamValue(\n 'tableHandle', node, tensorMap, context,\n resourceManager) as Tensor;\n const keys = getParamValue('keys', node, tensorMap, context) as Tensor;\n

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const defaultValue = \n getParamValue('defaultValue', node, tensorMap, context) as Tensor;\n\n const
hashTable = resourceManager.getHashTableById(handle.id);\n return [await hashTable.find(keys,
defaultValue)];\n }\n default:\n throw TypeError(`Node type ${node.op} is not implemented`);\n
}\n};\n\nexport const CATEGORY = 'hash_table';\n", "/*\n * @license\n * Copyright 2018 Google LLC. All
Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n
* distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR
CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing
permissions and\n * limitations under the License.\n *
===== \n
*/\n\nimport {Tensor, Tensor1D, Tensor2D, Tensor3D, Tensor4D} from '@tensorflow/tfjs-core';\n// tslint:disable-
next-line: no-imports-from-dist\nimport * as tfOps from '@tensorflow/tfjs-
core/dist/ops/ops_for_converter';\n\nimport {NamedTensorsMap} from '../data/types';\nimport
{ExecutionContext} from '../executor/execution_context';\nimport {InternalOpExecutor, Node} from
'../types';\n\nimport {getParamValue} from './utils';\n\nexport const executeOp: InternalOpExecutor = \n (node:
Node, tensorMap: NamedTensorsMap, \n context: ExecutionContext): Tensor[] => {\n switch (node.op) {\n
case 'ResizeBilinear': {\n const images
= \n getParamValue('images', node, tensorMap, context) as Tensor;\n const size = \n
getParamValue('size', node, tensorMap, context) as number[];\n const alignCorners = \n
getParamValue('alignCorners', node, tensorMap, context) as \n boolean;\n const halfPixelCenters = \n
getParamValue('halfPixelCenters', node, tensorMap, context) as \n boolean;\n return
[tfOps.image.resizeBilinear(\n images as Tensor3D | Tensor4D, [size[0], size[1]], alignCorners, \n
halfPixelCenters)];\n }\n case 'ResizeNearestNeighbor': {\n const images = \n
getParamValue('images', node, tensorMap, context) as Tensor;\n const size = \n
getParamValue('size', node, tensorMap, context) as number[];\n const alignCorners = \n
getParamValue('alignCorners', node, tensorMap, context) as \n boolean;\n const halfPixelCenters = \n
getParamValue('halfPixelCenters', node, tensorMap, context) as \n boolean;\n return
[tfOps.image.resizeNearestNeighbor(\n images as Tensor3D | Tensor4D, [size[0], size[1]], alignCorners, \n
halfPixelCenters)];\n }\n case 'CropAndResize': {\n const image = \n
getParamValue('image', node, tensorMap, context) as Tensor;\n const boxes = \n
getParamValue('boxes', node, tensorMap, context) as Tensor;\n const boxInd = \n
getParamValue('boxInd', node, tensorMap, context) as Tensor;\n const cropSize = \n
getParamValue('cropSize', node, tensorMap, context) as number[];\n const method = \n
getParamValue('method', node, tensorMap, context) as string;\n const extrapolationValue = \n
getParamValue('extrapolationValue', node, tensorMap, context) as \n number;\n return
[tfOps.image.cropAndResize(\n image as Tensor4D, boxes as Tensor2D, boxInd as Tensor1D, \n
cropSize as [number, number], method as 'bilinear' | 'nearest', \n extrapolationValue)];\n }\n
default:\n throw TypeError(`Node type ${node.op} is not implemented`);\n }\n }\n};\n\nexport const
CATEGORY = 'image';\n", "/*\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed
under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n *
Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed
on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
implied.\n * See the License for the specific language governing permissions and\n * limitations
under the License.\n *
===== \n

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```

*\\n\\nimport { Tensor } from '@tensorflow/tfjs-core';\\n// tslint:disable-next-line: no-imports-from-dist\\nimport * as
tfOps from '@tensorflow/tfjs-core/dist/ops/ops_for_converter';\\n\\nimport { NamedTensorsMap } from
'../../data/types';\\nimport { ExecutionContext } from '../../executor/execution_context';\\nimport { InternalOpExecutor,
Node } from '../../types';\\n\\nimport { getParamValue } from './utils';\\n\\nexport const executeOp: InternalOpExecutor =\\n
(node: Node, tensorMap: NamedTensorsMap,\\n context: ExecutionContext): Tensor[] => {\\n switch
(node.op) {\\n case 'Equal': {\\n return [tfOps.equal(\\n getParamValue('a', node, tensorMap,
context) as Tensor,\\n getParamValue('b', node, tensorMap, context) as Tensor)];\\n }\\n case
'NotEqual': {\\n return [tfOps.notEqual(\\n getParamValue('a', node, tensorMap, context)
as Tensor,\\n getParamValue('b', node, tensorMap, context) as Tensor)];\\n }\\n case 'Greater': {\\n
return [tfOps.greater(\\n getParamValue('a', node, tensorMap, context) as Tensor,\\n
getParamValue('b', node, tensorMap, context) as Tensor)];\\n }\\n case 'GreaterEqual': {\\n return
[tfOps.greaterEqual(\\n getParamValue('a', node, tensorMap, context) as Tensor,\\n
getParamValue('b', node, tensorMap, context) as Tensor)];\\n }\\n case 'Less': {\\n return [tfOps.less(\\n
getParamValue('a', node, tensorMap, context) as Tensor,\\n getParamValue('b', node, tensorMap,
context) as Tensor)];\\n }\\n case 'LessEqual': {\\n return [tfOps.lessEqual(\\n getParamValue('a',
node, tensorMap, context) as Tensor,\\n getParamValue('b', node, tensorMap, context) as Tensor)];\\n }\\n
case 'LogicalAnd':
{\\n return [tfOps.logicalAnd(\\n getParamValue('a', node, tensorMap, context) as Tensor,\\n
getParamValue('b', node, tensorMap, context) as Tensor)];\\n }\\n case 'LogicalNot': {\\n return
[tfOps.logicalNot(\\n getParamValue('a', node, tensorMap, context) as Tensor)];\\n }\\n case
'LogicalOr': {\\n return [tfOps.logicalOr(\\n getParamValue('a', node, tensorMap, context) as Tensor,\\n
getParamValue('b', node, tensorMap, context) as Tensor)];\\n }\\n case 'Select':\\n case 'SelectV2':
{\\n return [tfOps.where(\\n getParamValue('condition', node, tensorMap, context) as Tensor,\\n
getParamValue('a', node, tensorMap, context) as Tensor,\\n getParamValue('b', node, tensorMap, context) as
Tensor)];\\n }\\n default:\\n throw TypeError(`Node type ${node.op} is not implemented`);\\n }\\n
};\\n\\nexport const

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CATEGORY = 'logical';\\n", "/\*\\n \* @license\\n \* Copyright 2018 Google LLC. All Rights Reserved.\\n \* Licensed
 under the Apache License, Version 2.0 (the "License");\\n \* you may not use this file except in compliance with the
 License.\\n \* You may obtain a copy of the License at\\n \* \\n \* <http://www.apache.org/licenses/LICENSE-2.0>\\n \* \\n \*
 Unless required by applicable law or agreed to in writing, software\\n \* distributed under the License is distributed
 on an "AS IS" BASIS,\\n \* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or
 implied.\\n \* See the License for the specific language governing permissions and\\n \* limitations under the
 License.\\n \*

```

=====\\n
*\\n\\nimport { Tensor, Tensor2D } from '@tensorflow/tfjs-core';\\n// tslint:disable-next-line: no-imports-from-
dist\\nimport * as tfOps from '@tensorflow/tfjs-core/dist/ops/ops_for_converter';\\n\\nimport { NamedTensorsMap }
from '../../data/types';\\nimport
{ ExecutionContext } from '../../executor/execution_context';\\nimport { InternalOpExecutor, Node } from
'../../types';\\n\\nimport { getParamValue } from './utils';\\n\\nexport const executeOp: InternalOpExecutor =\\n (node:
Node, tensorMap: NamedTensorsMap,\\n context: ExecutionContext): Tensor[] => {\\n switch (node.op) {\\n
case 'BatchMatMul':\\n case 'BatchMatMulV2':\\n case 'MatMul':\\n return [tfOps.matMul(\\n
getParamValue('a', node, tensorMap, context) as Tensor2D,\\n getParamValue('b', node, tensorMap, context)
as Tensor2D,\\n getParamValue('transposeA', node, tensorMap, context) as boolean,\\n
getParamValue('transposeB', node, tensorMap, context) as\\n boolean)];\\n\\n case 'Transpose':\\n
return [tfOps.transpose(\\n getParamValue('x', node, tensorMap, context) as Tensor,\\n
getParamValue('perm', node, tensorMap, context) as number[])];\\n\\n case '_FusedMatMul':\\n
const [extraOp, activationFunc] =\\n (getParamValue('fusedOps', node, tensorMap, context) as
string[]);\\n\\n const isBiasAdd = extraOp === 'biasadd';\\n const isPrelu = activationFunc === 'prelu';\\n\\n

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const numArgs =\n (getParamValue('numArgs', node, tensorMap, context) as number);\n\nleakyreluAlpha =\n getParamValue('leakyreluAlpha', node, tensorMap, context) as\n number;\n\nif (isBiasAdd) {\n if (isPrelu && numArgs !== 2) {\n throw new Error(\n 'Fused\nMatMul with BiasAdd and Prelu must have two '\n +'\n 'extra arguments: bias and alpha.');\n }\n if (!isPrelu && numArgs !== 1) {\n throw new Error(\n 'Fused MatMul with BiasAdd must\nhave one extra argument: bias.');\n }\n const [biasArg, preluArg] =\n getParamValue('args',\n node, tensorMap, context) as Tensor[];\n return [tfOps.fused.matMul({\n a: getParamValue('a', node,\ntensorMap, context) as Tensor2D,\n b: getParamValue('b', node, tensorMap, context) as Tensor2D,\n transposeA: getParamValue('transposeA', node, tensorMap, context) as\n boolean,\n transposeB:\n getParamValue('transposeB', node, tensorMap, context) as\n boolean,\n bias: biasArg,\n activation: activationFunc as tfOps.fused.Activation,\n preluActivationWeights: preluArg,\n leakyreluAlpha\n })];\n}\n\ndefault:\n throw TypeError(`Node type ${node.op} is not\nimplemented`);\n}\n};\n\nexport const CATEGORY = 'matrices';\n\n/*\n * @license\n * Copyright 2018\nGoogle LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n *\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless\nrequired by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an\n\"AS IS\"\nBASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n *\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n\nimport {Scalar, Tensor, Tensor3D, Tensor4D} from '@tensorflow/tfjs-core';\n// tslint:disable-next-line: no-imports-from-dist\nimport * as tfOps from '@tensorflow/tfjs-core/dist/ops/ops_for_converter';\nimport {NamedTensorsMap} from '../data/types';\nimport {ExecutionContext} from\n '../executor/execution_context';\nimport {InternalOpExecutor, Node} from '../types';\nimport {getParamValue}\nfrom './utils';\n\nexport const executeOp: InternalOpExecutor = (\n node: Node, tensorMap:\n NamedTensorsMap,\n context: ExecutionContext): Tensor[] => {\n switch (node.op) {\n case\n'FusedBatchNorm':\n case 'FusedBatchNormV2': {\n return [tfOps.batchNorm(\n getParamValue('x', node, tensorMap, context) as Tensor,\n getParamValue('mean', node, tensorMap,\n context) as Tensor,\n getParamValue('variance', node, tensorMap, context) as Tensor,\n getParamValue('offset', node, tensorMap, context) as Tensor,\n getParamValue('scale', node, tensorMap,\n context) as Tensor,\n getParamValue('epsilon', node, tensorMap, context) as number)];\n }\n case\n'FusedBatchNormV3': {\n return [tfOps.batchNorm(\n getParamValue('x', node, tensorMap, context)\nas Tensor,\n getParamValue('mean', node, tensorMap, context) as Tensor,\n getParamValue('variance', node, tensorMap, context) as Tensor,\n getParamValue('offset',\n node, tensorMap, context) as Tensor,\n getParamValue('scale', node, tensorMap, context) as Tensor,\n getParamValue('epsilon', node, tensorMap, context) as number)];\n }\n case 'LRN': {\n return\n[tfOps.localResponseNormalization(\n getParamValue('x', node, tensorMap, context) as Tensor3D\n \\\nTensor4D,\n getParamValue('radius', node, tensorMap, context) as number,\n getParamValue('bias', node, tensorMap, context) as number,\n getParamValue('alpha', node, tensorMap,\n context) as number,\n getParamValue('beta', node, tensorMap, context) as number)];\n }\n case\n'Softmax': {\n return [tfOps.softmax(\n getParamValue('x', node, tensorMap, context) as Tensor)];\n }\n case 'LogSoftmax': {\n return [tfOps.logSoftmax(\n getParamValue('x', node, tensorMap,\n context) as Tensor)];\n }\n case\n'SparseToDense': {\n return [tfOps.sparseToDense(\n getParamValue('sparseIndices', node,\n tensorMap, context) as\n Tensor,\n getParamValue('outputShape', node, tensorMap, context) as\n Tensor,\n getParamValue('sparseValues', node, tensorMap, context) as\n number[],\n getParamValue('defaultValue', node, tensorMap, context) as\n Scalar)];\n }\n default:\n
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throw TypeError(`Node type ${node.op} is not implemented`);\n }\n };\n\nexport const CATEGORY =
'normalization';\n", "/*\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the
Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * \n *
Unless required by applicable law or agreed to in writing, software\n *
distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR
CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing
permissions and\n * limitations under the License.\n *

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*\n\nimport {Tensor, Tensor1D, Tensor2D} from '@tensorflow/tfjs-core';\n// tslint:disable-next-line: no-imports-
from-dist\nimport * as tfOps from '@tensorflow/tfjs-core/dist/ops/ops_for_converter';\n\nimport
{NamedTensorsMap} from '../data/types';\nimport {ExecutionContext} from
'../executor/execution_context';\nimport {InternalOpExecutor, Node} from '../types';\n\nimport {getParamValue}
from '../utils';\n\nexport const executeOp: InternalOpExecutor =\n (node: Node, tensorMap: NamedTensorsMap,\n context: ExecutionContext): Tensor[] => {\n switch (node.op) {\n case 'Max': {\n const axis =\n getParamValue('axis',\n node, tensorMap, context) as number[];\n const keepDims =\n getParamValue('keepDims', node,\n tensorMap, context) as boolean;\n return [tfOps.max(\n getParamValue('x', node, tensorMap, context)\n as Tensor, axis,\n keepDims)];\n }\n case 'Mean': {\n const axis =\n getParamValue('axis', node, tensorMap, context) as number[];\n const keepDims =\n getParamValue('keepDims', node, tensorMap, context) as boolean;\n return [tfOps.mean(\n getParamValue('x', node, tensorMap, context) as Tensor, axis,\n keepDims)];\n }\n case 'Min': {\n const axis =\n getParamValue('axis', node, tensorMap, context) as number[];\n const keepDims =\n getParamValue('keepDims', node, tensorMap, context) as boolean;\n return [tfOps.min(\n getParamValue('x', node, tensorMap, context) as Tensor,\n axis,\n keepDims)];\n }\n case 'Sum': {\n const axis =\n getParamValue('axis', node,\n tensorMap, context) as number[];\n const keepDims =\n getParamValue('keepDims', node, tensorMap,\n context) as boolean;\n return [tfOps.sum(\n getParamValue('x', node, tensorMap, context) as Tensor,\n axis,\n keepDims)];\n }\n case 'All': {\n const axis =\n getParamValue('axis', node,\n tensorMap, context) as number[];\n const keepDims =\n getParamValue('keepDims', node, tensorMap,\n context) as boolean;\n return [tfOps.all(\n getParamValue('x', node, tensorMap, context) as Tensor,\n axis,\n keepDims)];\n }\n case 'Any': {\n const axis =\n getParamValue('axis', node,\n tensorMap, context) as number[];\n const keepDims =\n getParamValue('keepDims', node, tensorMap,\n context) as boolean;\n return [tfOps.any(\n getParamValue('x', node, tensorMap, context) as Tensor,\n axis,\n keepDims)];\n }\n case 'ArgMax': {\n const axis =\n getParamValue('axis',\n node, tensorMap, context) as number;\n return [tfOps.argMax(\n getParamValue('x', node, tensorMap,\n context) as Tensor, axis)];\n }\n case 'ArgMin': {\n const axis =\n getParamValue('axis', node,\n tensorMap, context) as number;\n return [tfOps.argMin(\n getParamValue('x', node, tensorMap,\n context) as Tensor, axis)];\n }\n case 'Prod': {\n const axis =\n getParamValue('axis', node,\n tensorMap, context) as number[];\n const keepDims =\n getParamValue('keepDims', node, tensorMap,\n context) as boolean;\n return [tfOps.prod(\n getParamValue('x', node, tensorMap, context) as Tensor,\n axis,\n keepDims)];\n }\n case 'Cumsum': {\n const axis =\n getParamValue('axis', node,\n tensorMap, context) as number;\n const exclusive =\n getParamValue('exclusive', node, tensorMap,\n context) as boolean;\n const reverse =\n getParamValue('reverse', node, tensorMap, context) as\n boolean;\n return [tfOps.cumsum(\n getParamValue('x', node, tensorMap, context) as Tensor, axis,\n exclusive, reverse)];\n }\n case 'Bincount': {\n const x = getParamValue('x', node, tensorMap,\n context) as Tensor1D;\n const weights =\n getParamValue('weights', node, tensorMap, context) as

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Tensor1D;\n const size =\n getParamValue('size', node, tensorMap, context) as number;\n\nreturn [tfOps.bincount(x, weights, size)];\n case 'DenseBincount': {\n const x = getParamValue('x', node,\ntensorMap, context)\n\n as Tensor1D\n Tensor2D;\n const weights =\n getParamValue('weights', node, tensorMap,\ncontext) as Tensor1D\n Tensor2D;\n const size =\n getParamValue('size', node, tensorMap,\ncontext) as number;\n\n const binaryOutput =\n getParamValue('binaryOutput', node, tensorMap,\ncontext) as\n boolean;\n\n return [tfOps.denseBincount(x, weights, size, binaryOutput)];\n }\n\ndefault:\n throw TypeError(`Node type ${node.op} is not implemented`);\n }\n };\n\nexport const\nCATEGORY = 'reduction';\n", "/*\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in\n * compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,\n * software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES\n * OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language\n * governing permissions and\n * limitations under the License.\n *\n * =====\n *\n * import {Scalar, Tensor, Tensor1D, tidy, util} from '@tensorflow/tfjs-core';\n * tslint:disable-next-line: no-
imports-from-dist\n * import * as tfOps from '@tensorflow/tfjs-core/dist/ops/ops_for_converter';\n * import\n * {NamedTensorsMap} from '../data/types';\n * import {ExecutionContext} from\n * '../executor/execution_context';\n * import {InternalOpExecutor, Node} from './types';\n * import {getParamValue}\n * from './utils';\n * export const executeOp: InternalOpExecutor =\n * (node: Node, tensorMap: NamedTensorsMap,\n * context: ExecutionContext): Tensor[] => {\n * switch (node.op) {\n * case 'ConcatV2':\n * case 'Concat': {\n * const n = getParamValue('n', node, tensorMap, context) as number;\n * const axis =\n * getParamValue('axis', node, tensorMap, context) as number;\n * let inputs =\n * getParamValue('tensors',\n * node, tensorMap, context) as Tensor[];\n * inputs = inputs.slice(0, n);\n * return [tfOps.concat(inputs,\n * axis)];\n * }\n * case 'Gather': {\n * const input = getParamValue('x', node, tensorMap, context) as\n * Tensor;\n * const indices =\n * getParamValue('indices', node, tensorMap, context) as Tensor1D;\n * return [tfOps.gather(input, tfOps.cast(indices, 'int32'), 0)];\n * }\n * case 'GatherV2': {\n * const axis =\n * getParamValue('axis', node, tensorMap, context) as number;\n * const batchDims =\n * getParamValue('batchDims', node, tensorMap, context) as number;\n * const input = getParamValue('x', node,\n * tensorMap, context) as Tensor;\n * const indices =\n * getParamValue('indices', node, tensorMap, context) as Tensor1D;\n * return\n * [tfOps.gather(\n * input, tfOps.cast(indices, 'int32'), axis, batchDims)];\n * }\n * case 'Reverse': {\n * const dims =\n * getParamValue('dims', node, tensorMap, context) as boolean[];\n * const axis = [];\n * for (let i = 0; i < dims.length; i++) {\n * if (dims[i]) {\n * axis.push(i);\n * }\n * }\n * const\n * input = getParamValue('x', node, tensorMap, context) as Tensor;\n * return [tfOps.reverse(input, axis)];\n * }\n * case 'ReverseV2': {\n * const axis =\n * getParamValue('axis', node, tensorMap, context) as\n * number[];\n * const input = getParamValue('x', node, tensorMap, context) as Tensor;\n * return\n * [tfOps.reverse(input, axis)];\n * }\n * case 'Slice': {\n * // tslint:disable-next-line:no-any\n * const\n * begin = getParamValue('begin', node, tensorMap, context) as any;\n * // tslint:disable-next-line:no-any\n * const size = getParamValue('size', node, tensorMap, context) as any;\n * return [tfOps.slice(\n * getParamValue('x', node, tensorMap, context) as Tensor, begin,\n * size)];\n * }\n * case 'StridedSlice':\n * {\n * const begin =\n * getParamValue('begin', node, tensorMap, context) as number[];\n * const end\n * =\n * getParamValue('end', node, tensorMap, context) as number[];\n * const strides =\n * getParamValue('strides', node, tensorMap, context) as number[];\n * const beginMask =\n * getParamValue('beginMask', node, tensorMap, context) as number;\n * const endMask =\n * getParamValue('endMask', node, tensorMap, context) as number;\n * const ellipsisMask =\n * getParamValue('ellipsisMask', node, tensorMap, context) as number;\n
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const newAxisMask =\n getParamValue('newAxisMask', node, tensorMap, context) as number;\n\nconst shrinkAxisMask =\n getParamValue('shrinkAxisMask', node, tensorMap, context) as\nnumber;\n\nconst tensor = getParamValue('x', node, tensorMap, context) as Tensor;\n\nreturn [tfOps.stridedSlice(\n tensor, begin, end, strides, beginMask, endMask, ellipsisMask,\nnewAxisMask, shrinkAxisMask)];\n}\n\n case 'Pack': {\n return tidy(() => {\n const axis =\n getParamValue('axis', node, tensorMap, context) as number;\n const tensors =\n getParamValue('tensors', node, tensorMap, context) as Tensor[];\n // Reshape the tensors to the first tensor's\nshape if they don't\n // match.\n const shape = tensors[0].shape;\n const squeezedShape =\ntfOps.squeeze(tensors[0]).shape;\n const\nmapped = tensors.map(tensor => {\n const sameShape = util.arraysEqual(tensor.shape, shape);\n if\n(!sameShape &&\n !util.arraysEqual(\n tfOps.squeeze(tensor).shape, squeezedShape)) {\nthrow new Error('the input tensors shape does not match');\n }\n return sameShape ? tensor :\ntfOps.reshape(tensor, shape);\n });\n return [tfOps.stack(mapped, axis)];\n });\n}\n\n case\n'Unpack': {\n const axis =\n getParamValue('axis', node, tensorMap, context) as number;\n const\n tensor =\n getParamValue('tensor', node, tensorMap, context) as Tensor;\n return tfOps.unstack(tensor,\naxis);\n}\n\n case 'Tile': {\n const reps =\n getParamValue('reps', node, tensorMap, context) as\nnumber[];\n return [tfOps.tile(\n getParamValue('x', node, tensorMap, context)\nas Tensor, reps)];\n}\n\n case 'Split':\n case 'SplitV': {\n const axis =\n getParamValue('axis', node, tensorMap, context) as number;\n const numOrSizeSplits =\n getParamValue('numOrSizeSplits', node, tensorMap, context) as\nnumber | \nnumber[];\n const tensor = getParamValue('x', node, tensorMap, context) as Tensor;\n return tfOps.split(tensor,\nnumOrSizeSplits, axis);\n}\n\n case 'ScatterNd': {\n const indices =\n getParamValue('indices',\node, tensorMap, context) as Tensor;\n const values =\n getParamValue('values', node, tensorMap,\ncontext) as Tensor;\n const shape =\n getParamValue('shape', node, tensorMap, context) as\nnumber[];\n return [tfOps.scatterND(indices, values, shape)];\n}\n\n case 'GatherNd': {\n const x\n= getParamValue('x', node, tensorMap, context)\nas Tensor;\n const indices =\n getParamValue('indices', node, tensorMap, context) as Tensor;\n return [tfOps.gatherND(x, indices)];\n}\n\n case 'SparseToDense': {\n const indices =\n getParamValue('sparseIndices', node, tensorMap, context) as\nTensor;\n const shape =\n getParamValue('outputShape', node, tensorMap, context) as\nnumber[];\n const sparseValues =\n getParamValue('sparseValues', node, tensorMap, context) as Tensor;\n const defaultValue =\n getParamValue('defaultValue', node, tensorMap, context) as Scalar;\n return [tfOps.sparseToDense(\nindices, sparseValues, shape,\nsparseValues.dtype === defaultValue.dtype ?\ndefaultValue : \n tfOps.cast(defaultValue, sparseValues.dtype))];\n}\n\n default:\n throw TypeError(`Node type\n${node.op} is not implemented`);\n}\n};\n\nexport const CATEGORY = 'slice_join';\n\n/* ** @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the\n * \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the\n * License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or\n * agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for\n * the specific language governing permissions and\n * limitations under the License.\n */\n\n=====\n\nimport {Tensor} from '@tensorflow/tfjs-core';\n// tslint:disable-next-line: no-imports-from-dist\nimport *\nas tfOps from '@tensorflow/tfjs-core/dist/ops/ops_for_converter';\n\nimport {\nNamedTensorsMap\n} from '../data/types';\nimport {ExecutionContext} from\n../executor/context';\nimport {\nInternalOpExecutor,\nNode\n} from '../types';\nimport {\ngetParamValue\n} from './utils';\n\nexport const executeOp: InternalOpExecutor = (\nnode: Node,\ntensorMap: NamedTensorsMap,\ncontext: ExecutionContext):\nTensor[] => {\n switch (node.op) {\n case 'FFT': {\n return
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[tfOps.fft(\n getParamValue('x', node, tensorMap, context) as Tensor)];\n }\n case 'IFFT':
{\n return [tfOps.ifft(\n getParamValue('x', node, tensorMap, context) as Tensor)];\n }\n case 'RFFT': {\n return [tfOps.rfft(\n getParamValue('x', node, tensorMap, context) as
Tensor)];\n }\n case 'IRFFT': {\n return [tfOps.irfft(\n getParamValue('x', node,
tensorMap, context) as Tensor)];\n }\n default:\n throw TypeError('Node type ${node.op} is not implemented');\n }\n
};\n\nexport const CATEGORY = 'spectral';\n", "/*\n * @license\n * Copyright 2018 Google LLC. All Rights
Reserved.\n * Licensed under the Apache License, Version 2.0 (the 'License');\n * you may not use this file
except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an 'AS IS' BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n *
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*\n\nimport {Tensor, Tensor4D} from '@tensorflow/tfjs-core';\n// tslint:disable-next-line: no-imports-from-
dist\nimport
* as tfOps from '@tensorflow/tfjs-core/dist/ops/ops_for_converter';\n\nimport {NamedTensorsMap} from
'../data/types';\nimport {ExecutionContext} from '../executor/execution_context';\nimport {InternalOpExecutor,
Node} from '../types';\nimport {getParamValue} from './utils';\n\nexport const executeOp: InternalOpExecutor =\n(node: Node, tensorMap: NamedTensorsMap,\n context: ExecutionContext): Tensor[] => {\n switch
(node.op) {\n case 'Cast': {\n return [tfOps.cast(\n getParamValue('x', node, tensorMap, context)
as Tensor,\n getParamValue('dtype', node, tensorMap, context) as 'int32' | 'float32' | 'bool')];\n }\n case 'ExpandDims': {\n const axis =\n getParamValue('axis', node, tensorMap, context) as
number;\n return [tfOps.expandDims(\n getParamValue('x', node, tensorMap, context) as Tensor,\n axis)];\n }\n case 'Squeeze': {\n const axis =\n getParamValue('axis', node, tensorMap, context) as number[];\n return
[tfOps.squeeze(\n getParamValue('x', node, tensorMap, context) as Tensor, axis)];\n }\n case
'Reshape': {\n return [tfOps.reshape(\n getParamValue('x', node, tensorMap, context) as Tensor,\n getParamValue('shape', node, tensorMap, context) as number[])];\n }\n case 'MirrorPad': {\n return
[tfOps.mirrorPad(\n getParamValue('x', node, tensorMap, context) as Tensor,\n getParamValue('padding', node, tensorMap, context) as\n Array<[number, number]>,\n getParamValue('mode', node, tensorMap, context) as 'reflect' | 'symmetric')];\n }\n case
'PadV2': {\n case 'Pad': {\n return [tfOps.pad(\n getParamValue('x', node, tensorMap, context) as
Tensor,\n getParamValue('padding',
node, tensorMap, context) as\n Array<[number, number]>,\n getParamValue('constantValue',
node, tensorMap, context) as\n number)];\n }\n }\n case 'SpaceToBatchND': {\n const
blockShape =\n getParamValue('blockShape', node, tensorMap, context) as number[];\n const
paddings =\n getParamValue('paddings', node, tensorMap, context) as number[][];\n return
[tfOps.spaceToBatchND(\n getParamValue('x', node, tensorMap, context) as Tensor,\n blockShape,\n paddings)];\n }\n case 'BatchToSpaceND': {\n const blockShape =\n getParamValue('blockShape', node, tensorMap, context) as number[];\n const crops =\n getParamValue('crops', node, tensorMap, context) as number[][];\n return [tfOps.batchToSpaceND(\n getParamValue('x', node, tensorMap, context) as Tensor,\n blockShape,\n crops)];\n }\n case 'DepthToSpace': {\n const blockSize =\n getParamValue('blockSize',
node, tensorMap, context) as number;\n const dataFormat =\n (getParamValue('dataFormat', node,
tensorMap, context) as\n string).toUpperCase() as 'NHWC' | 'NCHW';\n return
[tfOps.depthToSpace(\n getParamValue('x', node, tensorMap, context) as Tensor4D,\n blockSize,\n dataFormat)];\n }\n case 'BroadcastTo': {\n return [tfOps.broadcastTo(\n getParamValue('x',

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node, tensorMap, context) as Tensor,\n getParamValue('shape', node, tensorMap, context) as number[]);\n}\n default:\n throw TypeError(`Node type ${node.op} is not implemented`);\n }\n};\n\nexport\nconst CATEGORY = 'transformation';\n"/**\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n\nimport * as tfc from '@tensorflow/tfjs-core';\nimport {NamedTensorsMap} from '../data/types';\nimport {ExecutionContext} from '../executor/execution_context';\nimport {ResourceManager} from '../executor/resource_manager';\nimport {NodeValueImpl} from '../custom_op/node_value_impl';\nimport {getRegisteredOp} from '../custom_op/register';\nimport * as arithmetic from '../executors/arithmetic_executor';\nimport *\nfrom '../executors/basic_math_executor';\nimport * as control from '../executors/control_executor';\nimport * as convolution from '../executors/convolution_executor';\nimport * as creation from '../executors/creation_executor';\nimport * as dynamic from '../executors/dynamic_executor';\nimport * as evaluation from '../executors/evaluation_executor';\nimport * as graph from '../executors/graph_executor';\nimport * as hashTable from '../executors/hash_table_executor';\nimport * as image from '../executors/image_executor';\nimport * as logical from '../executors/logical_executor';\nimport * as matrices from '../executors/matrices_executor';\nimport * as normalization from '../executors/normalization_executor';\nimport * as reduction from '../executors/reduction_executor';\nimport * as sliceJoin from '../executors/slice_join_executor';\nimport * as spectral from '../executors/spectral_executor';\nimport * as transformation from '../executors/transformation_executor';\nimport {\n Node\n} from './types';\n/**\n * Executes the op defined by the node object.\n * @param node\n * @param tensorMap contains tensors for executed nodes and weights\n * @param context contains tensors and information for running the current node.\n * @param resourceManager Optional. Contains global resources of the model.\n */\nexport function executeOp(\n node: Node, tensorMap: NamedTensorsMap, context: ExecutionContext,\n resourceManager?: ResourceManager): tfc.Tensor[]|Promise<tfc.Tensor[]> {\n const value = (\n (node: Node, tensorMap: NamedTensorsMap, context: ExecutionContext) => {\n switch (node.category) {\n case 'arithmetic':\n return tfc.tidy(() => arithmetic.executeOp(node, tensorMap, context));\n case 'basic_math':\n return tfc.tidy(() => basicMath.executeOp(node, tensorMap, context));\n case 'control':\n return control.executeOp(node, tensorMap, context);\n case 'convolution':\n return tfc.tidy(() => convolution.executeOp(node, tensorMap, context));\n case 'creation':\n return tfc.tidy(() => creation.executeOp(node, tensorMap, context));\n case 'dynamic':\n return dynamic.executeOp(node, tensorMap, context);\n case 'evaluation':\n return tfc.tidy(() => evaluation.executeOp(node, tensorMap, context));\n case 'image':\n return tfc.tidy(() => image.executeOp(node, tensorMap, context));\n case 'graph':\n return tfc.tidy(() => graph.executeOp(node, tensorMap, context));\n case 'logical':\n return tfc.tidy(() => logical.executeOp(node, tensorMap, context));\n case 'matrices':\n return tfc.tidy(() => matrices.executeOp(node, tensorMap, context));\n case 'normalization':\n return tfc.tidy(() => normalization.executeOp(node, tensorMap, context));\n case 'reduction':\n return tfc.tidy(() => reduction.executeOp(node, tensorMap, context));\n case 'slice_join':\n return tfc.tidy(() => sliceJoin.executeOp(node, tensorMap, context));\n case 'spectral':\n return tfc.tidy(() => spectral.executeOp(node, tensorMap, context));\n case 'transformation':\n return tfc.tidy(() => transformation.executeOp(node, tensorMap, context));\n case 'hash_table':\n return hashTable.executeOp(node, tensorMap,
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context, resourceManager);\n case 'custom':\n const opMapper = getRegisteredOp(node.op);\n if (opMapper && opMapper.customExecutor) {\n return opMapper.customExecutor(\n new\n NodeValueImpl(node, tensorMap, context));\n } else {\n throw TypeError(`Custom op ${node.op}\n is not registered.`);\n }\n default:\n throw TypeError(\n `Unknown op '${node.op}'.\n File an issue at ` +\n `https://github.com/tensorflow/tfjs/issues so we can add it` +\n `, or register a\n custom execution with tf.registerOp()`);\n }\n })(node, tensorMap, context);\n if (tfc.util.isPromise(value))\n {\n return (value as Promise<tfc.Tensor>).then((data) => [].concat(data));\n }\n return\n [].concat(value);\n }\n "\n", "/*\n * @license\n * Copyright 2018 Google LLC. All Rights Reserved.\n * Licensed under\n the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the\n License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed\n on an \"AS IS\" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY\n KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */\n =====\n *\n * @import {Tensor} from '@tensorflow/tfjs-core';\n * @import {NamedTensorsMap, TensorArrayMap,\n * TensorListMap} from './data/types';\n * @import {TensorArray} from './tensor_array';\n * @import {TensorList} from\n * './tensor_list';\n * @import {FunctionExecutor} from './types';\n * @export interface ExecutionContextInfo {\n * id: number;\n * // the unique id of the context info\n * frameName: string; // The frame name of the loop, this comes from\n * // the TensorFlow NodeDef.\n * iterationId: number; // The iteration id of the loop\n * }\n *\n * ExecutionContext captures the runtime environment of the node. It keeps\n * track of the current frame and iteration\n * for the control flow ops.\n * For example, typical Dynamic RNN model may contain loops, for\n * which\n * TensorFlow will generate graphs with Enter/Exit nodes to control the\n * current execution frame, and\n * NextIteration Nodes for iteration id increment.\n * For model with branch logic, TensorFlow will generate\n * Switch/Merge ops.\n * @export class ExecutionContext {\n * private rootContext = {id: 0, frameName: '', iterationId:\n * 0};\n * private contexts: ExecutionContextInfo[] = [this.rootContext];\n * private lastId = 0;\n * private\n * _currentContextIds: string[];\n *\n * constructor(\n * readonly weightMap: NamedTensorsMap = {},\n * readonly\n * tensorArrayMap: TensorArrayMap = {},\n * readonly tensorListMap: TensorListMap = {},\n * readonly\n * functionMap: {[key: string]: FunctionExecutor} = {})\n * {\n * this.generateCurrentContextIds();\n * }\n *\n * private\n * newFrame(id: number, frameName: string)\n * {\n * return {id, frameName, iterationId: 0};\n * }\n *\n * /*\n * * Set the\n * current context\n * * @param contexts: ExecutionContextInfo[] the current path of execution\n * * frames\n * * @\n * set currentContext(contexts: ExecutionContextInfo[]) {\n * if (this.contexts !== contexts) {\n * this.contexts =\n * contexts;\n * this.generateCurrentContextIds();\n * }\n * }\n *\n * get currentContext(): ExecutionContextInfo {\n * return this.contexts;\n * }\n *\n * /*\n * * Returns the current context in string format.\n * * @\n * get currentContextId():\n * string {\n * return this._currentContextIds[0];\n * }\n *\n * /*\n * * Returns the current context and all parent contexts\n * in string format.\n * * This allow access to the nodes in the current and parent frames.\n * * @\n * get\n * currentContextIds(): string[] {\n * return this._currentContextIds;\n * }\n *\n * private generateCurrentContextIds() {\n * const names = [];\n * for (let i = 0; i < this.contexts.length - 1; i++) {\n * const contexts = this.contexts.slice(0,\n * this.contexts.length - i);\n * names.push(this.contextIdforContexts(contexts));\n * }\n * names.push('');\n * this._currentContextIds = names;\n * }\n *\n * private contextIdforContexts(contexts:\n * ExecutionContextInfo[]) {\n * return contexts\n * .map(\n * context => (context.id\n * === 0 && context.iterationId === 0) ?\n * '' :\n * `${context.frameName}-\n * ${context.iterationId}`)\n * .join('/')\n * .join('');\n * }\n *\n * /*\n * * Enter a new frame, a new context is pushed on\n * the current context list.\n * * @param frameId new frame id\n * * @\n * enterFrame(frameId: string) {\n * if\n * (this.contexts) {\n * this.lastId++;\n * this.contexts = this.contexts.slice();\n * this.contexts.push(this.newFrame(this.lastId, frameId));\n * }\n *\n * this._currentContextIds.unshift(this.contextIdforContexts(this.contexts));\n * }\n *\n * /*\n * * Exit the current\n * frame, the last context is removed from the current\n * * context list.\n * * @\n * exitFrame() {\n * if (this.contexts &&

```



```
this.contexts.length > 1) {\n this.contexts = this.contexts.slice();\n this.contexts.splice(-1);\n this.currentContextIds.shift();\n } else {\n throw new Error('Cannot exit frame, the context is empty');\n }\n}\n\n/**\n * Enter the next iteration of a loop, the iteration id of last context is increased.\n */\nnextIteration() {\n if (this.contexts && this.contexts.length > 0) {\n this.contexts = this.contexts.slice();\n this.lastId++;\n const context =\n Object.assign({}, this.contexts[this.contexts.length - 1]);\n context.iterationId += 1;\n context.id = this.lastId;\n this.contexts.splice(-1, 1, context);\n this._currentContextIds.splice(\n 0, 1, this.contextIdForContexts(this.contexts));\n } else {\n throw new Error('Cannot increase frame iteration, the context is empty');\n }\n}\n\ngetWeight(name: string): Tensor[] {\n return this.weightMap[name];\n}\n\naddTensorArray(tensorArray: TensorArray) {\n this.tensorArrayMap[tensorArray.id] = tensorArray;\n}\n\ngetTensorArray(id:\nnumber): TensorArray {\n return this.tensorArrayMap[id];\n}\n\naddTensorList(tensorList: TensorList) {\n this.tensorListMap[tensorList.id] = tensorList;\n}\n\ngetTensorList(id: number): TensorList {\n return this.tensorListMap[id];\n}\n\ndispose(keepIds: Set<number>) {\n for (const key in this.tensorArrayMap) {\n this.tensorArrayMap[key].clearAndClose(keepIds);\n }\n for (const key in this.tensorListMap) {\n this.tensorListMap[key].clearAndClose(keepIds);\n }\n}\n\n"/**\n * @license\n * Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,\n software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *\n=====\n*/\n\nimport {NamedTensorMap} from '@tensorflow/tfjs-core';\nimport {NamedTensorsMap} from './data/types';\nimport {parseNodeName} from './operations/executors/utils';\nimport {Graph, Node} from './operations/types';\n\nexport interface ExecutionInfo {\n inputs: NamedTensorMap;\n outputs: Node[];\n usedNodes: Set<string>;\n missingInputs: string[];\n dynamicNode: Node;\n syncInputs: string[];\n}\n\n/**\n * Given graph inputs and desired outputs, find the minimal set of nodes\n * to execute in order to compute the outputs. In addition return other useful\n * info such:\n * - Missing inputs needed to compute the output.\n * - Whether the subgraph contains dynamic ops (control flow, dynamic shape).\n * - Alternative inputs in order to avoid async (dynamic op) execution.\n */\n\nexport function getExecutionSubgraph(\n inputs: NamedTensorMap, outputs: Node[], weightMap: NamedTensorsMap,\n initNodes?: Node[]): ExecutionInfo {\n const usedNodes = new Set<string>();\n const missingInputs: string[] = [];\n let dynamicNode: Node = null;\n let syncInputs: string[] = null;\n\n // Start with the outputs, going backwards and find all the nodes that are\n // needed to compute those outputs.\n const seen = new Set<string>();\n const inputNodeNames =\n Object.keys(inputs).map(name => parseNodeName(name)[0]);\n\n let initNodeNames: string[] = [];\n if (initNodes != null) {\n initNodeNames = initNodes.map(node => parseNodeName(node.name)[0]);\n }\n\n const frontier = [...outputs];\n while (frontier.length > 0) {\n const node = frontier.pop();\n if (isControlFlow(node) || isDynamicShape(node) || isHashTable(node)) {\n if (dynamicNode == null) {\n dynamicNode = node;\n syncInputs = dynamicNode.children.map(child => child.name)\n .filter(name => usedNodes.has(name));\n }\n }\n usedNodes.add(node.name);\n\n // Weights are dead end since we already have their values.\n if (weightMap[node.name] != null) {\n continue;\n }\n\n // This node is a dead end since it's one of the user-provided inputs.\n if (inputNodeNames.indexOf(node.name) !== -1) {\n continue;\n }\n\n // This node is a dead end since it doesn't have any inputs.\n if (initNodeNames.indexOf(node.name) !== -1) {\n continue;\n }\n\n if (node.inputs.length === 0) {\n missingInputs.push(node.name);\n continue;\n }\n\n node.inputs.forEach(input => {\n // Don't add to the frontier if it is already there.\n if (seen.has(input.name)) {\n return;\n }\n seen.add(input.name);\n frontier.push(input);\n });\n }\n\n return {inputs, outputs, usedNodes, missingInputs, dynamicNode, syncInputs};\n}
```

```

* Given the execution info, return a list of nodes in topological order that
* need to be executed to compute the output.
*/
nexport function getNodesInTopologicalOrder(
 graph: Graph, weightMap: NamedTensorsMap,
 executionInfo: ExecutionInfo): Node[] {
 const {usedNodes, inputs} = executionInfo;
 const frontier: Node[] = [];
 const inputNodes = Object.keys(inputs).map(name => parseNodeName(name)[0]).map(name => graph.nodes[name]);
 const initNodes = graph.initNodes;
 inputNodes.forEach(input => {
 if (usedNodes.has(input.name)) {
 frontier.push(input);
 }
 });
 graph.weights.forEach(weight => {
 if (usedNodes.has(weight.name)) {
 frontier.push(weight);
 }
 });
 if (initNodes != null) {
 initNodes.forEach(node => {
 if (usedNodes.has(node.name)) {
 frontier.push(node);
 }
 });
 }
 const seen = new Set<string>();
 const orderedNodes: Node[] = [];
 while (frontier.length > 0) {
 const node = frontier.pop();
 seen.add(node.name);
 if (!weightMap[node.name]) {
 orderedNodes.push(node);
 }
 node.children.forEach(child => {
 if (!seen.has(child.name) && usedNodes.has(child.name) && child.inputs.every(input => seen.has(input.name))) {
 frontier.push(child);
 }
 });
 }
 return orderedNodes;
}

const CONTROL_FLOW_OPS = ['Switch', 'Merge', 'Enter', 'Exit', 'NextIteration', 'StatelessIf', 'StatelessWhile', 'if', 'While'];
const DYNAMIC_SHAPE_OPS = ['NonMaxSuppressionV2', 'NonMaxSuppressionV3', 'NonMaxSuppressionV5', 'Where'];
const HASH_TABLE_OPS = ['HashTable', 'HashTableV2', 'LookupTableImport', 'LookupTableImportV2', 'LookupTableFind', 'LookupTableFindV2'];

nexport function isControlFlow(node: Node) {
 return CONTROL_FLOW_OPS.indexOf(node.op) >= 0;
}

nexport function isDynamicShape(node: Node) {
 return DYNAMIC_SHAPE_OPS.indexOf(node.op) >= 0;
}

nexport function isHashTable(node: Node) {
 return HASH_TABLE_OPS.indexOf(node.op) >= 0;
}

/**
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 * distributed under the License is distributed on an "AS IS" BASIS,
 * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.
 * See the License for the specific language governing permissions and
 * limitations under the License.
 */

=====

*/
nimport {DataType, NamedTensorMap, Tensor, tidy, util} from '@tensorflow/tfjs-core';
nimport {ISignatureDef} from '../data/compiled_api';
nimport {NamedTensorsMap, TensorArrayMap, TensorInfo, TensorListMap} from '../data/types';
nimport {getNodeNameAndIndex, getParamValue, getTensor, getTensorsForCurrentContext, parseNodeName} from '../operations/executors/utils';
nimport {executeOp} from '../operations/operation_executor';
nimport {Graph, Node} from '../operations/types';
nimport {ExecutionContext, ExecutionContextInfo} from './execution_context';
nimport {getExecutionSubgraph, getNodesInTopologicalOrder, isControlFlow} from './model_analysis';
nimport {ResourceManager} from './resource_manager';
nimport {FunctionExecutor} from './types';

ninterface NodeWithContexts {
 contexts: ExecutionContextInfo[];
 node: Node;
}

nexport class GraphExecutor implements FunctionExecutor {
 private compiledMap: Map<string, Node[]> = new Map();
 private _weightMap: NamedTensorsMap = {};
 private _weightIds: number[];
 private _signature: ISignatureDef;
 private _inputs: Node[];
 private _outputs: Node[];
 private _initNodes: Node[];

 // Internal init nodes to start initialization.
 private SEPERATOR = ',';
 private _functions: {[key: string]: Graph} = {};
 private _functionExecutorMap: {[key: string]: FunctionExecutor} = {};
 private _resourceManager: ResourceManager;

 get weightIds(): number[] {
 return this.parent ? this.parent.weightIds : this._weightIds;
 }

 get functionExecutorMap(): {[key: string]: FunctionExecutor} {
 return this.parent ? this.parent.functionExecutorMap : this._functionExecutorMap;
 }

 get weightMap(): NamedTensorsMap {
 return this.parent ? this.parent.weightMap : this._weightMap;
 }

 set weightMap(weightMap: NamedTensorsMap) {
 const weightIds = Object.keys(weightMap).map(key => weightMap[key].map(tensor => tensor.id));
 this._weightIds = [].concat(...weightIds);
 this._weightMap = weightMap;
 }

 /**
 * Set `ResourceManager` shared by executors of a model.
 * @param

```

resourceManager:

```
`ResourceManager` of the `GraphModel`.
*/
set resourceManager(resourceManager: ResourceManager) {
 this._resourceManager = resourceManager;
}

get inputs(): TensorInfo[] {
 return this._inputs.map(node => {
 name: node.name,
 shape: node.attrParams['shape'] ?
 node.attrParams['shape'].value as number[] :
 undefined,
 dtype: node.attrParams['dtype'] ?
 node.attrParams['dtype'].value as DataType :
 undefined
 });
}

get outputs(): TensorInfo[] {
 return this._outputs.map(node => {
 name: node.name,
 shape:
 node.attrParams['shape'] ?
 node.attrParams['shape'].value as number[] :
 undefined,
 dtype:
 node.attrParams['dtype'] ?
 node.attrParams['dtype'].value as DataType :
 undefined
 });
}

get inputNodes(): string[] {
 return this._inputs.map(node => node.signatureKey || node.name);
}

get outputNodes(): string[] {
 return this._outputs.map((node) => {
 const name = node.signatureKey || node.name;
 return node.defaultOutput ?
 (`${name}:${node.defaultOutput}`) : name;
 });
}

get functions(): {[key: string]: ISignatureDef} {
 return Object.keys(this._functions).reduce((map, key) => {
 map[key] = this._functions[key].signature;
 return map;
 }, {} as {[key: string]: ISignatureDef});
}

/**
 * @param graph Graph the model or function graph to be executed.
 * @param parent When building function executor you need to set the parent
 * executor. Since the weights and function executor maps are set at parent
 * level, that function executor can access the function maps and weight maps
 * through the parent.
 */
constructor(private graph: Graph, private parent?: GraphExecutor) {
 this._outputs = graph.outputs;
 this._inputs = graph.inputs;
 this._initNodes = graph.initNodes;
 this._signature = graph.signature;
 this._functions = graph.functions;
 // create sub-graph executors
 if (graph.functions != null) {
 Object.keys(graph.functions).forEach(name => {
 this._functionExecutorMap[name] =
 new GraphExecutor(graph.functions[name], this);
 });
 }

 private getCompilationKey(inputs: Node[], outputs: Node[]): string {
 const sortedInputs = inputs.map(node => node.name).sort();
 const sortedOutputs = outputs.map(node => node.name).sort();
 return sortedInputs.join(this.SEPERATOR) + '--' +
 sortedOutputs.join(this.SEPERATOR);
 }

 /**
 * Compiles the inference graph and returns the minimal set of nodes that are
 * required for execution, in the correct execution order.
 */
 private compile(inputs: NamedTensorMap, outputs: Node[]): Node[] {
 const executionInfo =
 getExecutionSubgraph(inputs, outputs, this.weightMap,
 this._initNodes);
 const {missingInputs, dynamicNode, syncInputs} = executionInfo;
 if (dynamicNode != null) {
 throw new Error(
 `This execution contains the node '${dynamicNode.name}', which has ` +
 `the dynamic op '${dynamicNode.op}'. Please use ` +
 `model.executeAsync() instead. Alternatively, to avoid the ` +
 `dynamic ops, specify the inputs [${syncInputs}]`);
 }
 if (missingInputs.length > 0) {
 const outNames = outputs.map(n => n.name);
 const inNames = Object.keys(inputs);
 throw new Error(
 `Cannot compute the outputs [${outNames}] from the provided inputs ` +
 `[${inNames}]. Missing the following inputs: [${missingInputs}]`);
 }
 return getNodesInTopologicalOrder(
 this.graph, this.weightMap, executionInfo);
 }

 /**
 * Executes the inference for given input tensors.
 * @param inputs Tensor map for the model inputs, keyed by the input
 * node
 * @param names
 * @param outputs Optional. output node name from the Tensorflow model, if
 * no outputs are specified, the default outputs of the model would be used.
 * You can inspect intermediate nodes of the model by adding them to the
 * outputs array.
 */
 execute(inputs: NamedTensorMap, outputs?: string[]): Tensor[] {
 inputs = this.mapInputs(inputs);
 const names = Object.keys(inputs).sort();
 this.checkInputs(inputs);
 this.checkInputShapeAndType(inputs);
 outputs = this.mapOutputs(outputs);
 this.checkOutputs(outputs);
 const inputNodes =
 names.map(name => this.graph.nodes[parseNodeName(name)[0]]);
 const outputNodeNames =
 outputs.map(name => parseNodeName(name)[0]);
 let outputNodes =
 outputNodeNames.map(name => this.graph.nodes[name]);
 // If no outputs are specified, then use the default outputs of the model.
 if (outputNodes.length === 0) {
 outputNodes = this._outputs;
 }
 const compilationKey
```

```

= this.getCompilationKey(inputNodes, outputNodes);\n\n // Do nothing if the compiled graph cache contains the
input.\n\n let orderedNodes = this.compiledMap.get(compilationKey);\n\n if (orderedNodes == null) {\n\n
orderedNodes = this.compile(inputs, outputNodes);\n\n this.compiledMap.set(compilationKey, orderedNodes);\n\n
}\n\n\n const tensorArrayMap: TensorArrayMap = {};\n\n const tensorListMap: TensorListMap = {};\n\n\n return
tidy(() => {\n\n const context = new ExecutionContext(\n\n this.weightMap, tensorArrayMap, tensorListMap,\n\n
this.functionExecutorMap);\n\n const tensorsMap: NamedTensorsMap = {...this.weightMap};\n\n\n
Object.keys(inputs).forEach(name => {\n\n const [nodeName, index] = parseNodeName(name);\n\n const
tensors: Tensor[] = [];\n\n tensors[index] = inputs[name];\n\n tensorsMap[nodeName] = tensors;\n\n
});\n\n\n const tensorsToKeep = this.getFrozenTensorIds(tensorsMap);\n\n const intermediateTensorConsumerCount:
{[key: number]: number} = {};\n\n for (let i = 0; i < orderedNodes.length; i++) {\n\n const node =
orderedNodes[i];\n\n if (!tensorsMap[node.name]) {\n\n const tensors =\n\n executeOp(node,
tensorsMap, context, this._resourceManager) as\n\n Tensor[];\n\n if (util.isPromise(tensors)) {\n\n
throw new Error(\n\n `The execution of the op '${node.op}' returned a promise. ` +\n\n `Please use
model.executeAsync() instead.`);\n\n }\n\n tensorsMap[node.name] = tensors;\n\n
this.checkTensorForDisposal(\n\n node.name, node, tensorsMap, context, tensorsToKeep,\n\n
outputNodeNames, intermediateTensorConsumerCount);\n\n }\n\n }\n\n // dispose the context for the root
executor\n\n if (this.parent == null) {\n\n context.dispose(tensorsToKeep);\n\n }\n\n return outputs.map(name
=> getTensor(name, tensorsMap, context));\n\n });\n\n\n }\n\n\n private getFrozenTensorIds(tensorMap: NamedTensorsMap): Set<number> {\n\n const ids =
[].concat.apply(\n\n [],\n\n Object.keys(tensorMap)\n\n .map(key => tensorMap[key])\n\n
.map(tensors => tensors.map(tensor => tensor.id)));\n\n return new Set(ids);\n\n }\n\n\n private
checkTensorForDisposal(\n\n nodeName: string, node: Node, tensorMap: NamedTensorsMap,\n\n context:
ExecutionContext, tensorsToKeep: Set<number>,\n\n outputNames: string[],\n\n
intermediateTensorConsumerCount: {[key: string]: number}) {\n\n // Skip output nodes and any control flow nodes,
since its dependency is\n\n // tricky to track correctly.\n\n if (node.category === 'control' ||
outputNames.indexOf(nodeName) !== -1) {\n\n return;\n\n }\n\n\n tensorMap[nodeName].forEach(tensor => {\n\n
if (tensor != null) {\n\n intermediateTensorConsumerCount[tensor.id] =\n\n
(intermediateTensorConsumerCount[tensor.id] || 0) +\n\n node.children.length;\n\n
}\n\n });\n\n node.inputs.forEach(input => {\n\n // Skip any control flow nodes, since its dependency is tricky
to track\n\n // correctly.\n\n if (input.category !== 'control') {\n\n const tensors =\n\n
getTensorsForCurrentContext(input.name, tensorMap, context);\n\n if (tensors != null) {\n\n
tensors.forEach(tensor => {\n\n if (tensor && !tensorsToKeep.has(tensor.id)) {\n\n const count =
intermediateTensorConsumerCount[tensor.id];\n\n if (count === 1) {\n\n tensor.dispose();\n\n
delete intermediateTensorConsumerCount[tensor.id];\n\n } else if (count != null) {\n\n // only
intermediate nodes has count set, inputs and weights are\n\n // not.\n\n
intermediateTensorConsumerCount[tensor.id]--;\n\n }\n\n }\n\n });\n\n }\n\n });\n\n }\n\n }\n\n\n };\n\n\n /**\n\n * Executes the inference for given input tensors in
Async fashion.\n\n * @param inputs Tensor map for the model inputs, keyed by the input node\n\n * names.\n\n *
@param outputs output node name from the Tensorflow model, if no outputs\n\n * are specified, the default outputs
of the model would be used. You can\n\n * inspect intermediate nodes of the model by adding them to the outputs\n\n
* array.\n\n */\n\n async executeAsync(inputs: NamedTensorMap, outputs?: string[]): Promise<Tensor[]> {\n\n
return this._executeAsync(inputs, outputs);\n\n }\n\n\n /**\n\n * Executes the inference for given input tensors in
Async fashion.\n\n * @param inputs Tensor map for the model inputs, keyed by the input node\n\n * names.\n\n *
@param outputs Optional. output node name from the Tensorflow model,\n\n * if no outputs are specified, the
default outputs of the model would be\n\n * used. You can inspect intermediate nodes of the model by adding them
to the\n\n * outputs array.\n\n * @param isFunctionExecution Optional. Flag for executing a function.\n\n
* @param tensorArrayMap Optional, global TensorArray map by id. Used for\n\n * function execution.\n\n *
@param tensorArrayMap Optional global TensorList map by id. Used for\n\n * function execution.\n\n */\n\n private

```

```

async _executeAsync(\n inputs: NamedTensorMap, outputs?: string[], isFunctionExecution = false,\n tensorArrayMap: TensorArrayMap = {},\n tensorListMap: TensorListMap = {}): Promise<Tensor[]> {\n if\n (!isFunctionExecution) {\n inputs = this.mapInputs(inputs);\n this.checkInputs(inputs);\n this.checkInputShapeAndType(inputs);\n outputs = this.mapOutputs(outputs);\n this.checkOutputs(outputs);\n }\n const context = new ExecutionContext(\n this.weightMap, tensorArrayMap, tensorListMap,\n this.functionExecutorMap);\n // Graph with control flow op requires runtime evaluation of the execution\n // order, while without control flow the execution order is pre-determined\n // in the compile method.\n const tensorMap = await this.executeWithControlFlow(\n inputs, context, outputs, isFunctionExecution);\n const results = outputs.map(name => getTensor(name, tensorMap, context));\n // dispose all the intermediate\n tensors\n const outputIds = results.map(t => t.id);\n const inputIds = Object.keys(inputs).map(name =>\n inputs[name].id);\n const keepIds =\n new Set<number>([...outputIds, ...inputIds, ...this.weightIds]);\n Object.keys(tensorMap).forEach(key => {\n const tensorArray = tensorMap[key];\n tensorArray.forEach(tensor => {\n if (tensor && !tensor.isDisposed && !keepIds.has(tensor.id)) {\n tensor.dispose();\n }\n });\n });\n // dispose the context for the root executor\n if (this.parent == null)\n {\n context.dispose(keepIds);\n }\n return results;\n}\n\nasync executeFunctionAsync(\n inputs:\n Tensor[], tensorArrayMap: TensorArrayMap,\n tensorListMap: TensorListMap): Promise<Tensor[]>\n {\n const mappedInputs = inputs.reduce((map, tensor, index) => {\n map[this.inputs[index].name] = tensor;\n return map;\n }, {} as NamedTensorMap);\n return this._executeAsync(\n mappedInputs,\n this.outputNodes, true, tensorArrayMap, tensorListMap);\n }\n /**\n * When there are control flow nodes in the\n * graph, the graph execution use\n * ExecutionContext to keep track of the frames and loop iterators.\n * @param\n * inputs placeholder tensors for the graph.\n * @param context the execution context object for current execution.\n * @param outputNames Optional. output node name from the Tensorflow model,\n * if no outputs are specified,\n * the default outputs of the model would be\n * used. You can inspect intermediate nodes of the model by adding\n * them to the\n * outputs array.\n * @param isFunctionExecution Flag for executing a function.\n */\n private\n async executeWithControlFlow(\n inputs: NamedTensorMap, context: ExecutionContext,\n outputNames?: string[],\n isFunctionExecution?: boolean): Promise<NamedTensorsMap> {\n const names =\n Object.keys(inputs);\n const inputNodes =\n names.map(name =>\n this.graph.nodes[parseNodeName(name)[0]]);\n const outputNodeNames = outputNames.map(name =>\n parseNodeName(name)[0]);\n let outputNodes = outputNodeNames.map(name => this.graph.nodes[name]);\n // If no outputs are specified, then use the default outputs of the model.\n if (outputNodes.length === 0) {\n outputNodes = this._outputs;\n }\n const {usedNodes, missingInputs, dynamicNode, syncInputs} =\n getExecutionSubgraph(\n inputs, outputNodes, this.weightMap, this._initNodes);\n // First nodes to\n execute include inputNodes, weights, and initNodes.\n const stack: NodeWithContexts[] = [\n ...inputNodes,\n ...this.graph.weights, ...(this._initNodes || [])\n].map(node => {\n return {node, contexts:\n context.currentContext};\n });\n const tensorsMap:\n NamedTensorsMap = {...this.weightMap};\n Object.keys(inputs).forEach(name => {\n const [nodeName,\n index] = parseNodeName(name);\n const tensors: Tensor[] = [];\n tensors[index] = inputs[name];\n tensorsMap[nodeName] = tensors;\n });\n const intermediateTensorConsumerCount: {[key: number]: number} =\n {};\n const tensorsToKeep = this.getFrozenTensorIds(tensorsMap);\n const added: {[key: string]: boolean} =\n {};\n while (stack.length > 0) {\n const promises = this.processStack(\n inputNodes, stack, context,\n tensorsMap, added, tensorsToKeep,\n outputNodeNames, intermediateTensorConsumerCount, usedNodes);\n await Promise.all(promises);\n }\n if (dynamicNode == null && !isFunctionExecution) {\n console.warn(\n `This model execution did not contain any nodes with control flow`\n `or dynamic output shapes. You\n can use model.execute() instead.`);\n }\n const missingOutputs =\n outputNodes\n .filter(\n node => !isControlFlow(node) &&\n !getTensor(node.name, tensorsMap,\n context))\n .map(node => node.name);\n if (missingOutputs.length > 0) {\n let alternativeMsg = ";\n if (dynamicNode != null) {\n alternativeMsg =\n `Alternatively, to avoid the dynamic ops, use\n model.execute() ` +\n `and specify the inputs [${syncInputs}]`;\n }\n throw new Error(\n `Cannot

```



```

mapInputs(inputs: NamedTensorMap) {\n const result: NamedTensorMap = {};\n for (const inputName in
inputs) {\n if (this._signature != null && this._signature.inputs != null &&\n
this._signature.inputs[inputName] != null) {\n const tensor = this._signature.inputs[inputName];\n
result[tensor.name] = inputs[inputName];\n } else {\n result[inputName] = inputs[inputName];\n
 }\n }\n return result;\n }\n\n private checkInputs(inputs: NamedTensorMap) {\n const notInGraph =
Object.keys(inputs).filter(name => {\n const [nodeName] = parseNodeName(name);\n return
this.graph.nodes[nodeName] == null;\n });\n if (notInGraph.length > 0) {\n throw new Error(\n `The
dict provided in model.execute(dict) has ` +\n `keys: [${notInGraph}] that are not part of graph`);\n }\n
}\n\n private mapOutputs(outputs: string[]) {\n return outputs.map(name => {\n if (this._signature != null &&
this._signature.outputs != null &&\n this._signature.outputs[name] != null) {\n const tensor =
this._signature.outputs[name];\n return tensor.name;\n }\n return name;\n }, {});\n }\n\n private
checkOutputs(outputs: string[]): void {\n outputs.forEach(name => {\n const [normalizedName] =
parseNodeName(name);\n if (!this.graph.nodes[normalizedName]) {\n throw new
Error(`The output '${name}' is not found in the graph`);\n }\n });\n }\n }\n\n"/**\n * @license\n * Copyright
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you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES
OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language
governing permissions and\n * limitations under the License.\n */
\n\n
=====
\n\n
*/\nimport {HashTableMap, NamedTensorMap} from '../data/types';\nimport {HashTable} from
'/hash_table';\n\n/**\n * Contains global resources of a model.\n */\nexport class ResourceManager {\n
 constructor(\n readonly hashTableNameToHandle: NamedTensorMap = {},\n readonly hashTableMap:
HashTableMap = {}) {\n }\n\n /**\n * Register a `HashTable` in the resource manager.\n * \n * The `HashTable`
can be retrieved by `resourceManager.getHashTableById`,\n * where id is the table handle tensor's id.\n * \n *
@param name Op node name that creates the `HashTable`.\n * @param hashTable The `HashTable` to be added to
resource manager.\n */\n addHashTable(name: string, hashTable: HashTable) {\n
 this.hashTableNameToHandle[name] = hashTable.handle;\n this.hashTableMap[hashTable.id] = hashTable;\n
 }\n\n /**\n * Get the table handle by node name.\n * @param name Op node name that creates the `HashTable`.
This name is also\n * used in the inputs list of lookup and import `HashTable` ops.\n */\n getHashTableHandleByName(name: string) {\n
 return this.hashTableNameToHandle[name];\n }\n\n /**\n * Get the actual `HashTable` by its handle tensor's
id.\n * @param id The id of the handle tensor.\n */\n getHashTableById(id: number): HashTable {\n
 return this.hashTableMap[id];\n }\n\n /**\n * Dispose `ResourceManager`, including its hashTables and tensors in
them.\n */\n dispose() {\n for (const key in this.hashTableMap) {\n
 this.hashTableMap[key].clearAndClose();\n delete this.hashTableMap[key];\n }\n\n for (const name in
this.hashTableNameToHandle) {\n this.hashTableNameToHandle[name].dispose();\n delete
this.hashTableNameToHandle[name];\n }\n }\n }\n\n"/**\n * @license\n * Copyright 2018 Google LLC. All
Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this
file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n * Unless required by applicable law or agreed to in writing,
software\n * distributed under the License is distributed on an "AS
IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n */
\n\n
=====
\n\n
*/\nimport {InferenceModel, io, ModelPredictConfig, NamedTensorMap, Tensor} from 'tensorflow/tfjs-
core';\nimport * as tensorflow from '../data/compiled_api';\nimport {NamedTensorsMap, TensorInfo} from

```

```

'./data/types';\nimport {OperationMapper} from './operations/operation_mapper';\n\nimport {GraphExecutor} from
'./graph_executor';\nimport {ResourceManager} from './resource_manager';\n\nexport const
TFHUB_SEARCH_PARAM = '?tfjs-format=file';\nexport const DEFAULT_MODEL_NAME =
'model.json';\n\n/**\n * A `tf.GraphModel` is a directed, acyclic graph built from a\n * SavedModel GraphDef and
allows inference execution.\n *\n * A `tf.GraphModel` can only be created by loading from a model converted
from\n * a [TensorFlow
SavedModel](https://www.tensorflow.org/guide/saved_model) using\n * the command line converter tool and
loaded via `tf.loadGraphModel`.\n *\n * @doc {heading: 'Models', subheading: 'Classes'}\n */\nexport class
GraphModel implements InferenceModel {\n private executor: GraphExecutor;\n private version = 'n/a';\n private
handler: io.IOHandler;\n private artifacts: io.ModelArtifacts;\n private initializer: GraphExecutor;\n private
resourceManager: ResourceManager;\n private signature: tensorflow.ISignatureDef;\n\n // Returns the version
information for the tensorflow model GraphDef.\n get modelVersion(): string {\n return this.version;\n }\n\n get
inputNodes(): string[] {\n return this.executor.inputNodes;\n }\n\n get outputNodes(): string[] {\n return
this.executor.outputNodes;\n }\n\n get inputs(): TensorInfo[] {\n return this.executor.inputs;\n }\n\n get
outputs(): TensorInfo[] {\n return this.executor.outputs;\n }\n\n get weights(): NamedTensorsMap\n {\n return this.executor.weightMap;\n }\n\n get metadata(): {} {\n return this.artifacts.userDefinedMetadata;\n }\n\n get modelSignature(): {} {\n return this.signature;\n }\n\n /**\n * @param modelUrl url for the model, or
an `io.IOHandler`.\n * @param weightManifestUrl url for the weight file generated by\n * scripts/convert.py
script.\n * @param requestOptions options for Request, which allows to send credentials\n * and custom
headers.\n * @param onProgress Optional, progress callback function, fired periodically\n * before the load is
completed.\n */\n constructor(\n private modelUrl: string|io.IOHandler,\n private loadOptions:
io.LoadOptions = {}) {\n if (loadOptions == null) {\n this.loadOptions = {};\n }\n this.resourceManager =
new ResourceManager();\n }\n\n private findIOHandler() {\n const path = this.modelUrl;\n if ((path as
io.IOHandler).load != null) {\n // Path is an IO Handler.\n this.handler
= path as io.IOHandler;\n } else if (this.loadOptions.requestInit != null) {\n this.handler =
io.browserHTTPRequest(path as string, this.loadOptions);\n } else {\n const handlers =
io.getLoadHandlers(path as string, this.loadOptions);\n if (handlers.length === 0) {\n // For backward
compatibility: if no load handler can be found,\n // assume it is a relative http path.\n handlers.push(io.browserHTTPRequest(path as string, this.loadOptions));\n } else if (handlers.length > 1) {\n throw new Error(\n `Found more than one (${handlers.length}) load handlers for ` +\n `URL`
`${path}`);\n }\n this.handler = handlers[0];\n }\n }\n\n /**\n * Loads the model and weight files,
construct the in memory weight map and\n * compile the inference graph.\n */\n async load(): Promise<boolean>\n {\n this.findIOHandler();\n if (this.handler.load == null) {\n throw new Error(\n `Cannot proceed
with model loading because the IOHandler provided ` +\n `does not have the `load` method implemented.`);\n }\n const artifacts = await this.handler.load();\n return this.loadSync(artifacts);\n }\n\n /**\n *
Synchronously construct the in memory weight map and\n * compile the inference graph. Also initialize hashtable
if any.\n */\n * @doc {heading: 'Models', subheading: 'Classes', ignoreCI: true}\n */\n loadSync(artifacts:
io.ModelArtifacts) {\n this.artifacts = artifacts;\n const graph = this.artifacts.modelTopology as
tensorflow.IGraphDef;\n\n let signature;\n if (this.artifacts.userDefinedMetadata != null &&\n this.artifacts.userDefinedMetadata.signature != null) {\n signature = // tslint:disable-next-line:no-any\n (this.artifacts.userDefinedMetadata as any).signature as\n tensorflow.ISignatureDef;\n } else {\n signature
= this.artifacts.signature;\n }\n this.signature = signature;\n\n this.version = `${graph.versions.producer}.${graph.versions.minConsumer}`;\n const weightMap =\n io.decodeWeights(this.artifacts.weightData, this.artifacts.weightSpecs);\n this.executor = new GraphExecutor(\n
 OperationMapper.Instance.transformGraph(graph, this.signature);\n this.executor.weightMap =
this.convertTensorMapToTensorsMap(weightMap);\n // Attach a model-level resourceManager to each executor
to share resources,\n // such as `HashTable`.\n this.executor.resourceManager = this.resourceManager;\n\n if
(artifacts.modelInitializer != null &&\n (artifacts.modelInitializer as tensorflow.IGraphDef).node != null) {\n

```



```

const initializer =\n OperationMapper.Instance.transformGraph(artifacts.modelInitializer);\n this.initializer\n = new GraphExecutor(initializer);\n this.initializer.weightMap = this.executor.weightMap;\n // Attach a\n model-level resourceManager to the initializer, the\n // hashTables created from when\n executing the initializer will be stored\n // in the resourceManager.\n this.initializer.resourceManager =\n this.resourceManager;\n this.initializer.executeAsync({}, []);\n }\n return true;\n }\n /**\n * Save the\n configuration and/or weights of the GraphModel.\n *\n * An `IOHandler` is an object that has a `save` method of\n the proper\n * signature defined. The `save` method manages the storing or\n * transmission of serialized data\n ("artifacts") that represent the\n * model's topology and weights onto or via a specific medium, such as\n * file\n downloads, local storage, IndexedDB in the web browser and HTTP\n * requests to a server. TensorFlow.js\n provides `IOHandler`\n * implementations for a number of frequently used saving mediums, such as\n *\n `tf.io.browserDownloads` and `tf.io.browserLocalStorage`. See `tf.io`\n * for more details.\n *\n * This method\n also allows you to refer to certain types of `IOHandler`s\n * as URL-like\n string shortcuts, such as 'localStorage://' and\n * 'indexeddb://'.\n *\n * Example 1: Save `model`s topology and\n weights to browser [local\n * storage](https://developer.mozilla.org/en-\n US/docs/Web/API/Window/localStorage);\n * then load it back.\n *\n * ```js\n * const modelUrl =\n * 'https://storage.googleapis.com/tfjs-models/savedmodel/mobilenet_v2_1.0_224/model.json';\n * const model =\n * await tf.loadGraphModel(modelUrl);\n * const zeros = tf.zeros([1, 224, 224, 3]);\n * model.predict(zeros).print();\n *\n * const saveResults = await model.save('localStorage://my-model-1');\n *\n * const loadedModel = await tf.loadGraphModel('localStorage://my-model-1');\n * console.log('Prediction from\n loaded model:');\n * model.predict(zeros).print();\n * ```\n *\n * @param handlerOrURL An instance of\n `IOHandler` or a URL-like,\n * scheme-based string shortcut for `IOHandler`.\n *\n * @param config Options for\n saving the model.\n *\n * @returns A `Promise`\n of `SaveResult`, which summarizes the result of\n * the saving, such as byte sizes of the saved artifacts for the\n model's\n * topology and weight values.\n *\n * @doc {heading: 'Models', subheading: 'Classes', ignoreCI:\n true}\n *\n async save(handlerOrURL: io.IOHandler|string, config?: io.SaveConfig):\n Promise<io.SaveResult> {\n if (typeof handlerOrURL === 'string') {\n const handlers =\n io.getSaveHandlers(handlerOrURL);\n if (handlers.length === 0) {\n throw new Error(\n `Cannot find\n any save handlers for URL '${handlerOrURL}'`);\n } else if (handlers.length > 1) {\n throw new Error(\n `Found more than one (${handlers.length}) save handlers for ` +\n `URL '${handlerOrURL}'`);\n }\n handlerOrURL = handlers[0];\n }\n if (handlerOrURL.save == null) {\n throw new Error(\n 'GraphModel.save() cannot proceed because the IOHandler ' +\n 'provided does not have the `save`\n attribute defined.);\n }\n return handlerOrURL.save(this.artifacts);\n }\n /**\n * Execute the inference for\n the input tensors.\n *\n * @param input The input tensors, when there is single input for the model,\n * inputs\n param should be a `tf.Tensor`. For models with multiple inputs,\n * inputs\n params should be in either `tf.Tensor`[]\n if the input order is\n * fixed, or otherwise NamedTensorMap format.\n *\n * For model with multiple inputs,\n we recommend you use NamedTensorMap as the\n * input type, if you use `tf.Tensor`[], the order of the array\n needs to\n * follow the\n * order of inputNodes array. @see {@link GraphModel.inputNodes}\n *\n * You can\n also feed any intermediate nodes using the NamedTensorMap as the\n * input type. For example, given the graph\n *\n * InputNode => Intermediate => OutputNode,\n * you can execute the subgraph Intermediate => OutputNode by\n calling\n * model.execute('IntermediateNode' : tf.tensor(...));\n *\n *\n * This is useful for models that uses tf.dynamic_rnn, where the intermediate\n * state needs to be fed\n manually.\n *\n * For batch inference execution, the tensors for each input need to be\n * concatenated together.\n For example with mobilenet, the required input shape\n * is [1, 224, 224, 3], which represents the [batch, height,\n width, channel].\n *\n * If we are provide a batched data of 100 images, the input tensor should be\n * in the shape of\n [100, 224, 224, 3].\n *\n * @param config Prediction configuration for specifying the batch size and\n * output\n node names. Currently the batch size option is ignored for graph\n * model.\n *\n * @returns Inference result\n tensors. The output would be single `tf.Tensor`\n * if model has single output node, otherwise Tensor[] or\n NamedTensorMap[]\n * will be returned for model with multiple outputs.\n *\n * @doc {heading: 'Models',

```

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subheading: 'Classes')\n
 */\n
 predict(inputs: Tensor|Tensor[]|NamedTensorMap,
 config?: ModelPredictConfig):\n
 Tensor|Tensor[]|NamedTensorMap {\n
 return this.execute(inputs,
 this.outputNodes);\n
 }\n
 private normalizeInputs(inputs: Tensor|Tensor[]|NamedTensorMap):
 NamedTensorMap {\n
 if (!(inputs instanceof Tensor) && !Array.isArray(inputs)) {\n
 // The input is already a
 NamedTensorMap.\n
 return inputs;\n
 }\n
 inputs = Array.isArray(inputs) ? inputs : [inputs];\n
 if
 (inputs.length !== this.inputNodes.length) {\n
 throw new Error(\n
 'Input tensor count mismatch,' +\n
 `the graph model has ${this.inputNodes.length} placeholders, ` +\n
 `while there are ${inputs.length} input
 tensors.`);\n
 }\n
 return this.inputNodes.reduce((map, inputName, i) => {\n
 map[inputName] = (inputs as
 Tensor[])[i];\n
 return map;\n
 }, {} as NamedTensorMap);\n
 }\n
 private normalizeOutputs(outputs:
 string|string[]): string[] {\n
 outputs = outputs || this.outputNodes;\n
 return
 !Array.isArray(outputs) ? [outputs] : outputs;\n
 }\n
 /**\n
 * Executes inference for the model for given input
 tensors.\n
 * @param inputs tensor, tensor array or tensor map of the inputs for the\n
 * model, keyed by the input
 node names.\n
 * @param outputs output node name from the Tensorflow model, if no\n
 * outputs are specified,
 the default outputs of the model would be used.\n
 * You can inspect intermediate nodes of the model by adding
 them to the\n
 * outputs array.\n
 *\n
 * @returns A single tensor if provided with a single output or no outputs\n
 * are provided and there is only one default output, otherwise return a\n
 * tensor array. The order of the tensor
 array is the same as the outputs\n
 * if provided, otherwise the order of outputNodes attribute of the model.\n
 *\n
 * @doc {heading: 'Models', subheading: 'Classes'}\n
 */\n
 execute(inputs: Tensor|Tensor[]|NamedTensorMap,
 outputs?: string|string[]):\n
 Tensor|Tensor[] {\n
 inputs = this.normalizeInputs(inputs);\n
 outputs = this.normalizeOutputs(outputs);\n
 const result = this.executor.execute(inputs, outputs);\n
 return
 result.length > 1 ? result : result[0];\n
 }\n
 /**\n
 * Executes inference for the model for given input
 tensors in
 async\n
 * fashion, use this method when your model contains control flow ops.\n
 * @param inputs tensor, tensor
 array or tensor map of the inputs for the\n
 * model, keyed by the input
 node names.\n
 * @param outputs output
 node name from the Tensorflow model, if no outputs\n
 * are specified, the default outputs of the model would be
 used. You can\n
 * inspect intermediate nodes of the model by adding them to the outputs\n
 * array.\n
 *\n
 * @returns A Promise of single tensor if provided with a single output or\n
 * no outputs are provided and there is
 only one default output, otherwise\n
 * return a tensor map.\n
 *\n
 * @doc {heading: 'Models', subheading:
 'Classes'}\n
 */\n
 async executeAsync(inputs:
 Tensor|Tensor[]|NamedTensorMap, outputs?: string|string[]): Promise<Tensor|Tensor[]> {\n
 inputs =
 this.normalizeInputs(inputs);\n
 outputs = this.normalizeOutputs(outputs);\n
 const result = await
 this.executor.executeAsync(inputs, outputs);\n
 return result.length > 1 ? result : result[0];\n
 }\n
 private
 convertTensorMapToTensorsMap(map: NamedTensorMap): NamedTensorsMap {\n
 return
 Object.keys(map).reduce((newMap: NamedTensorsMap, key) => {\n
 newMap[key] = [map[key]];\n
 return
 newMap;\n
 }, {});\n
 }\n
 /**\n
 * Releases the memory used by the weight tensors and resourceManager.\n
 *\n
 * @doc {heading: 'Models', subheading: 'Classes'}\n
 */\n
 dispose() {\n
 this.executor.dispose();\n
 if
 (this.initializer) {\n
 this.initializer.dispose();\n
 }\n
 this.resourceManager.dispose();\n
 }\n
 /**\n
 * Load
 a graph model given a URL to the model definition.\n
 *\n
 * Example of loading MobileNetV2 from a URL and
 making a prediction with
 \n
 a\n
 * zeros input:\n
 *\n
 * ```js\n
 * const modelUrl =\n
 * 'https://storage.googleapis.com/tfjs-
 models/savedmodel/mobilenet_v2_1.0_224/model.json';\n
 * const model = await tf.loadGraphModel(modelUrl);\n
 * const zeros = tf.zeros([1, 224, 224, 3]);\n
 * model.predict(zeros).print();\n
 * ```\n
 *\n
 * Example of loading
 MobileNetV2 from a TF Hub URL and making a prediction with\n
 * a zeros input:\n
 *\n
 * ```js\n
 * const modelUrl
 =\n
 * 'https://tfhub.dev/google/imagenet/mobilenet_v2_140_224/classification/2';\n
 * const model = await
 tf.loadGraphModel(modelUrl, {fromTFHub: true});\n
 * const zeros = tf.zeros([1, 224, 224, 3]);\n
 * model.predict(zeros).print();\n
 * ```\n
 *\n
 * @param modelUrl The url or an `io.IOHandler` that loads the model.\n
 *\n
 * @param options Options for the HTTP request, which allows to send credentials\n
 * and custom headers.\n
 *\n
 * @doc {heading: 'Models', subheading: 'Loading'}\n
 */\n
 export async function loadGraphModel(\n
 modelUrl:
 string|io.IOHandler, options:

```

```

io.LoadOptions = {}): Promise<GraphModel> {\n if (modelUrl == null) {\n throw new Error(\n 'modelUrl in
loadGraphModel() cannot be null. Please provide a url ' +\n 'or an IOHandler that loads the model');\n }\n if
(options == null) {\n options = {};\n }\n if (options.fromTFHub) {\n if ((modelUrl as io.IOHandler).load ==
null) {\n if (!(modelUrl as string).endsWith('/')) {\n modelUrl = (modelUrl as string) + '/';\n }\n
modelUrl = `${modelUrl}${DEFAULT_MODEL_NAME}${TFHUB_SEARCH_PARAM}`;\n }\n }\n const
model = new GraphModel(modelUrl, options);\n await model.load();\n return
model;\n}\n",null,null,null,null,null,null,null,null,null,null,null,null,null,null,null,null,"/*\n * dat-gui
JavaScript Controller Library\n * http://code.google.com/p/dat-gui\n * \n * Copyright 2011 Data Arts Team, Google
Creative Lab\n * \n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file
except
in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n\nimport Color from './color/Color';\nimport math from
'./color/math';\nimport interpret from './color/interpret';\nimport Controller from './controllers/Controller';\nimport
BooleanController from './controllers/BooleanController';\nimport OptionController from
'./controllers/OptionController';\nimport StringController from './controllers/StringController';\nimport
NumberController from './controllers/NumberController';\nimport NumberControllerBox from
'./controllers/NumberControllerBox';\nimport NumberControllerSlider from
'./controllers/NumberControllerSlider';\nimport FunctionController from './controllers/FunctionController';\nimport
ColorController from './controllers/ColorController';\nimport domImport from './dom/dom';\nimport GUIImport
from './gui/GUI';\n\nexport const color = {\n Color: Color,\n math: math,\n interpret: interpret\n};\n\nexport
const controllers = {\n Controller: Controller,\n BooleanController: BooleanController,\n OptionController:
OptionController,\n StringController: StringController,\n NumberController: NumberController,\n
NumberControllerBox: NumberControllerBox,\n NumberControllerSlider: NumberControllerSlider,\n
FunctionController: FunctionController,\n ColorController: ColorController\n};\n\nexport const dom = { dom:
domImport };\n\nexport const gui = { GUI: GUIImport };\n\nexport const GUI = GUIImport;\n\nexport default {\n
color,\n controllers,\n dom,\n gui,\n GUI\n};\n", "/*\n * dat-gui JavaScript Controller Library\n *
http://code.google.com/p/dat-gui\n * \n * Copyright 2011 Data Arts Team, Google Creative Lab\n * \n * Licensed
under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n
*\n\nexport default function(color,
forceCSSHex) {\n const colorFormat = color.__state.conversionName.toString();\n\n const r =
Math.round(color.r);\n const g = Math.round(color.g);\n const b = Math.round(color.b);\n const a = color.a;\n
const h = Math.round(color.h);\n const s = color.s.toFixed(1);\n const v = color.v.toFixed(1);\n\n if (forceCSSHex
|| (colorFormat === 'THREE_CHAR_HEX') || (colorFormat === 'SIX_CHAR_HEX')) {\n let str =
color.hex.toString(16);\n while (str.length < 6) {\n str = '0' + str;\n }\n return '#' + str;\n } else if
(colorFormat === 'CSS_RGB') {\n return 'rgb(' + r + ',' + g + ',' + b + ')';\n } else if (colorFormat ===
'CSS_RGBA') {\n return 'rgba(' + r + ',' + g + ',' + b + ',' + a + ')';\n } else if (colorFormat === 'HEX') {\n
return '0x' + color.hex.toString(16);\n } else if (colorFormat === 'RGB_ARRAY') {\n return '[' + r + ',' + g + ',' + b +
']';\n } else if (colorFormat === 'RGBA_ARRAY') {\n return '[' + r + ',' + g + ',' + b + ',' + a +
']';\n } else if (colorFormat === 'RGB_OBJ') {\n return '{r:' + r + ',g:' + g + ',b:' + b + '}';\n } else if (colorFormat
=== 'RGBA_OBJ') {\n return '{r:' + r + ',g:' + g + ',b:' + b + ',a:' + a + '}';\n } else if (colorFormat ===
'HSV_OBJ') {\n return '{h:' + h + ',s:' + s + ',v:' + v + '}';\n } else if (colorFormat === 'HSA_OBJ') {\n
return '{h:' + h + ',s:' + s + ',v:' + v + ',a:' + a + '}';\n }\n\n return 'unknown format';\n}\n", "/*\n * dat-gui JavaScript
Controller Library\n * http://code.google.com/p/dat-gui\n * \n * Copyright 2011 Data Arts Team, Google Creative
Lab\n * \n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except
in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
http://www.apache.org/licenses/LICENSE-2.0\n * \n\nconst ARR_EACH = Array.prototype.forEach;\nconst
ARR_SLICE = Array.prototype.slice;\n\n/*\n * Band-aid methods for things that should be a lot easier in

```

```

JavaScript.\n * Implementation and structure inspired by underscore.js\n *
http://documentcloud.github.com/underscore/\n *\n\nconst Common = {\n BREAK: {},\n\n extend:
function(target) {\n this.each(ARR_SLICE.call(arguments, 1), function(obj) {\n const keys = this.isObject(obj)
? Object.keys(obj) : [];\n keys.forEach(function(key) {\n if (!this.isUndefined(obj[key])) {\n target[key] = obj[key];\n }\n }).bind(this));\n }, this);\n\n return target;\n },\n\n defaults: function(target)
{\n this.each(ARR_SLICE.call(arguments, 1), function(obj) {\n const keys = this.isObject(obj) ?
Object.keys(obj) : [];\n keys.forEach(function(key) {\n if (this.isUndefined(target[key])) {\n target[key]
= obj[key];\n }\n }).bind(this));\n }, this);\n\n return target;\n },\n\n compose: function() {\n const
toCall = ARR_SLICE.call(arguments);\n return function() {\n let args = ARR_SLICE.call(arguments);\n for (let i = toCall.length - 1; i >= 0; i--) {\n args = [toCall[i].apply(this, args)];\n }\n return args[0];\n };\n },\n\n each: function(obj, itr, scope) {\n if (!obj) {\n return;\n }\n\n if (ARR_EACH && obj.forEach
&& obj.forEach === ARR_EACH) {\n obj.forEach(itr, scope);\n } else if (obj.length === obj.length + 0) { // Is
number but not NaN\n let key;\n let l;\n for (key = 0, l = obj.length; key < l; key++) {\n if (key in obj
&& itr.call(scope, obj[key], key) === this.BREAK) {\n return;\n }\n }\n } else {\n for (const key
in obj) {\n if (itr.call(scope, obj[key], key) === this.BREAK) {\n return;\n }\n }\n }\n },\n\n defer: function(fnc) {\n setTimeout(fnc, 0);\n },\n\n // if the function is called repeatedly, wait until threshold
passes until we execute the function\n debounce: function(func, threshold, callImmediately) {\n let timeout;\n\n return function() {\n const obj = this;\n const args = arguments;\n function delayed() {\n timeout =
null;\n if (!callImmediately) func.apply(obj, args);\n }\n\n const callNow = callImmediately ||
!timeout;\n\n clearTimeout(timeout);\n timeout = setTimeout(delayed, threshold);\n\n if (callNow) {\n func.apply(obj, args);\n }\n };\n },\n\n toArray: function(obj) {\n if (obj.toArray) return obj.toArray();\n return ARR_SLICE.call(obj);\n },\n\n isUndefined: function(obj) {\n return obj === undefined;\n },\n\n isNull:
function(obj) {\n return obj === null;\n },\n\n isNaN: function(obj) {\n return isNaN(obj);\n },\n\n isArray:
Array.isArray || function(obj) {\n return obj.constructor === Array;\n },\n\n isObject: function(obj) {\n return
obj === Object(obj);\n },\n\n isNumber: function(obj) {\n return obj === obj + 0;\n },\n\n isString:
function(obj) {\n return obj === obj + '';\n },\n\n isBoolean: function(obj) {\n return obj === false || obj === true;\n },\n\n isFunction: function(obj) {\n return Object.prototype.toString.call(obj) === '[object Function]';\n },\n\n next: function(obj) {\n return obj.next;\n },\n\n export default Common;\n}

dat-gui JavaScript Controller Library\n * http://code.google.com/p/dat-gui\n * \n * Copyright 2011 Data Arts Team,
Google Creative Lab\n * \n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use
this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n\nimport toString from './toString';\nimport common from
'./utils/common';\n\nconst INTERPRETATIONS = [\n // Strings\n {\n litmus: common.isString,\n conversions:
{\n THREE_CHAR_HEX: {\n read: function(original) {\n const test = original.match(/^#([A-F0-9]{3})$/);\n if (test === null) {\n return false;\n }\n return {\n space: 'HEX',\n hex: parseInt(test[1].toString() +
test[1].toString() + test[1].toString(), 16);\n },\n write: toString\n },\n SIX_CHAR_HEX: {\n read: function(original) {\n const test = original.match(/^#([A-F0-9]{6})$/);\n if (test === null) {\n return false;\n }\n return {\n space: 'HEX',\n hex: parseInt(test[1].toString(), 16);\n },\n write:
toString\n },\n CSS_RGB: {\n read: function(original) {\n const test =
original.match(/^rgb\\((\\s*(.+))\\s*,\\s*(.+))\\s*,\\s*(.+))\\s*$/);\n if (test === null) {\n return false;\n }\n return {\n space: 'RGB',\n r: parseFloat(test[1]),\n g:
parseFloat(test[2]),\n b: parseFloat(test[3])\n },\n write: toString\n },\n CSS_RGBA: {\n read: function(original) {\n const test =
original.match(/^rgba\\((\\s*(.+))\\s*,\\s*(.+))\\s*,\\s*(.+))\\s*,\\s*(.+))\\s*$/);\n if (test === null) {\n return
false;\n }\n return {\n space: 'RGB',\n r: parseFloat(test[1]),\n g:
parseFloat(test[2]),\n b: parseFloat(test[3]),\n a: parseFloat(test[4])\n },\n write:
toString\n }\n }\n }\n }\n }\n }\n }\n];\n\nconst datGui = {\n init: function() {\n this._init();\n },\n _init: function() {\n this._initCommon();\n this._initInterpretations();\n },\n _initCommon: function() {\n this._initCommonProperties();\n this._initCommonMethods();\n },\n _initInterpretations: function() {\n this._initInterpretationProperties();\n this._initInterpretationMethods();\n },\n _initCommonProperties: function() {\n this._initCommonProperty('name', 'name', 'name');\n this._initCommonProperty('value', 'value', 'value');\n this._initCommonProperty('min', 'min', 'min');\n this._initCommonProperty('max', 'max', 'max');\n this._initCommonProperty('step', 'step', 'step');\n this._initCommonProperty('precision', 'precision', 'precision');\n this._initCommonProperty('readOnly', 'readOnly', 'readOnly');\n this._initCommonProperty('disabled', 'disabled', 'disabled');\n this._initCommonProperty('visible', 'visible', 'visible');\n this._initCommonProperty('label', 'label', 'label');\n this._initCommonProperty('description', 'description', 'description');\n this._initCommonProperty('units', 'units', 'units');\n this._initCommonProperty('color', 'color', 'color');\n this._initCommonProperty('fontStyle', 'fontStyle', 'fontStyle');\n this._initCommonProperty('fontWeight', 'fontWeight', 'fontWeight');\n this._initCommonProperty('fontSize', 'fontSize', 'fontSize');\n this._initCommonProperty('fontColor', 'fontColor', 'fontColor');\n this._initCommonProperty('fontFamily', 'fontFamily', 'fontFamily');\n this._initCommonProperty('fontStyle', 'fontStyle', 'fontStyle');\n this._initCommonProperty('fontWeight', 'fontWeight', 'fontWeight');\n this._initCommonProperty('fontSize', 'fontSize', 'fontSize');\n this._initCommonProperty('fontColor', 'fontColor', 'fontColor');\n this._initCommonProperty('fontFamily', 'fontFamily', 'fontFamily');\n },\n _initCommonMethods: function() {\n this._initCommonMethod('name', 'name', 'name');\n this._initCommonMethod('value', 'value', 'value');\n this._initCommonMethod('min', 'min', 'min');\n this._initCommonMethod('max', 'max', 'max');\n this._initCommonMethod('step', 'step', 'step');\n this._initCommonMethod('precision', 'precision', 'precision');\n this._initCommonMethod('readOnly', 'readOnly', 'readOnly');\n this._initCommonMethod('disabled', 'disabled', 'disabled');\n this._initCommonMethod('visible', 'visible', 'visible');\n this._initCommonMethod('label', 'label', 'label');\n this._initCommonMethod('description', 'description', 'description');\n this._initCommonMethod('units', 'units', 'units');\n this._initCommonMethod('color', 'color', 'color');\n this._initCommonMethod('fontStyle', 'fontStyle', 'fontStyle');\n this._initCommonMethod('fontWeight', 'fontWeight', 'fontWeight');\n this._initCommonMethod('fontSize', 'fontSize', 'fontSize');\n this._initCommonMethod('fontColor', 'fontColor', 'fontColor');\n this._initCommonMethod('fontFamily', 'fontFamily', 'fontFamily');\n },\n _initInterpretationProperties: function() {\n this._initInterpretationProperty('name', 'name', 'name');\n this._initInterpretationProperty('value', 'value', 'value');\n this._initInterpretationProperty('min', 'min', 'min');\n this._initInterpretationProperty('max', 'max', 'max');\n this._initInterpretationProperty('step', 'step', 'step');\n this._initInterpretationProperty('precision', 'precision', 'precision');\n this._initInterpretationProperty('readOnly', 'readOnly', 'readOnly');\n this._initInterpretationProperty('disabled', 'disabled', 'disabled');\n this._initInterpretationProperty('visible', 'visible', 'visible');\n this._initInterpretationProperty('label', 'label', 'label');\n this._initInterpretationProperty('description', 'description', 'description');\n this._initInterpretationProperty('units', 'units', 'units');\n this._initInterpretationProperty('color', 'color', 'color');\n this._initInterpretationProperty('fontStyle', 'fontStyle', 'fontStyle');\n this._initInterpretationProperty('fontWeight', 'fontWeight', 'fontWeight');\n this._initInterpretationProperty('fontSize', 'fontSize', 'fontSize');\n this._initInterpretationProperty('fontColor', 'fontColor', 'fontColor');\n this._initInterpretationProperty('fontFamily', 'fontFamily', 'fontFamily');\n },\n _initInterpretationMethods: function() {\n this._initInterpretationMethod('name', 'name', 'name');\n this._initInterpretationMethod('value', 'value', 'value');\n this._initInterpretationMethod('min', 'min', 'min');\n this._initInterpretationMethod('max', 'max', 'max');\n this._initInterpretationMethod('step', 'step', 'step');\n this._initInterpretationMethod('precision', 'precision', 'precision');\n this._initInterpretationMethod('readOnly', 'readOnly', 'readOnly');\n this._initInterpretationMethod('disabled', 'disabled', 'disabled');\n this._initInterpretationMethod('visible', 'visible', 'visible');\n this._initInterpretationMethod('label', 'label', 'label');\n this._initInterpretationMethod('description', 'description', 'description');\n this._initInterpretationMethod('units', 'units', 'units');\n this._initInterpretationMethod('color', 'color', 'color');\n this._initInterpretationMethod('fontStyle', 'fontStyle', 'fontStyle');\n this._initInterpretationMethod('fontWeight', 'fontWeight', 'fontWeight');\n this._initInterpretationMethod('fontSize', 'fontSize', 'fontSize');\n this._initInterpretationMethod('fontColor', 'fontColor', 'fontColor');\n this._initInterpretationMethod('fontFamily', 'fontFamily', 'fontFamily');\n }\n};\n\nexport default datGui;\n

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toString\n }\n }\n // Numbers\n {\n litmus: common.isNumber,\n conversions: {\n HEX: {\n read: function(original) {\n return {\n space: 'HEX',\n hex: original,\n conversionName: 'HEX'\n };\n },\n write: function(color) {\n return color.hex;\n }\n }\n }\n }\n // Arrays\n {\n litmus: common.isArray,\n conversions: {\n RGB_ARRAY: {\n read: function(original) {\n if (original.length !== 3) {\n return false;\n }\n return {\n space: 'RGB',\n r: original[0],\n g: original[1],\n b: original[2]\n };\n },\n write: function(color) {\n return [color.r, color.g, color.b];\n }\n },\n RGBA_ARRAY: {\n read: function(original) {\n if (original.length !== 4) return false;\n return {\n space: 'RGBA',\n r: original[0],\n g: original[1],\n b: original[2],\n a: original[3]\n };\n },\n write: function(color) {\n return [color.r, color.g, color.b, color.a];\n }\n }\n },\n // Objects\n {\n litmus: common.isObject,\n conversions: {\n RGBA_OBJ:\n {\n read: function(original) {\n if (common.isNumber(original.r) &&\n common.isNumber(original.g) &&\n common.isNumber(original.b) &&\n common.isNumber(original.a)) {\n return {\n space: 'RGBA',\n r: original.r,\n g: original.g,\n b: original.b,\n a: original.a\n };\n }\n return false;\n },\n write: function(color) {\n return {\n r: color.r,\n g: color.g,\n b: color.b,\n a: color.a\n };\n }\n },\n RGB_OBJ: {\n read: function(original) {\n if (common.isNumber(original.r) &&\n common.isNumber(original.g) &&\n common.isNumber(original.b)) {\n return {\n space: 'RGB',\n r: original.r,\n g: original.g,\n b: original.b\n };\n }\n return false;\n },\n write: function(color) {\n return {\n r: color.r,\n g: color.g,\n b: color.b\n };\n }\n },\n HSVA_OBJ: {\n read: function(original) {\n if (common.isNumber(original.h) &&\n common.isNumber(original.s) &&\n common.isNumber(original.v) &&\n common.isNumber(original.a)) {\n return {\n space: 'HSVA',\n h: original.h,\n s: original.s,\n v: original.v,\n a: original.a\n };\n }\n return false;\n },\n write: function(color) {\n return {\n h: color.h,\n s: color.s,\n v: color.v,\n a: color.a\n };\n }\n },\n HSV_OBJ: {\n read: function(original) {\n if (common.isNumber(original.h) &&\n common.isNumber(original.s) &&\n common.isNumber(original.v)) {\n return {\n space: 'HSV',\n h: original.h,\n s: original.s,\n v: original.v\n };\n }\n return false;\n },\n write: function(color) {\n return {\n h: color.h,\n s: color.s,\n v: color.v\n };\n }\n }\n }\n];\n\nlet result;\nlet toReturn;\n\nconst interpret = function() {\n toReturn = false;\n\n const original = arguments.length > 1 ? common.toArray(arguments) : arguments[0];\n\n common.each(INTERPRETATIONS, function(family) {\n if (family.litmus(original)) {\n common.each(family.conversions, function(conversion, conversionName) {\n result = conversion.read(original);\n\n if (toReturn === false && result !== false) {\n toReturn = result;\n result.conversionName = conversionName;\n result.conversion = conversion;\n return common.BREAK;\n }\n });\n }\n });\n\n return toReturn;\n};\n\nexport default interpret;\n\n\"**\n * dat-gui JavaScript Controller Library\n *\n http://code.google.com/p/dat-gui\n *\n Copyright 2011 Data Arts Team, Google Creative Lab\n *\n Licensed under the Apache License, Version 2.0 (the \"License\");\n you may not use this file except in compliance with the License.\n You may obtain a copy of the License at\n *\n http://www.apache.org/licenses/LICENSE-2.0\n *\n\nlet tmpComponent;\n\nconst ColorMath = {\n hsv_to_rgb: function(h, s, v) {\n const hi = Math.floor(h / 60)\n % 6;\n\n const f = h / 60 - Math.floor(h / 60);\n const p = v * (1.0 - s);\n const q = v * (1.0 - (f * s));\n const t = v * (1.0 - ((1.0 - f) * s));\n\n const c = [\n [v, t, p],\n [q, v, p],\n [p, v, t],\n [p, q, v],\n [t, p, v],\n [v, p, q]\n][hi];\n\n return {\n r: c[0] * 255,\n g: c[1] * 255,\n b: c[2] * 255\n };\n },\n rgb_to_hsv: function(r, g, b) {\n const min = Math.min(r, g, b);\n const max = Math.max(r, g, b);\n const delta = max - min;\n let h;\n let s;\n\n if (max !== 0) {\n s
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= delta / max;\n } else {\n return {\n h: NaN,\n s: 0,\n v: 0\n };\n }\n\n if (r === max) {\n
h = (g - b) / delta;\n } else if (g === max) {\n h = 2 + (b - r) / delta;\n } else {\n h = 4 + (r - g) / delta;\n
}\n h /= 6;\n if (h < 0) {\n h += 1;\n }\n\n return {\n h: h * 360,\n s: s,\n v: max / 255\n };\n
},\n\n rgb_to_hex: function(r, g, b) {\n let hex = this.hex_with_component(0, 2, r);\n hex =
this.hex_with_component(hex, 1, g);\n hex = this.hex_with_component(hex, 0, b);\n return hex;\n },\n\n
component_from_hex: function(hex, componentIndex) {\n return (hex >> (componentIndex * 8)) & 0xFF;\n
},\n\n hex_with_component:
function(hex, componentIndex, value) {\n return value << (tmpComponent = componentIndex * 8) | (hex &
~(0xFF << tmpComponent));\n }\n};\n\nexport default ColorMath;\n", "/*\n * dat-gui JavaScript Controller
Library\n * http://code.google.com/p/dat-gui\n * Copyright 2011 Data Arts Team, Google Creative Lab\n *\n *
Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in
compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n\nimport interpret from './interpret';\nimport math from
'./math';\nimport colorToString from './toString';\nimport common from './utils/common';\n\nclass Color {\n
constructor() {\n this.__state = interpret.apply(this, arguments);\n\n if (this.__state === false) {\n throw new
Error('Failed to interpret color arguments');\n }\n\n this.__state.a = this.__state.a || 1;\n }\n\n toString() {\n
return colorToString(this);\n
}\n\n toHexString() {\n return colorToString(this, true);\n }\n\n toOriginal() {\n return
this.__state.conversion.write(this);\n }\n}\n\nfunction defineRGBComponent(target, component,
componentHexIndex) {\n Object.defineProperty(target, component, {\n get: function() {\n if
(this.__state.space === 'RGB') {\n return this.__state[component];\n }\n\n Color.recalculateRGB(this,
component, componentHexIndex);\n\n return this.__state[component];\n },\n\n set: function(v) {\n if
(this.__state.space !== 'RGB') {\n Color.recalculateRGB(this, component, componentHexIndex);\n
this.__state.space = 'RGB';\n }\n\n this.__state[component] = v;\n }\n });\n}\n\nfunction
defineHSVComponent(target, component) {\n Object.defineProperty(target, component, {\n get: function() {\n
if (this.__state.space === 'HSV') {\n return this.__state[component];\n }\n\n
Color.recalculateHSV(this);\n\n return
this.__state[component];\n },\n\n set: function(v) {\n if (this.__state.space !== 'HSV') {\n
Color.recalculateHSV(this);\n this.__state.space = 'HSV';\n }\n\n this.__state[component] = v;\n }\n
});\n}\n\n\nColor.recalculateRGB = function(color, component, componentHexIndex) {\n if (color.__state.space
=== 'HEX') {\n color.__state[component] = math.component_from_hex(color.__state.hex,
componentHexIndex);\n } else if (color.__state.space === 'HSV') {\n common.extend(color.__state,
math.hsv_to_rgb(color.__state.h, color.__state.s, color.__state.v));\n } else {\n throw new Error('Corrupted color
state');\n }\n};\n\nColor.recalculateHSV = function(color) {\n const result = math.rgb_to_hsv(color.r, color.g,
color.b);\n\n common.extend(color.__state, {\n s: result.s,\n v: result.v\n });\n\n if
(!common.isNaN(result.h)) {\n color.__state.h = result.h;\n } else if (common.isUndefined(color.__state.h)) {\n
color.__state.h
= 0;\n }\n};\n\nColor.COMPONENTS = ['r', 'g', 'b', 'h', 's', 'v', 'hex', 'a'];\n\ndefineRGBComponent(Color.prototype,
'r', 2);\n\ndefineRGBComponent(Color.prototype, 'g', 1);\n\ndefineRGBComponent(Color.prototype, 'b',
0);\n\ndefineHSVComponent(Color.prototype, 'h');\n\ndefineHSVComponent(Color.prototype,
's');\n\ndefineHSVComponent(Color.prototype, 'v');\n\nObject.defineProperty(Color.prototype, 'a', {\n get: function()
{\n return this.__state.a;\n },\n\n set: function(v) {\n this.__state.a = v;\n
}\n});\n\nObject.defineProperty(Color.prototype, 'hex', {\n get: function() {\n if (!this.__state.space !== 'HEX')
{\n this.__state.hex = math.rgb_to_hex(this.r, this.g, this.b);\n }\n\n return this.__state.hex;\n },\n\n set:
function(v) {\n this.__state.space = 'HEX';\n this.__state.hex = v;\n }\n});\n\nexport default Color;\n", "/*\n *
dat-gui JavaScript Controller Library\n * http://code.google.com/p/dat-gui\n * Copyright 2011 Data Arts Team,
Google Creative Lab\n *\n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not
use this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *

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http://www.apache.org/licenses/LICENSE-2.0\n *\n\n/**\n * @class An \"abstract\" class that represents a given
property of an object.\n *\n * @param {Object} object The object to be manipulated\n * @param {string} property
The name of the property to be manipulated\n */\nclass Controller {\n constructor(object, property) {\n
this.initialValue = object[property];\n\n /**\n * Those who extend this class will put their DOM elements in
here.\n *\n * @type {DOMElement}\n */\n this.domElement = document.createElement('div');\n\n /**\n *
The object to manipulate\n *\n * @type {Object}\n */\n this.object = object;\n\n /**\n * The name of the
property to manipulate\n *\n * @type {String}\n */\n this.property = property;\n\n /**\n *
The function to be called on change.\n *\n * @type {Function}\n *\n * @ignore\n */\n this.__onChange =
undefined;\n\n /**\n * The function to be called on finishing change.\n *\n * @type {Function}\n *\n * @ignore\n
*/\n this.__onFinishChange = undefined;\n }\n\n /**\n * Specify that a function fire every time someone
changes the value with\n *\n * this Controller.\n *\n * @param {Function} fnc This function will be called
whenever the value\n * is modified via this Controller.\n *\n * @returns {Controller} this\n */\n onChange(fnc) {\n
this.__onChange = fnc;\n return this;\n }\n\n /**\n * Specify that a function fire every time someone
\"finishes\" changing\n * the value with this Controller. Useful for values that change\n * incrementally like
numbers or strings.\n *\n * @param {Function} fnc This function will be called whenever\n * someone
\"finishes\" changing the value via this Controller.\n *\n * @returns {Controller} this\n */\n onFinshChange(fnc) {\n
this.__onFinishChange = fnc;\n return this;\n }\n\n /**\n * Change the value of
<code>object[property]</code>\n *\n * @param {Object} newValue The new value of
<code>object[property]</code>\n */\n setValue(newValue) {\n this.object[this.property] = newValue;\n if
(this.__onChange) {\n this.__onChange.call(this, newValue);\n }\n\n this.updateDisplay();\n return this;\n
}\n\n /**\n * Gets the value of <code>object[property]</code>\n *\n * @returns {Object} The current value of
<code>object[property]</code>\n */\n getValue() {\n return this.object[this.property];\n }\n\n /**\n *
Refreshes the visual display of a Controller in order to keep sync\n * with the object's current value.\n *\n * @returns
{Controller} this\n */\n updateDisplay() {\n return this;\n }\n\n /**\n * @returns {Boolean} true if the value
has deviated from initialValue\n */\n isModified() {\n return this.initialValue !== this.getValue();\n
}\n}\n\nexport default Controller;\n\n\"/**\n * dat-gui JavaScript Controller Library\n */
http://code.google.com/p/dat-gui\n *\n * Copyright 2011 Data Arts Team, Google Creative Lab\n *\n * Licensed
under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n
*/\n\nimport common from '../utils/common';\n\nconst EVENT_MAP = {\n HTMLEvents: ['change'],\n MouseEvents: ['click', 'mousemove', 'mousedown', 'mouseup', 'mouseover'],\n KeyboardEvents:
['keydown']\n};\n\nconst EVENT_MAP_INV = {};\n\ncommon.each(EVENT_MAP, function(v, k) {\n common.each(v, function(e) {\n EVENT_MAP_INV[e] = k;\n });\n});\n\nconst CSS_VALUE_PIXELS =
/(\\d+(\\.\\d+)?px)/;\n\nfunction cssValueToPixels(val) {\n if (val === '0' || common.isUndefined(val)) {\n return
0;\n }\n\n const match = val.match(CSS_VALUE_PIXELS);\n\n if (!common.isNull(match)) {\n return
parseFloat(match[1]);\n }\n\n // TODO ...ems? %?\n return 0;\n}\n\n/**\n * @namespace\n */\n\n@member dat.dom\n\nconst dom = {\n\n /**\n *\n * @param elem\n * @param selectable\n */\n makeSelectable: function(elem, selectable) {\n if (elem === undefined || elem.style === undefined) return;\n\n elem.onselectstart = selectable ? function() {\n return false;\n } : function() {\n };;\n\n elem.style.MozUserSelect = selectable ? 'auto' : 'none';\n elem.style.KhtmlUserSelect = selectable ? 'auto' :
'none';\n elem.unselectable = selectable ? 'on' : 'off';\n },\n\n /**\n *\n * @param elem\n * @param
horizontal\n * @param vert\n */\n makeFullscreen: function(elem, hor, vert) {\n let vertical = vert;\n let
horizontal = hor;\n\n if (common.isUndefined(horizontal)) {\n horizontal = true;\n }\n\n if
(common.isUndefined(vertical)) {\n vertical = true;\n }\n\n elem.style.position = 'absolute';\n\n if (horizontal) {\n elem.style.left = 0;\n elem.style.right = 0;\n }\n\n if (vertical) {\n elem.style.top =
0;\n elem.style.bottom = 0;\n }\n },\n\n /**\n *\n * @param elem\n * @param eventType\n * @param
params\n */\n fakeEvent: function(elem, eventType, pars, aux) {\n const params = pars || {};\n const
className = EVENT_MAP_INV[eventType];\n if (!className) {\n throw new Error('Event type ' +

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eventType + ' not supported.');
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`}\n const evt = document.createEvent(className);\n switch (className) {\n
 case 'MouseEvents':\n {\n const clientX = params.x || params.clientX || 0;\n const clientY =
params.y || params.clientY || 0;\n evt.initMouseEvent(eventType, params.bubbles || false,\nparams.cancelable || true, window, params.clickCount || 1,\n0, // screen X\n0, // screen Y\nclientX, // client X\nclientY, // client
Y\nfalse, false, false, false, 0, null);\n break;\n }\n case 'KeyboardEvents':\n {\n const
init = evt.initKeyboardEvent || evt.initKeyEvent; // webkit || moz\n common.defaults(params, {\n
cancelable: true,\nctrlKey: false,\naltKey: false,\nshiftKey: false,\nmetaKey: false,\n
keyCode: undefined,\ncharCode: undefined\n});\n init(eventType, params.bubbles || false,\nparams.cancelable, window,\nparams.ctrlKey, params.altKey,\nparams.shiftKey,
params.metaKey,\nparams.keyCode, params.charCode);\n break;\n }\n default:\n {\n
evt.initEvent(eventType, params.bubbles || false, params.cancelable || true);\n break;\n }\n }\n
common.defaults(evt, aux);\n elem.dispatchEvent(evt);\n },\n\n /**\n * @param elem\n * @param
event\n
 * @param func\n * @param bool\n */\n bind: function(elem, event, func, newBool) {\n const bool =
newBool || false;\n if (elem.addEventListener) {\n elem.addEventListener(event, func, bool);\n } else if
(elem.attachEvent) {\n elem.attachEvent('on' + event, func);\n }\n return dom;\n },\n\n /**\n *
@param elem\n * @param event\n * @param func\n * @param bool\n */\n unbind: function(elem, event,
func, newBool) {\n const bool = newBool || false;\n if (elem.removeEventListener) {\n
elem.removeEventListener(event, func, bool);\n } else if (elem.detachEvent) {\n elem.detachEvent('on' + event,
func);\n }\n return dom;\n },\n\n /**\n * @param elem\n * @param className\n */\n addClass:
function(elem, className) {\n if (elem.className === undefined) {\n elem.className = className;\n } else
if (elem.className !== className) {\n const classes = elem.className.split(/ +/);\n if
(classes.indexOf(className)
=== -1) {\n classes.push(className);\n elem.className = classes.join(' ').replace(/^\s+/, '').replace(/\s+$/,
'');\n }\n }\n return dom;\n },\n\n /**\n * @param elem\n * @param className\n */\n
removeClass: function(elem, className) {\n if (className) {\n if (elem.className === className) {\n
elem.removeAttribute('class');\n } else {\n const classes = elem.className.split(/ +/);\n const index =
classes.indexOf(className);\n if (index !== -1) {\n classes.splice(index, 1);\n elem.className =
classes.join(' ');\n }\n }\n } else {\n elem.className = undefined;\n }\n return dom;\n },\n\n
hasClass: function(elem, className) {\n return new RegExp('(?:^|\\\\\\\\s+)' + className +
'(?:\\\\\\\\s+$)').test(elem.className) || false;\n },\n\n /**\n * @param elem\n */\n getWidth: function(elem)
{\n const style = getComputedStyle(elem);\n\n return cssValueToPixels(style['border-left-width']) +\n cssValueToPixels(style['border-right-width']) +\n
cssValueToPixels(style['padding-left']) +\n cssValueToPixels(style['padding-right']) +\n
cssValueToPixels(style.width);\n },\n\n /**\n * @param elem\n */\n getHeight: function(elem) {\n const
style = getComputedStyle(elem);\n return cssValueToPixels(style['border-top-width']) +\n
cssValueToPixels(style['border-bottom-width']) +\n cssValueToPixels(style['padding-top']) +\n
cssValueToPixels(style['padding-bottom']) +\n cssValueToPixels(style.height);\n },\n\n /**\n * @param
el\n */\n getOffset: function(el) {\n let elem = el;\n const offset = { left: 0, top: 0 }; \n if (elem.offsetParent)
{\n do {\n offset.left += elem.offsetLeft;\n offset.top += elem.offsetTop;\n elem =
elem.offsetParent;\n } while (elem);\n }\n return offset;\n },\n\n //
http://stackoverflow.com/posts/2684561/revisions\n
 /**\n * @param elem\n */\n isActive: function(elem) {\n return elem === document.activeElement &&
(elem.type || elem.href);\n }\n\n};\n\nexport default dom;\n\n",\n\n /**\n * dat-gui JavaScript Controller Library\n *
http://code.google.com/p/dat-gui\n * Copyright 2011 Data Arts Team, Google Creative Lab\n * Licensed
under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the License at\n * http://www.apache.org/licenses/LICENSE-2.0\n`



```

*/\n\nimport Controller from './Controller';\nimport dom from '../dom/dom';\n\n/**\n * @class Provides a checkbox
input to alter the boolean property of an object.\n *\n * @extends dat.controllers.Controller\n *\n * @param
{Object} object The object to be manipulated\n *\n * @param {string} property The name of the property to be
manipulated\n */\n\nclass BooleanController extends Controller {\n constructor(object,
property) {\n super(object, property);\n\n const _this = this;\n this.__prev = this.getValue();\n\n this.__checkbox = document.createElement('input');\n this.__checkbox.setAttribute('type', 'checkbox');\n\n function onChange() {\n _this.setValue(!_this.__prev);\n }\n\n dom.bind(this.__checkbox, 'change',
onChange, false);\n\n this.domElement.appendChild(this.__checkbox);\n\n // Match original value\n this.updateDisplay();\n }\n\n setValue(v) {\n const toReturn = super.setValue(v);\n if (this.__onFinishChange) {\n this.__onFinishChange.call(this, this.getValue());\n }\n this.__prev = this.getValue();\n return
toReturn;\n }\n\n updateDisplay() {\n if (this.getValue() === true) {\n this.__checkbox.setAttribute('checked',
'checked');\n this.__checkbox.checked = true;\n this.__prev = true;\n } else {\n this.__checkbox.checked
= false;\n this.__prev = false;\n }\n\n return super.updateDisplay();\n }\n}\n\nexport default BooleanController;\n", "/*\n * dat-gui JavaScript Controller Library\n *\n
http://code.google.com/p/dat-gui\n *\n * Copyright 2011 Data Arts Team, Google Creative Lab\n *\n * Licensed
under the Apache License, Version 2.0 (the "License");\n *\n * you may not use this file except in compliance with the
License.\n *\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n
*/\n\nimport Controller from './Controller';\nimport dom from '../dom/dom';\nimport common from
'../utils/common';\n\n/**\n * @class Provides a select input to alter the property of an object, using a\n *\n * list of
accepted values.\n *\n * @extends dat.controllers.Controller\n *\n * @param {Object} object The object to be
manipulated\n *\n * @param {string} property The name of the property to be manipulated\n *\n * @param
{Object|string[]} options A map of labels to acceptable values, or\n *\n * a list of acceptable string values.\n */\n\nclass
OptionController extends Controller\n\n{\n constructor(object, property, opts) {\n super(object, property);\n\n let options = opts;\n\n const _this =
this;\n\n /**\n * The drop down menu\n *\n * @ignore\n */\n this.__select =
document.createElement('select');\n\n if (common.isArray(options)) {\n const map = {};\n\n common.each(options, function(element) {\n map[element] = element;\n });\n options = map;\n }\n\n common.each(options, function(value, key) {\n const opt = document.createElement('option');\n\n opt.innerHTML = key;\n opt.setAttribute('value', value);\n _this.__select.appendChild(opt);\n });\n\n //
Acknowledge original value\n this.updateDisplay();\n\n dom.bind(this.__select, 'change', function() {\n const
desiredValue = this.options[this.selectedIndex].value;\n _this.setValue(desiredValue);\n });\n\n this.domElement.appendChild(this.__select);\n }\n\n setValue(v) {\n const toReturn = super.setValue(v);\n\n if (this.__onFinishChange) {\n this.__onFinishChange.call(this, this.getValue());\n }\n\n return toReturn;\n }\n\n updateDisplay() {\n if (dom.isActive(this.__select)) return this; // prevent number from updating if user is
trying to manually update\n this.__select.value = this.getValue();\n return super.updateDisplay();\n }\n}\n\nexport default OptionController;\n", "/*\n * dat-gui JavaScript Controller Library\n *\n
http://code.google.com/p/dat-gui\n *\n * Copyright 2011 Data Arts Team, Google Creative Lab\n *\n * Licensed
under the Apache License, Version 2.0 (the "License");\n *\n * you may not use this file except in compliance with the
License.\n *\n * You may obtain a copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n
*/\n\nimport Controller from './Controller';\nimport dom from '../dom/dom';\n\n/**\n * @class Provides a text input
to alter the string property of an object.\n *\n * @extends dat.controllers.Controller\n *\n * @param
{Object} object The object to be manipulated\n *\n * @param {string} property The name of the property to be
manipulated\n */\n\nclass StringController extends Controller {\n constructor(object, property) {\n super(object,
property);\n\n const _this = this;\n\n function onChange() {\n _this.setValue(_this.__input.value);\n }\n\n function onBlur() {\n if (_this.__onFinishChange) {\n _this.__onFinishChange.call(_this,
_this.getValue());\n }\n }\n\n this.__input = document.createElement('input');\n\n this.__input.setAttribute('type', 'text');\n\n dom.bind(this.__input, 'keyup', onChange);\n dom.bind(this.__input,
'change', onChange);\n dom.bind(this.__input, 'blur', onBlur);\n dom.bind(this.__input, 'keydown', function(e)

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{\n if (e.keyCode === 13) {\n this.blur();\n }\n});\n\n this.updateDisplay();\n\n this.domElement.appendChild(this.__input);\n }\n\n updateDisplay() {\n // Stops the caret from moving on
 account of:\n // keyup -> setValue -> updateDisplay\n if (!dom.isActive(this.__input)) {\n this.__input.value
 = this.getValue();\n }\n return super.updateDisplay();\n }\n}\n\nexport default StringController;\n", "/*\n * dat-
gui JavaScript Controller Library\n * http://code.google.com/p/dat-gui\n *\n * Copyright 2011 Data Arts Team,
Google Creative Lab\n *\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use
this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n\nimport Controller from './Controller';\nimport common from
'./utils/common';\n\nfunction numDecimals(x) {\n const _x = x.toString();\n if (_x.indexOf('.') > -1) {\n return
_x.length - _x.indexOf('.') - 1;\n }\n\n return 0;\n}\n\n/**\n * @class Represents a given property of an object that
is a number.\n *\n * @extends dat.controllers.Controller\n *\n * @param {Object} object
The object to be manipulated\n *\n * @param {string} property The name of the property to be manipulated\n *\n
@param {Object} [params] Optional parameters\n *\n * @param {Number} [params.min] Minimum allowed value\n *\n
@param {Number} [params.max] Maximum allowed value\n *\n * @param {Number} [params.step] Increment by
which to change value\n *\n\nclass NumberController extends Controller {\n constructor(object, property, params)
{\n super(object, property);\n\n const _params = params || {};\n\n this.__min = _params.min;\n this.__max =
_params.max;\n this.__step = _params.step;\n\n if (common.isUndefined(this.__step)) {\n if (this.initialValue
=== 0) {\n this.__impliedStep = 1; // What are we, psychics?\n } else {\n // Hey Doug, check this out.\n
 this.__impliedStep = Math.pow(10, Math.floor(Math.log(Math.abs(this.initialValue)) / Math.LN10)) / 10;\n
 }\n } else {\n this.__impliedStep = this.__step;\n }\n\n this.__precision =
numDecimals(this.__impliedStep);\n\n }\n\n setValue(v) {\n let _v = v;\n\n if (this.__min !== undefined && _v < this.__min) {\n _v =
this.__min;\n } else if (this.__max !== undefined && _v > this.__max) {\n _v = this.__max;\n }\n\n if
(this.__step !== undefined && _v % this.__step !== 0) {\n _v = Math.round(_v / this.__step) * this.__step;\n
 }\n\n return super.setValue(_v);\n }\n\n /**\n * Specify a minimum value for <code>object[property]</code>.\n
 *\n * @param {Number} min\n * The minimum value for\n * <code>object[property]</code>\n *\n * @returns
 * {dat.controllers.NumberController} this\n *\n * @min(minValue) {\n * this.__min = minValue;\n * return this;\n
 * }\n\n * Specify a maximum value for <code>object[property]</code>.\n *\n * @param {Number}
 * max\n * The maximum value for\n * <code>object[property]</code>\n *\n * @returns
 * {dat.controllers.NumberController} this\n *\n * @max(maxValue) {\n * this.__max = maxValue;\n * return
 * this;\n * }\n\n * Specify a step value that dat.controllers.NumberController\n * increments by.\n *\n *
@param {Number} step\n * The step value for\n * dat.controllers.NumberController\n * @default if minimum
 * and maximum specified increment is 1% of the\n * difference otherwise stepValue is 1\n * @returns
 * {dat.controllers.NumberController} this\n *\n * @step(stepValue) {\n * this.__step = stepValue;\n
 * this.__impliedStep = stepValue;\n * this.__precision = numDecimals(stepValue);\n * return this;\n * }\n
 * }\n\n\nexport
 * default NumberController;\n", "/*\n * dat-gui JavaScript Controller Library\n * http://code.google.com/p/dat-gui\n
*\n * Copyright 2011 Data Arts Team, Google Creative Lab\n *\n * Licensed under the Apache License, Version
2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n *\n *
http://www.apache.org/licenses/LICENSE-2.0\n *\n\nimport NumberController from './NumberController';\nimport dom from './dom/dom';\nimport common from './utils/common';\n\nfunction
roundToDecimal(value, decimals) {\n const tenTo = Math.pow(10, decimals);\n return Math.round(value * tenTo)
/ tenTo;\n}\n\n/**\n * @class Represents a given property of an object that is a number and\n * provides an input
element with which to manipulate it.\n *\n * @extends dat.controllers.Controller\n *\n * @extends
dat.controllers.NumberController\n *\n * @param {Object} object The object to be manipulated\n *\n * @param
{string} property The name of the property to be manipulated\n *\n * @param {Object} [params] Optional parameters\n
*\n * @param {Number} [params.min] Minimum allowed value\n *\n * @param {Number} [params.max] Maximum
allowed value\n *\n * @param {Number} [params.step] Increment by which to change value\n *\n\nclass
NumberControllerBox extends NumberController {\n constructor(object, property, params) {\n super(object,

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property, params);\n\n this.__truncationSuspended = false;\n\n
const _this = this;\n\n /**\n * {Number} Previous mouse y position\n * @ignore\n */\n let prevY;\n\n
function onChange() {\n const attempted = parseFloat(_this.__input.value);\n if (!common.isNaN(attempted))\n {\n _this.setValue(attempted);\n }\n}\n\n function onFinish() {\n if (_this.__onFinishChange) {\n _this.__onFinishChange.call(_this, _this.getValue());\n }\n}\n\n function onBlur() {\n onFinish();\n}\n\n
function onMouseDrag(e) {\n const diff = prevY - e.clientY;\n _this.setValue(_this.getValue() + diff *
__this.__impliedStep);\n\n prevY = e.clientY;\n}\n\n
function onMouseUp() {\n dom.unbind(window,
'mousemove', onMouseDrag);\n dom.unbind(window, 'mouseup', onMouseUp);\n onFinish();\n}\n\n
function onMouseDown(e) {\n dom.bind(window, 'mousemove', onMouseDrag);\n dom.bind(window,
'mouseup', onMouseUp);\n prevY = e.clientY;\n}\n\n
this.__input = document.createElement('input');\n this.__input.setAttribute('type', 'text');\n\n // Makes it so
manually specified values are not truncated.\n\n dom.bind(this.__input, 'change', onChange);\n\n
dom.bind(this.__input, 'blur', onBlur);\n dom.bind(this.__input, 'mousedown', onMouseDown);\n\n
dom.bind(this.__input, 'keydown', function(e) {\n // When pressing enter, you can be as precise as you want.\n
if (e.keyCode === 13) {\n _this.__truncationSuspended = true;\n this.blur();\n _this.__truncationSuspended = false;\n onFinish();\n }\n});\n\n this.updateDisplay();\n\n
this.domElement.appendChild(this.__input);\n}\n\n
updateDisplay() {\n this.__input.value =
this.__truncationSuspended ? this.getValue() : roundToDecimal(this.getValue(), this.__precision);\n return
super.updateDisplay();\n}\n}\n\n
export default NumberControllerBox;\n", "/*\n * dat-gui JavaScript Controller
Library\n * http://code.google.com/p/dat-gui\n
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2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a
copy of the License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n */\n\n
import NumberController from
'./NumberController';\nimport dom from './dom/dom';\n\n
function map(v, i1, i2, o1, o2) {\n return o1 + (o2 - o1) *
((v - i1) / (i2 - i1));\n}\n\n
/**\n * @class Represents a given property of an object that is a number, contains\n * a
minimum and maximum, and provides a slider element with which to\n * manipulate it. It should be noted that the
slider element is made up of\n * <code><div>></code> tags, not the html5\n *
<code><slider>></code> element.\n *\n * @extends dat.controllers.Controller\n *\n * @extends
dat.controllers.NumberController\n *\n * @param {Object} object The object to be manipulated\n *\n * @param
{string} property The name of the property to be manipulated\n *\n * @param {Number} min\nValue Minimum allowed
value\n *\n * @param {Number} max\nValue Maximum allowed value\n *\n * @param {Number} step\nValue Increment by
which to change value\n */\n
class NumberControllerSlider extends NumberController {\n constructor(object,
property, min, max, step) {\n super(object, property, { min: min, max: max, step: step });\n\n const _this =
this;\n\n this.__background = document.createElement('div');\n this.__foreground =
document.createElement('div');\n\n dom.bind(this.__background, 'mousedown', onMouseDown);\n\n
dom.bind(this.__background, 'touchstart', onTouchStart);\n\n dom.addClass(this.__background, 'slider');\n\n
dom.addClass(this.__foreground, 'slider-fg');\n\n function onMouseDown(e) {\n
document.activeElement.blur();\n\n dom.bind(window, 'mousemove', onMouseDrag);\n dom.bind(window,
'mouseup', onMouseUp);\n\n onMouseDrag(e);\n }\n\n function onMouseDrag(e)\n {\n e.preventDefault();\n\n const bgRect = _this.__background.getBoundingClientRect();\n\n
_this.setValue(\n map(e.clientX, bgRect.left, bgRect.right, _this.__min, _this.__max)\n);\n\n return
false;\n }\n\n function onMouseUp() {\n dom.unbind(window, 'mousemove', onMouseDrag);\n\n
dom.unbind(window, 'mouseup', onMouseUp);\n if (_this.__onFinishChange) {\n
_this.__onFinishChange.call(_this, _this.getValue());\n }\n }\n\n function onTouchStart(e) {\n if
(e.touches.length !== 1) { return; }\n\n dom.bind(window, 'touchmove', onTouchMove);\n dom.bind(window,
'touchend', onTouchEnd);\n\n onTouchMove(e);\n }\n\n function onTouchMove(e) {\n const clientX =
e.touches[0].clientX;\n const bgRect = _this.__background.getBoundingClientRect();\n\n _this.setValue(\n
map(clientX, bgRect.left, bgRect.right, _this.__min, _this.__max)\n);\n }\n\n function onTouchEnd() {\n

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 dom.unbind(window, 'touchmove', onTouchMove);\n dom.unbind(window, 'touchend', onTouchEnd);\n if
 (_this.__onFinishChange) {\n _this.__onFinishChange.call(_this, _this.getValue());\n }\n }\n\n this.updateDisplay();\n\n this.__background.appendChild(this.__foreground);\n\n this.domElement.appendChild(this.__background);\n }\n\n updateDisplay() {\n const pct = (this.getValue() -
 this.__min) / (this.__max - this.__min);\n this.__foreground.style.width = pct * 100 + '%';\n return
 super.updateDisplay();\n }\n}\n\nexport default NumberControllerSlider;\n", "/*\n * dat-gui JavaScript Controller
 Library\n * http://code.google.com/p/dat-gui/\n * Copyright 2011 Data Arts Team, Google Creative Lab\n * \n *
 Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in
 compliance with the License.\n * You may obtain a copy of the License at\n *\n *
 http://www.apache.org/licenses/LICENSE-2.0\n *\n\nimport Controller
 from './Controller';\nimport dom from './dom/dom';\n\n/**\n * @class Provides a GUI interface to fire a specified
 method, a property of an object.\n *\n * @extends dat.controllers.Controller\n *\n * @param {Object} object The
 object to be manipulated\n *\n * @param {string} property The name of the property to be manipulated\n *\n\nclass
 FunctionController extends Controller {\n constructor(object, property, text) {\n super(object, property);\n\n
 const _this = this;\n\n this.__button = document.createElement('div');\n this.__button.innerHTML = text ===
 undefined ? 'Fire' : text;\n\n dom.bind(this.__button, 'click', function(e) {\n e.preventDefault();\n
 _this.fire();\n return false;\n });\n\n dom.addClass(this.__button, 'button');\n\n
 this.domElement.appendChild(this.__button);\n }\n\n fire() {\n if (this.__onChange) {\n
 this.__onChange.call(this);\n }\n this.getValue().call(this.object);\n if (this.__onFinishChange) {\n
 this.__onFinishChange.call(this, this.getValue());\n }\n }\n}\n\nexport default FunctionController;\n", "/*\n *
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 Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use
 this file except in compliance with the License.\n * You may obtain a copy of the License at\n *\n *
 http://www.apache.org/licenses/LICENSE-2.0\n *\n\nimport Controller from './Controller';\nimport dom from
 './dom/dom';\nimport Color from './color/Color';\nimport interpret from './color/interpret';\nimport common from
 './utils/common';\n\n/**\n * @class Represents a given property of an object that is a color.\n *\n * @param {Object}
 object\n *\n * @param {string} property\n *\n\nclass ColorController extends Controller {\n constructor(object,
 property) {\n super(object, property);\n\n this.__color = new Color(this.getValue());\n this.__temp
 = new Color(0);\n\n const _this = this;\n\n this.domElement = document.createElement('div');\n\n
 dom.makeSelectable(this.domElement, false);\n\n this.__selector = document.createElement('div');\n\n
 this.__selector.className = 'selector';\n\n this.__saturation_field = document.createElement('div');\n\n
 this.__saturation_field.className = 'saturation-field';\n\n this.__field_knob = document.createElement('div');\n\n
 this.__field_knob.className = 'field-knob';\n this.__field_knob_border = '2px solid ';\n\n this.__hue_knob =
 document.createElement('div');\n this.__hue_knob.className = 'hue-knob';\n\n this.__hue_field =
 document.createElement('div');\n this.__hue_field.className = 'hue-field';\n\n this.__input =
 document.createElement('input');\n this.__input.type = 'text';\n this.__input_textShadow = '0 1px 1px ';\n\n
 dom.bind(this.__input, 'keydown', function(e) {\n if (e.keyCode === 13) { // on enter\n onBlur.call(this);\n
 }\n });\n\n dom.bind(this.__input, 'blur', onBlur);\n\n dom.bind(this.__selector, 'mousedown', function(/* e
 /) {\n dom\n .addClass(this, 'drag')\n .bind(window, 'mouseup', function(/ e */) {\n
 dom.removeClass(_this.__selector, 'drag');\n });\n });\n\n dom.bind(this.__selector, 'touchstart', function(/* e
 /) {\n dom\n .addClass(this, 'drag')\n .bind(window, 'touchend', function(/ e */) {\n
 dom.removeClass(_this.__selector, 'drag');\n });\n });\n\n const valueField =
 document.createElement('div');\n\n common.extend(this.__selector.style, {\n width: '122px',\n height:
 '102px',\n padding: '3px',\n backgroundColor: '#222',\n boxShadow: '0px 1px 3px rgba(0,0,0,0.3)'\n
 });\n\n common.extend(this.__field_knob.style, {\n position: 'absolute',\n width: '12px',\n height:
 '12px',\n border: this.__field_knob_border + (this.__color.v < 0.5 ? '#fff'
 : '#000'),\n boxShadow: '0px 1px 3px rgba(0,0,0,0.5)',\n borderRadius: '12px',\n zIndex: 1\n });\n\n
 common.extend(this.__hue_knob.style, {\n position: 'absolute',\n width: '15px',\n height: '2px',\n

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borderRight: '4px solid #fff',\n zIndex: 1\n });\n\n common.extend(this.__saturation_field.style, {\n width: '100px',\n height: '100px',\n border: '1px solid #555',\n marginRight: '3px',\n display: 'inline-block',\n cursor: 'pointer'\n });\n\n common.extend(valueField.style, {\n width: '100%',\n height: '100%',\n background: 'none'\n });\n\n linearGradient(valueField, 'top', 'rgba(0,0,0,0)', '#000');\n\n common.extend(this.__hue_field.style, {\n width: '15px',\n height: '100px',\n border: '1px solid #555',\n cursor: 'ns-resize',\n position: 'absolute',\n top: '3px',\n right: '3px'\n });\n\n hueGradient(this.__hue_field);\n\n common.extend(this.__input.style, {\n outline: 'none',\n width: '120px',\n textAlign: 'center',\n padding: '4px',\n marginBottom: '6px',\n color: '#fff',\n border: 0,\n fontWeight: 'bold',\n textShadow: this.__input_textShadow + 'rgba(0,0,0,0.7)'\n });\n\n dom.bind(this.__saturation_field, 'mousedown', fieldDown);\n dom.bind(this.__saturation_field, 'touchstart', fieldDown);\n dom.bind(this.__field_knob, 'mousedown', fieldDown);\n dom.bind(this.__field_knob, 'touchstart', fieldDown);\n dom.bind(this.__hue_field, 'mousedown', fieldDownH);\n dom.bind(this.__hue_field, 'touchstart', fieldDownH);\n\n function fieldDown(e) {\n setSV(e);\n dom.bind(window, 'mousemove', setSV);\n dom.bind(window, 'touchmove', setSV);\n dom.bind(window, 'mouseup', fieldUpSV);\n dom.bind(window, 'touchend', fieldUpSV);\n }\n\n function fieldDownH(e) {\n setH(e);\n dom.bind(window, 'mousemove', setH);\n dom.bind(window, 'touchmove', setH);\n dom.bind(window, 'mouseup', fieldUpH);\n dom.bind(window, 'touchend', fieldUpH);\n }\n\n function fieldUpSV() {\n dom.unbind(window, 'mousemove', setSV);\n dom.unbind(window, 'touchmove', setSV);\n dom.unbind(window, 'mouseup', fieldUpSV);\n dom.unbind(window, 'touchend', fieldUpSV);\n onFinish();\n }\n\n function fieldUpH() {\n dom.unbind(window, 'mousemove', setH);\n dom.unbind(window, 'touchmove', setH);\n dom.unbind(window, 'mouseup', fieldUpH);\n dom.unbind(window, 'touchend', fieldUpH);\n onFinish();\n }\n\n function onBlur() {\n const i = interpret(this.value);\n if (i !== false) {\n _this.__color.__state = i;\n _this.setValue(_this.__color.toOriginal());\n } else {\n this.value = _this.__color.toString();\n }\n }\n\n function onFinish() {\n if (_this.__onFinishChange) {\n _this.__onFinishChange.call(_this, _this.__color.toOriginal());\n }\n }\n\n this.__saturation_field.appendChild(valueField);\n this.__selector.appendChild(this.__field_knob);\n this.__selector.appendChild(this.__saturation_field);\n this.__selector.appendChild(this.__hue_field);\n this.__hue_field.appendChild(this.__hue_knob);\n\n this.domElement.appendChild(this.__input);\n this.domElement.appendChild(this.__selector);\n\n this.updateDisplay();\n\n function setSV(e) {\n if (e.type.indexOf('touch') === -1) { e.preventDefault(); }\n\n const fieldRect = _this.__saturation_field.getBoundingClientRect();\n const { clientX, clientY } = (e.touches && e.touches[0]) || e;\n let s = (clientX - fieldRect.left) / (fieldRect.right - fieldRect.left);\n let v = 1 - (clientY - fieldRect.top) / (fieldRect.bottom - fieldRect.top);\n\n if (v > 1) {\n v = 1;\n } else if (v < 0) {\n v = 0;\n }\n\n if (s > 1) {\n s = 1;\n } else if (s < 0) {\n s = 0;\n }\n\n _this.__color.v = v;\n _this.__color.s = s;\n\n _this.setValue(_this.__color.toOriginal());\n\n return false;\n }\n\n function setH(e) {\n if (e.type.indexOf('touch') === -1) { e.preventDefault(); }\n\n const fieldRect = _this.__hue_field.getBoundingClientRect();\n const { clientY } = (e.touches && e.touches[0]) || e;\n let h = 1 - (clientY - fieldRect.top) / (fieldRect.bottom - fieldRect.top);\n\n if (h > 1) {\n h = 1;\n } else if (h < 0) {\n h = 0;\n }\n\n _this.__color.h = h * 360;\n\n _this.setValue(_this.__color.toOriginal());\n\n return false;\n }\n\n updateDisplay() {\n const i = interpret(this.getValue());\n if (i !== false) {\n let mismatch = false;\n // Check for mismatch on the interpreted value.\n\n common.each(Color.COMPONENTS, function(component) {\n if (!common.isUndefined(i[component]) && !common.isUndefined(this.__color.__state[component]) && i[component] !== this.__color.__state[component]) {\n mismatch = true;\n return {};\n }\n }, this);\n // If nothing diverges, we keep our previous values\n // for statefulness, otherwise we recalculate fresh\n if (mismatch) {\n common.extend(this.__color.__state, i);\n }\n\n common.extend(this.__temp.__state, this.__color.__state);\n this.__temp.a = 1;\n const flip = (this.__color.v

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< 0.5 || this.__color.s > 0.5) ? 255 : 0;\n const _flip = 255 - flip;\n\n common.extend(this.__field_knob.style, {\n marginLeft: 100 * this.__color.s - 7 + 'px',\n marginTop: 100 * (1 - this.__color.v) - 7 + 'px',\n backgroundColor: this.__temp.toHexString(),\n border: this.__field_knob_border + 'rgb(' + flip + ',' + flip + ',' + flip + ')'\n });\n\n this.__hue_knob.style.marginTop = (1 - this.__color.h / 360) * 100 + 'px';\n\n this.__temp.s = 1;\n this.__temp.v = 1;\n\n linearGradient(this.__saturation_field, 'left', '#fff', this.__temp.toHexString());\n\n this.__input.value = this.__color.toString();\n\n common.extend(this.__input.style, {\n backgroundColor: this.__color.toHexString(),\n color: 'rgb(' + flip + ',' + flip + ',' + flip + ')',\n textShadow: this.__input_textShadow + 'rgba(' + _flip + ',' + _flip + ',' + _flip + ',.7)'\n });\n }\n\n const vendors = ['-moz-', '-o-', '-webkit-', '-ms-', ''];\n\n function linearGradient(elem, x, a, b) {\n elem.style.background = ";\n common.each(vendors, function(vendor) {\n elem.style.cssText += 'background: ' + vendor + 'linear-gradient(' + x + ', ' + a + ' 0%, ' + b + ' 100%);';\n });\n }\n\n function hueGradient(elem) {\n elem.style.background = ";\n elem.style.cssText += 'background: -moz-linear-gradient(top, #ff0000 0%, #ff00ff 17%, #0000ff 34%, #00ffff 50%, #00ff00 67%, #ffff00 84%, #ff0000 100%);';\n elem.style.cssText += 'background: -webkit-linear-gradient(top, #ff0000 0%, #ff00ff 17%, #0000ff 34%, #00ffff 50%, #00ff00 67%, #ffff00 84%, #ff0000 100%);';\n elem.style.cssText += 'background: -o-linear-gradient(top, #ff0000 0%, #ff00ff 17%, #0000ff 34%, #00ffff 50%, #00ff00 67%, #ffff00 84%, #ff0000 100%);';\n elem.style.cssText += 'background: -ms-linear-gradient(top, #ff0000 0%, #ff00ff 17%, #0000ff 34%, #00ffff 50%, #00ff00 67%, #ffff00 84%, #ff0000 100%);';\n elem.style.cssText += 'background: linear-gradient(top, #ff0000 0%, #ff00ff 17%, #0000ff 34%, #00ffff 50%, #00ff00 67%, #ffff00 84%, #ff0000 100%);';\n }\n\n export default ColorController;\n ", "/*\n * dat-gui JavaScript Controller Library\n * http://code.google.com/p/dat-gui\n * \n * Copyright 2011 Data Arts Team, Google Creative Lab\n * \n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n *\n */\n\nconst css = {\n load: function(url, indoc) {\n const doc = indoc || document;\n const link = doc.createElement('link');\n link.type = 'text/css';\n link.rel = 'stylesheet';\n link.href = url;\n doc.getElementsByTagName('head')[0].appendChild(link);\n },\n\n inject: function(cssContent, indoc) {\n const doc = indoc || document;\n const injected = document.createElement('style');\n injected.type = 'text/css';\n injected.innerHTML = cssContent;\n const head = doc.getElementsByTagName('head')[0];\n try {\n head.appendChild(injected);\n } catch (e) {\n // Unable to inject CSS, probably because of a Content Security Policy\n }\n }\n};\n\nexport default css;\n", "const saveDialogContent = `<div id=\"dg-save\" class=\"dg-dialogue\">\n\n Here's the new load parameter for your <code>GUI</code>'s constructor:\n\n <textarea id=\"dg-new-constructor\"></textarea>\n\n <div id=\"dg-save-locally\">\n\n <input id=\"dg-local-storage\" type=\"checkbox\"/> Automatically save\n values to <code>localStorage</code> on exit.\n\n <div id=\"dg-local-explain\">\n The values saved to <code>localStorage</code> will\n override those passed to\n <code>dat.GUI</code>'s constructor. This makes it\n easier to work incrementally, but\n <code>localStorage</code> is fragile,\n and your friends may not see the same values you do.\n\n </div>\n </div>\n`;\n\nexport default saveDialogContent;\n", "/*\n * dat-gui JavaScript Controller Library\n * http://code.google.com/p/dat-gui\n * \n * Copyright 2011 Data Arts Team, Google Creative Lab\n * \n * Licensed under the Apache License, Version 2.0 (the \"License\");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n *\n */\n\nimport OptionController from './OptionController';\nimport NumberControllerBox from './NumberControllerBox';\nimport NumberControllerSlider from './NumberControllerSlider';\nimport StringController from './StringController';\nimport FunctionController from './FunctionController';\nimport BooleanController from './BooleanController';\nimport common from './utils/common';\n\nconst ControllerFactory = function(object, property) {\n const initialValue = object[property];\n\n // Providing options?\n if (common.isArray(arguments[2]) || common.isObject(arguments[2])) {\n return new OptionController(object, property, arguments[2]);\n }\n\n // Providing a map?\n if (common.isNumber(initialValue)) {\n // Has min and max? (slider)\n if (common.isNumber(arguments[2]) &&

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common.isNumber(arguments[3])) {\n // has step?\n if (common.isNumber(arguments[4])) {\n return new
NumberControllerSlider(object, property,\n arguments[2], arguments[3], arguments[4]);\n }\n\n return new NumberControllerSlider(object, property, arguments[2], arguments[3]);\n }\n\n // number
box\n if (common.isNumber(arguments[4])) {\n // has step\n return new NumberControllerBox(object,
property,\n { min: arguments[2], max: arguments[3], step: arguments[4] });\n }\n return new
NumberControllerBox(object, property, { min: arguments[2], max: arguments[3] });\n }\n\n if
(common.isString(initialValue)) {\n return new StringController(object, property);\n }\n\n if
(common.isFunction(initialValue)) {\n return new FunctionController(object, property, "");\n }\n\n if
(common.isBoolean(initialValue)) {\n return new BooleanController(object, property);\n }\n\n return
null;\n};\n\nexport default ControllerFactory;\n", "/*\n * dat-gui JavaScript Controller Library\n *
http://code.google.com/p/dat-gui\n * Copyright 2011 Data Arts Team, Google Creative Lab\n * Licensed
under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the
License.\n * You may obtain a copy of the
License at\n * http://www.apache.org/licenses/LICENSE-2.0\n */\n\nfunction
requestAnimationFrame(callback) {\n setTimeout(callback, 1000 / 60);\n}\n\nexport default
window.requestAnimationFrame ||\n window.webkitRequestAnimationFrame ||\n window.mozRequestAnimationFrame ||\n window.oRequestAnimationFrame ||\n window.msRequestAnimationFrame ||\n requestAnimationFrame;\n", "/*\n * dat-gui JavaScript Controller
Library\n * http://code.google.com/p/dat-gui\n * Copyright 2011 Data Arts Team, Google Creative Lab\n * Licensed
under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in
compliance with the License.\n * You may obtain a copy of the License at\n *
http://www.apache.org/licenses/LICENSE-2.0\n */\n\nimport dom from '../dom/dom';\nimport common from
'../utils/common';\n\nclass CenteredDiv {\n constructor() {\n this.backgroundElement =
document.createElement('div');\n common.extend(this.backgroundElement.style,
{\n backgroundColor: 'rgba(0,0,0,0.8)',\n top: 0,\n left: 0,\n display: 'none',\n zIndex: '1000',\n opacity: 0,\n WebkitTransition: 'opacity 0.2s linear',\n transition: 'opacity 0.2s linear'\n });\n\n dom.makeFullscreen(this.backgroundElement);\n this.backgroundElement.style.position = 'fixed';\n\n this.domElement = document.createElement('div');\n common.extend(this.domElement.style, {\n position:
'fixed',\n display: 'none',\n zIndex: '1001',\n opacity: 0,\n WebkitTransition: '-webkit-transform 0.2s
ease-out, opacity 0.2s linear',\n transition: 'transform 0.2s ease-out, opacity 0.2s linear'\n });\n\n document.body.appendChild(this.backgroundElement);\n document.body.appendChild(this.domElement);\n\n const _this = this;\n dom.bind(this.backgroundElement, 'click', function() {\n _this.hide();\n });\n\n show() {\n const _this = this;\n\n this.backgroundElement.style.display
= 'block';\n\n this.domElement.style.display = 'block';\n this.domElement.style.opacity = 0;\n\n this.domElement.style.top = '52%';\n this.domElement.style.webkitTransform = 'scale(1.1)';\n\n this.layout();\n\n common.defer(function() {\n _this.backgroundElement.style.opacity = 1;\n _this.domElement.style.opacity =
1;\n _this.domElement.style.webkitTransform = 'scale(1)';\n });\n\n /**\n * Hide centered div\n */\n hide() {\n const _this = this;\n\n const hide = function() {\n _this.domElement.style.display = 'none';\n _this.backgroundElement.style.display = 'none';\n\n dom.unbind(_this.domElement, 'webkitTransitionEnd',
hide);\n dom.unbind(_this.domElement, 'transitionend', hide);\n dom.unbind(_this.domElement,
'oTransitionEnd', hide);\n }; \n\n dom.bind(this.domElement, 'webkitTransitionEnd', hide);\n dom.bind(this.domElement, 'transitionend', hide);\n dom.bind(this.domElement, 'oTransitionEnd',
hide);\n\n this.backgroundElement.style.opacity = 0;\n\n this.domElement.style.top = '48%';\n this.domElement.style.opacity = 0;\n this.domElement.style.webkitTransform = 'scale(1.1)';\n }\n\n layout() {\n this.domElement.style.left = window.innerWidth / 2 - dom.getWidth(this.domElement) / 2 + 'px';\n this.domElement.style.top = window.innerHeight / 2 - dom.getHeight(this.domElement) / 2 + 'px';\n }\n\n export
default CenteredDiv;\n", "/*\n * dat-gui JavaScript Controller Library\n * http://code.google.com/p/dat-gui\n *
Copyright 2011 Data Arts Team, Google Creative Lab\n * Licensed under the Apache License, Version 2.0 (the

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"License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the
License at\n *\n * http://www.apache.org/licenses/LICENSE-2.0\n *\n\nimport css from './utils/css';\nimport
saveDialogueContents from './saveDialogue.html';\nimport ControllerFactory from
'./controllers/ControllerFactory';\nimport
Controller from './controllers/Controller';\nimport BooleanController from
'./controllers/BooleanController';\nimport FunctionController from './controllers/FunctionController';\nimport
NumberControllerBox from './controllers/NumberControllerBox';\nimport NumberControllerSlider from
'./controllers/NumberControllerSlider';\nimport ColorController from './controllers/ColorController';\nimport
requestAnimationFrame from './utils/requestAnimationFrame';\nimport CenteredDiv from
'./dom/CenteredDiv';\nimport dom from './dom/dom';\nimport common from './utils/common';\n\nimport
styleSheet from './style.scss'; // CSS to embed in build\n\nncss.inject(styleSheet);\n\n/** @ignore Outer-most
className for GUI's *\n\nconst CSS_NAMESPACE = 'dg';\n\nconst HIDE_KEY_CODE = 72;\n\n/** @ignore The
only value shared between the JS and SCSS. Use caution. *\n\nconst CLOSE_BUTTON_HEIGHT = 20;\n\nconst
DEFAULT_DEFAULT_PRESET_NAME = 'Default';\n\nconst SUPPORTS_LOCAL_STORAGE =
(function() {\n try {\n return !!window.localStorage;\n } catch (e) {\n return false;\n }\n})();\n\nlet
SAVE_DIALOGUE;\n\n/** @ignore Have we yet to create an autoPlace GUI? *\n\nlet autoPlaceVirgin =
true;\n\n/** @ignore Fixed position div that auto place GUI's go inside *\n\nlet autoPlaceContainer;\n\n/** @ignore
Are we hiding the GUI's ? *\n\nlet hide = false;\n\n/** @private GUI's which should be hidden *\n\nconst
hideableGuis = [];\n\n/**\n * @class A lightweight controller library for JavaScript. It allows you to easily\n *
manipulate variables and fire functions on the fly.\n * \n * @typicalname gui\n * \n * @example\n * // Creating a
GUI with options.\n * var gui = new dat.GUI({ name: 'My GUI' });\n * \n * @example\n * // Creating a GUI and a
subfolder.\n * var gui = new dat.GUI();\n * var folder1 = gui.addFolder('Flow Field');\n * \n * @param {Object}
[params]\n * @param {String} [params.name] The name of this GUI.\n * @param {Object} [params.load] JSON
object representing the
saved state of\n * this GUI.\n * @param {dat.gui.GUI} [params.parent] The GUI I'm nested in.\n * @param
{Boolean} [params.autoPlace=true]\n * @param {Boolean} [params.hideable=true] If true, GUI is shown/hidden by
<kbd>h</kbd> keypress.\n * @param {Boolean} [params.closed=false] If true, starts closed\n * @param {Boolean}
[params.closeOnTop=false] If true, close/open button shows on top of the GUI\n * \n\nconst GUI = function(pars) {\n
const _this = this;\n\n let params = pars || {};\n\n /**\n * Outermost DOM Element\n * @type {DOMElement}\n
*\n * this.domElement = document.createElement('div');\n * this.__ul = document.createElement('ul');\n
this.domElement.appendChild(this.__ul);\n\n dom.addClass(this.domElement, CSS_NAMESPACE);\n\n /**\n *
Nested GUI's by name\n * @ignore\n * \n * this.__folders = {};\n\n this.__controllers = [];\n\n /**\n * List of
objects I'm remembering for save, only used in top level GUI\n * @ignore\n * \n * this.__rememberedObjects =
[];\n\n
/**\n * Maps the index of remembered objects to a map of controllers, only used\n * in top level GUI.\n * \n *
@private\n * @ignore\n * \n * @example\n * [\n * {\n * propertyName: Controller,\n *
anotherPropertyName: Controller\n * },\n * {\n * propertyName: Controller\n * }\n *]\n * \n * \n * \n *
this.__rememberedObjectIndecesToControllers = [];\n\n this.__listening = [];\n\n // Default parameters\n params =
common.defaults(params, {\n closeOnTop: false,\n autoPlace: true,\n width: GUI.DEFAULT_WIDTH\n
});\n\n params = common.defaults(params, {\n resizable: params.autoPlace,\n hideable: params.autoPlace\n
});\n\n if (!common.isUndefined(params.load)) {\n // Explicit preset\n if (params.preset) {\n
params.load.preset = params.preset;\n }\n } else {\n params.load = { preset:
DEFAULT_DEFAULT_PRESET_NAME };\n }\n\n if (common.isUndefined(params.parent) &&
params.hideable) {\n hideableGuis.push(this);\n
}\n\n // Only root level GUI's are resizable.\n params.resizable = common.isUndefined(params.parent) &&
params.resizable;\n\n if (params.autoPlace && common.isUndefined(params.scrollable)) {\n params.scrollable =
true;\n }\n\n // params.scrollable = common.isUndefined(params.parent) && params.scrollable === true;\n\n // Not
part of params because I don't want people passing this in via\n // constructor. Should be a 'remembered' value.\n

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let useLocalStorage =\n SUPPORTS_LOCAL_STORAGE &&\n
localStorage.getItem(getLocalStorageHash(this, 'isLocal')) === 'true';\n\n let saveToLocalStorage;\n let
titleRow;\n\n Object.defineProperties(this,\n /** @lends GUI.prototype */\n {\n /**\n * The parent
<code>GUI</code>\n * @type dat.gui.GUI\n */\n parent: {\n get: function() {\n return
params.parent;\n }\n },\n scrollable: {\n get: function() {\n return params.scrollable;\n }\n
 },\n /**\n * Handles <code>GUI</code>'s element placement for you\n * @type Boolean\n */\n autoPlace: {\n get: function() {\n return params.autoPlace;\n }\n },\n /**\n * Handles
<code>GUI</code>'s position of open/close button\n * @type Boolean\n */\n closeOnTop: {\n get:
function() {\n return params.closeOnTop;\n }\n },\n /**\n * The identifier for a set of saved
values\n * @type String\n */\n preset: {\n get: function() {\n if (_this.parent) {\n return
_this.getRoot().preset;\n }\n return params.load.preset;\n },\n set: function(v) {\n if
(_this.parent) {\n _this.getRoot().preset = v;\n } else {\n params.load.preset = v;\n }\n
 }\n },\n setPresetSelectIndex(this);\n _this.revert();\n },\n /**\n * The width of <code>GUI</code> element\n * @type Number\n */\n width: {\n get: function() {\n
 return params.width;\n },\n set: function(v) {\n params.width = v;\n setWidth(_this, v);\n
 }\n },\n /**\n * The name of <code>GUI</code>. Used for folders. i.e\n * a folder's name\n *
@type String\n */\n name: {\n get: function() {\n return params.name;\n },\n set:
function(v) {\n // TODO Check for collisions among sibling folders\n params.name = v;\n if
(titleRow) {\n titleRow.innerHTML = params.name;\n }\n },\n },\n /**\n * Whether the
<code>GUI</code> is collapsed or not\n * @type Boolean\n */\n closed: {\n get: function() {\n
 return params.closed;\n },\n set: function(v) {\n params.closed = v;\n if (params.closed)
{\n dom.addClass(_this.__ul, GUI.CLASS_CLOSED);\n } else {\n
 dom.removeClass(_this.__ul, GUI.CLASS_CLOSED);\n }\n },\n // For browsers that aren't going to respect
the CSS transition,\n // Lets just check our height against the window height right off\n // the bat.\n this.onResize();\n },\n if (_this.__closeButton) {\n _this.__closeButton.innerHTML = v ?
GUI.TEXT_OPEN : GUI.TEXT_CLOSED;\n }\n },\n /**\n * Contains all presets\n *
@type Object\n */\n load: {\n get: function() {\n return params.load;\n }\n },\n /**\n *
Determines whether or not to use localStorage as the means for\n *
<code>remember</code>ing\n * @type Boolean\n */\n useLocalStorage: {\n get: function() {\n
 return useLocalStorage;\n },\n set: function(bool) {\n if (SUPPORTS_LOCAL_STORAGE) {\n useLocalStorage =
bool;\n }\n if (bool) {\n dom.bind(window, 'unload', saveToLocalStorage);\n } else {\n
 dom.unbind(window, 'unload', saveToLocalStorage);\n }\n },\n },\n localStorage.setItem(getLocalStorageHash(_this, 'isLocal'), bool);\n },\n // Are we a
root level GUI?\n if (common.isUndefined(params.parent)) {\n this.closed = params.closed || false;\n dom.addClass(this.domElement, GUI.CLASS_MAIN);\n dom.makeSelectable(this.domElement, false);\n //
Are we supposed to be loading locally?\n if (SUPPORTS_LOCAL_STORAGE) {\n if (useLocalStorage) {\n
 _this.useLocalStorage = true;\n const savedGui = localStorage.getItem(getLocalStorageHash(this, 'gui'));\n if (savedGui) {\n params.load = JSON.parse(savedGui);\n }\n }\n this.__closeButton = document.createElement('div');\n this.__closeButton.innerHTML =
GUI.TEXT_CLOSED;\n dom.addClass(this.__closeButton, GUI.CLASS_CLOSE_BUTTON);\n if
(params.closeOnTop) {\n dom.addClass(this.__closeButton, GUI.CLASS_CLOSE_TOP);\n }\n this.domElement.insertBefore(this.__closeButton, this.domElement.childNodes[0]);\n } else {\n
 dom.addClass(this.__closeButton, GUI.CLASS_CLOSE_BOTTOM);\n }\n this.domElement.appendChild(this.__closeButton);\n dom.bind(this.__closeButton, 'click', function() {\n
 _this.closed = !_this.closed;\n });\n // Oh, you're a nested GUI!\n } else {\n if (params.closed === undefined)

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{\n params.closed = true;\n }\n\n const titleRowName = document.createTextNode(params.name);\n dom.addClass(titleRowName, 'controller-name');\n\n titleRow = addRow(_this, titleRowName);\n\n const\n onClickTitle = function(e) {\n e.preventDefault();\n _this.closed = !_this.closed;\n return\n false;\n };\n\n dom.addClass(this.__ul, GUI.CLASS_CLOSED);\n\n dom.addClass(titleRow, 'title');\n\n dom.bind(titleRow, 'click', onClickTitle);\n\n if (!params.closed) {\n this.closed = false;\n }\n\n if\n (params.autoPlace) {\n if (common.isUndefined(params.parent)) {\n if (autoPlaceVirgin) {\n autoPlaceContainer = document.createElement('div');\n dom.addClass(autoPlaceContainer,\n CSS_NAMESPACE);\n dom.addClass(autoPlaceContainer, GUI.CLASS_AUTO_PLACE_CONTAINER);\n document.body.appendChild(autoPlaceContainer);\n autoPlaceVirgin = false;\n }\n\n // Put it in the dom\n for you.\n autoPlaceContainer.appendChild(this.domElement);\n\n // Apply the auto styles\n dom.addClass(this.domElement, GUI.CLASS_AUTO_PLACE);\n }\n\n // Make it not elastic.\n if\n (!this.parent) {\n setWidth(_this, params.width);\n }\n }\n\n this.__resizeHandler = function() {\n _this.onResizeDebounced();\n };\n\n dom.bind(window, 'resize', this.__resizeHandler);\n dom.bind(this.__ul, 'webkitTransitionEnd',\n this.__resizeHandler);\n dom.bind(this.__ul, 'transitionend', this.__resizeHandler);\n dom.bind(this.__ul,\n 'oTransitionEnd', this.__resizeHandler);\n this.onResize();\n\n if (params.resizable) {\n addResizeHandle(this);\n }\n\n saveToLocalStorage = function() {\n if (SUPPORTS_LOCAL_STORAGE &&\n localStorage.getItem(getLocalStorageHash(_this, 'isLocal')) === 'true') {\n localStorage.setItem(getLocalStorageHash(_this, 'gui'), JSON.stringify(_this.getSaveObject()));\n }\n };\n\n //\n expose this method publicly\n this.saveToLocalStorageIfPossible = saveToLocalStorage;\n\n function resetWidth()\n {\n const root = _this.getRoot();\n root.width += 1;\n common.defer(function() {\n root.width -= 1;\n });\n }\n\n if (!params.parent) {\n resetWidth();\n }\n\n GUI.toggleHide = function() {\n hide = !hide;\n common.each(hideableGuis, function(gui)\n {\n gui.domElement.style.display = hide ? 'none' : '';\n });\n }\n\n GUI.CLASS_AUTO_PLACE =\n 'a';\n GUI.CLASS_AUTO_PLACE_CONTAINER = 'ac';\n GUI.CLASS_MAIN =\n 'main';\n GUI.CLASS_CONTROLLER_ROW = 'cr';\n GUI.CLASS_TOO_TALL = 'taller-than-\n window';\n GUI.CLASS_CLOSED = 'closed';\n GUI.CLASS_CLOSE_BUTTON = 'close-\n button';\n GUI.CLASS_CLOSE_TOP = 'close-top';\n GUI.CLASS_CLOSE_BOTTOM = 'close-\n bottom';\n GUI.CLASS_DRAG = 'drag';\n\n GUI.DEFAULT_WIDTH = 245;\n GUI.TEXT_CLOSED = 'Close\n Controls';\n GUI.TEXT_OPEN = 'Open Controls';\n\n GUI._keydownHandler = function(e) {\n if\n (document.activeElement.type !== 'text' &&\n (e.which === HIDE_KEY_CODE || e.keyCode ===\n HIDE_KEY_CODE)) {\n GUI.toggleHide();\n }\n };\n\n dom.bind(window, 'keydown', GUI._keydownHandler,\n false);\n\n common.extend(\n GUI.prototype,\n /** @lends GUI.prototype */\n {\n /**\n * Adds a new\n * {@link Controller} to the GUI. The type of controller created\n * is inferred from the initial value of\n <code>object[property]</code>.\n *\n For\n * color properties, see {@link addColor}.\n *\n * @param {Object} object The object to be\n manipulated\n * @param {String} property The name of the property to be manipulated\n * @param\n {Number} [min] Minimum allowed value\n * @param {Number} [max] Maximum allowed value\n * @param\n {Number} [step] Increment by which to change value\n * @returns {Controller} The controller that was added to\n the GUI.\n * @instance\n *\n * @example\n * // Add a string controller.\n * var person = { name:\n 'Sam'};\n * gui.add(person, 'name');\n *\n * @example\n * // Add a number controller slider.\n * var\n person = { age: 45};\n * gui.add(person, 'age', 0, 100);\n */\n add: function(object, property) {\n return\n add(\n this,\n object,\n property,\n {\n factoryArgs: Array.prototype.slice.call(arguments, 2)\n }\n);\n },\n /**\n * Adds a new color controller\n to the GUI.\n *\n * @param object\n * @param property\n * @returns {Controller} The controller that\n was added to the GUI.\n *\n * @instance\n *\n * @example\n * var palette = {\n * color1: '#FF0000', //\n CSS string\n * color2: [0, 128, 255], // RGB array\n * color3: [0, 128, 255, 0.3], // RGB with alpha\n * color4: { h: 350, s: 0.9, v: 0.3 } // Hue, saturation, value\n * };\n * gui.addColor(palette, 'color1');\n */

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gui.addColor(palette, 'color2');\n * gui.addColor(palette, 'color3');\n * gui.addColor(palette, 'color4');\n */\n addColor: function(object, property) {\n return add(\n this,\n object,\n property,\n {\n color: true\n }\n);\n },\n /**\n * Removes the given controller from the GUI.\n * @param {Controller} controller\n * @instance\n */\n remove: function(controller) {\n // TODO listening?\n this.__ul.removeChild(controller.__li);\n\n this.__controllers.splice(this.__controllers.indexOf(controller), 1);\n const _this = this;\n common.defer(function() {\n _this.onResize();\n });\n },\n /**\n * Removes the root GUI from the document and unbinds all event listeners.\n * For subfolders, use `gui.removeFolder(folder)` instead.\n * @instance\n */\n destroy: function() {\n if (this.parent) {\n throw new Error(\n 'Only the root GUI should be removed with .destroy(). '\n 'For subfolders, use gui.removeFolder(folder) instead.'\n);\n }\n if (this.autoPlace) {\n autoPlaceContainer.removeChild(this.domElement);\n }\n const _this = this;\n common.each(this.__folders, function(subfolder) {\n _this.removeFolder(subfolder);\n });\n dom.unbind(window, 'keydown', GUI._keydownHandler, false);\n removeListeners(this);\n },\n /**\n * Creates a new subfolder GUI instance.\n * @param name\n * @returns {dat.gui.GUI} The new folder.\n * @throws {Error} if this GUI already has a folder by the specified\n * name\n * @instance\n */\n addFolder: function(name) {\n // We have to prevent collisions on names in order to have a key\n // by which to remember saved values\n if (this.__folders[name] !== undefined) {\n throw new Error('You already have a folder in this GUI by the '\n 'name \'' + name + '\");\n }\n const newGuiParams = {\n name: name,\n parent: this\n };\n // We need to pass down the autoPlace trait so that we can\n // attach event listeners to open/close folder actions to\n // ensure that a scrollbar appears if the window is too short.\n newGuiParams.autoPlace = this.autoPlace;\n // Do we have saved appearance data for this folder?\n if (this.load && // Anything loaded?\n this.load.folders && // Was my parent a dead-end?\n this.load.folders[name]) {\n // Did daddy remember me?\n // Start me closed if I was closed\n newGuiParams.closed = this.load.folders[name].closed;\n // Pass down the loaded data\n newGuiParams.load = this.load.folders[name];\n }\n const gui = new GUI(newGuiParams);\n this.__folders[name] = gui;\n const li = addRow(this, gui.domElement);\n dom.addClass(li, 'folder');\n return gui;\n },\n /**\n * Removes a subfolder GUI instance.\n * @param {dat.gui.GUI} folder The folder to remove.\n * @instance\n */\n removeFolder: function(folder) {\n this.__ul.removeChild(folder.domElement.parentElement);\n delete this.__folders[folder.name];\n // Do we have saved appearance data for this folder?\n if (this.load && // Anything loaded?\n this.load.folders && // Was my parent a dead-end?\n this.load.folders[folder.name]) {\n delete this.load.folders[folder.name];\n }\n removeListeners(folder);\n const _this = this;\n common.each(folder.__folders, function(subfolder) {\n folder.removeFolder(subfolder);\n });\n common.defer(function() {\n _this.onResize();\n });\n },\n /**\n * Opens the GUI.\n */\n open: function() {\n this.closed = false;\n },\n /**\n * Closes the GUI.\n */\n close: function() {\n this.closed = true;\n },\n /**\n * Hides the GUI.\n */\n hide: function() {\n this.domElement.style.display = 'none';\n },\n /**\n * Shows the GUI.\n */\n show: function() {\n this.domElement.style.display = '';\n },\n onResize: function() {\n // we debounce this function to prevent performance issues when rotating on tablet/mobile\n const root = this.getRoot();\n if (root.scrollable) {\n const top = dom.getOffset(root.__ul).top;\n let h = 0;\n common.each(root.__ul.childNodes, function(node) {\n if (!root.autoPlace && node === root.__save_row)) {\n h += dom.getHeight(node);\n }\n });\n if (window.innerHeight - top - CLOSE_BUTTON_HEIGHT < h) {\n dom.addClass(root.domElement, GUI.CLASS_TOO_TALL);\n root.__ul.style.height = window.innerHeight - top - CLOSE_BUTTON_HEIGHT + 'px';\n } else {\n dom.removeClass(root.domElement, GUI.CLASS_TOO_TALL);\n root.__ul.style.height = 'auto';\n }\n if (root.__resize_handle) {\n common.defer(function() {\n root.__resize_handle.style.height = root.__ul.offsetHeight + 'px';\n });\n }\n if (root.__closeButton) {\n root.__closeButton.style.width

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= root.width + 'px';\n }\n },\n\n onResizeDebounce: common.debounce(function() { this.onResize(); },
50),\n\n /**\n * Mark objects for saving. The order of these objects cannot change as\n
 * the GUI grows. When remembering new objects, append them to the end\n
 * of the list.\n
 * @param {...Object} objects\n
 * @throws {Error} if not called on a top level GUI.\n
 * @instance\n
 * @ignore\n
 */\n remember: function() {\n if (common.isUndefined(SAVE_DIALOGUE)) {\n SAVE_DIALOGUE =
new CenteredDiv();\n SAVE_DIALOGUE.domElement.innerHTML = saveDialogueContents;\n }\n if
(this.parent) {\n throw new Error('You can only call remember on a top level GUI.);\n }\n const _this =
this;\n common.each(Array.prototype.slice.call(arguments), function(object) {\n if
(_this.__rememberedObjects.length === 0) {\n addSaveMenu(_this);\n }\n if
(_this.__rememberedObjects.indexOf(object) === -1) {\n _this.__rememberedObjects.push(object);\n }\n
 });\n if (this.autoPlace) {\n // Set save row width\n setWidth(this, this.width);\n }\n
 },\n\n /**\n * @returns {dat.gui.GUI} the topmost parent GUI of a nested GUI.\n
 * @instance\n
 */\n getRoot: function() {\n let gui = this;\n while (gui.parent) {\n gui = gui.parent;\n }\n return gui;\n
 },\n\n /**\n * @returns {Object} a JSON object representing the current state of\n
 * this GUI as well as its
remembered properties.\n
 * @instance\n
 */\n getSaveObject: function() {\n const toReturn = this.load;\n toReturn.closed = this.closed;\n // Am I remembering any values?\n if (this.__rememberedObjects.length >
0) {\n toReturn.preset = this.preset;\n if (!toReturn.remembered) {\n toReturn.remembered = {};\n
 }\n toReturn.remembered[this.preset] = getCurrentPreset(this);\n }\n toReturn.folders = {};\n common.each(this.__folders, function(element, key) {\n toReturn.folders[key] = element.getSaveObject();\n
 });\n return
toReturn;\n },\n\n save: function() {\n if (!this.load.remembered) {\n this.load.remembered = {};\n
 }\n this.load.remembered[this.preset] = getCurrentPreset(this);\n markPresetModified(this, false);\n this.saveToLocalStorageIfPossible();\n },\n\n saveAs: function(presetName) {\n if (!this.load.remembered)
{\n // Retain default values upon first save\n this.load.remembered = {};\n this.load.remembered[DEFAULT_DEFAULT_PRESET_NAME] = getCurrentPreset(this, true);\n }\n this.load.remembered[presetName] = getCurrentPreset(this);\n this.preset = presetName;\n addPresetOption(this, presetName, true);\n this.saveToLocalStorageIfPossible();\n },\n\n revert: function(gui)
{\n common.each(this.__controllers, function(controller) {\n // Make revert work on Default.\n if
(!this.getRoot().load.remembered) {\n controller.setValue(controller.initialValue);\n }\n } else {\n recallSavedValue(gui || this.getRoot(), controller);\n }\n // fire onFinishChange
callback\n if (controller.__onFinishChange) {\n controller.__onFinishChange.call(controller,
controller.getValue());\n }\n }, this);\n common.each(this.__folders, function(folder) {\n folder.revert(folder);\n });\n if (!gui) {\n markPresetModified(this.getRoot(), false);\n }\n },\n\n listen: function(controller) {\n const init = this.__listening.length === 0;\n this.__listening.push(controller);\n if (init) {\n updateDisplays(this.__listening);\n }\n },\n\n updateDisplay: function() {\n common.each(this.__controllers, function(controller) {\n controller.updateDisplay();\n });\n common.each(this.__folders, function(folder) {\n folder.updateDisplay();\n });\n }\n },\n\n /**\n * Add
a row to the end of the GUI or before another row.\n
 *\n
 * @param gui\n
 * @param [newDom] If specified, inserts the dom content in the new row\n
 * @param [liBefore] If specified, places the new row before another row\n
 * @ignore\n
 */\n function addRow(gui,
newDom, liBefore) {\n const li = document.createElement('li');\n if (newDom) {\n li.appendChild(newDom);\n
 }\n if (liBefore) {\n gui.__ul.insertBefore(li, liBefore);\n } else {\n gui.__ul.appendChild(li);\n }\n gui.onResize();\n return li;\n }\n\n function removeListeners(gui) {\n dom.unbind(window, 'resize',
gui.__resizeHandler);\n if (gui.saveToLocalStorageIfPossible) {\n dom.unbind(window, 'unload',
gui.saveToLocalStorageIfPossible);\n }\n }\n\n function markPresetModified(gui, modified) {\n const opt =
gui.__preset_select[gui.__preset_select.selectedIndex];\n if (modified) {\n opt.innerHTML = opt.value + '*';\n
 } else {\n opt.innerHTML = opt.value;\n }\n }\n\n function augmentController(gui, li, controller) {\n controller.__li = li;\n controller.__gui

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= gui;\n\n common.extend(controller, /** @lends Controller.prototype */ {\n /**\n * @param {Array|Object}
options\n * @return {Controller}\n */\n options: function(options) {\n if (arguments.length > 1) {\n
const nextSibling = controller.__li.nextElementSibling;\n controller.remove();\n\n return add(\n gui,\n controller.object,\n controller.property,\n {\n before: nextSibling,\n factoryArgs:
[common.toArray(arguments)]\n }\n);\n }\n\n if (common.isArray(options) ||
common.isObject(options)) {\n const nextSibling = controller.__li.nextElementSibling;\n
controller.remove();\n\n return add(\n gui,\n controller.object,\n controller.property,\n {\n before: nextSibling,\n factoryArgs: [options]\n }\n);\n }\n},\n\n /**\n * Sets the
name of the
controller.\n * @param {string} name\n * @return {Controller}\n */\n name: function(name) {\n
controller.__li.firstChild.firstChild.innerHTML = name;\n return controller;\n },\n\n /**\n * Sets controller to listen for changes on its underlying object.\n * @return {Controller}\n */\n listen:
function() {\n controller.__gui.listen(controller);\n return controller;\n },\n\n /**\n * Removes the
controller from its parent GUI.\n * @return {Controller}\n */\n remove: function() {\n
controller.__gui.remove(controller);\n return controller;\n }\n});\n\n // All sliders should be accompanied by a
box.\n if (controller instanceof NumberControllerSlider) {\n const box = new
NumberControllerBox(controller.object, controller.property,\n { min: controller.__min, max: controller.__max,
step: controller.__step });\n\n common.each(['updateDisplay', 'onChange', 'onFinishChange', 'step',
'min', 'max'], function(method) {\n const pc = controller[method];\n const pb = box[method];\n
controller[method] = box[method] = function() {\n const args = Array.prototype.slice.call(arguments);\n
pb.apply(box, args);\n return pc.apply(controller, args);\n };\n });\n\n dom.addClass(li, 'has-slider');\n
controller.domElement.insertBefore(box.domElement, controller.domElement.firstChild);\n } else if
(controller instanceof NumberControllerBox) {\n const r = function(returned) {\n // Have we defined both
boundaries?\n if (common.isNumber(controller.__min) && common.isNumber(controller.__max)) {\n //
Well, then lets just replace this with a slider.\n\n // lets remember if the old controller had a specific name or
was listening\n const oldName = controller.__li.firstChild.firstChild.innerHTML;\n const
wasListening = controller.__gui.__listening.indexOf(controller) > -1;\n\n controller.remove();\n const newController = add(\n gui,\n controller.object,\n
controller.property,\n {\n before: controller.__li.nextElementSibling,\n factoryArgs:
[controller.__min, controller.__max, controller.__step]\n }\n);\n\n newController.name(oldName);\n if
(wasListening) newController.listen();\n\n return newController;\n }\n\n return returned;\n };\n\n controller.min = common.compose(r, controller.min);\n controller.max = common.compose(r, controller.max);\n
} else if (controller instanceof BooleanController) {\n dom.bind(li, 'click', function() {\n
dom.fakeEvent(controller.__checkbox, 'click');\n });\n\n dom.bind(controller.__checkbox, 'click', function(e) {\n
e.stopPropagation(); // Prevents double-toggle\n });\n } else if (controller instanceof FunctionController) {\n
dom.bind(li, 'click', function() {\n dom.fakeEvent(controller.__button,
'click');\n });\n\n dom.bind(li, 'mouseover', function() {\n dom.addClass(controller.__button, 'hover');\n
 });\n\n dom.bind(li, 'mouseout', function() {\n dom.removeClass(controller.__button, 'hover');\n });\n } else
if (controller instanceof ColorController) {\n dom.addClass(li, 'color');\n controller.updateDisplay =
common.compose(function(val) {\n li.style.borderColor = controller.__color.toString();\n return val;\n
 }, controller.updateDisplay);\n\n controller.updateDisplay();\n }\n\n controller.setValue =
common.compose(function(val) {\n if (gui.getRoot().__preset_select && controller.isModified()) {\n
markPresetModified(gui.getRoot(), true);\n }\n\n return val;\n }, controller.setValue);\n\n\nfunction
recallSavedValue(gui, controller) {\n // Find the topmost GUI, that's where remembered objects live.\n const root =
gui.getRoot();\n\n // Does the object we're controlling match anything we've
been told to\n // remember?\n const matchedIndex = root.__rememberedObjects.indexOf(controller.object);\n\n //
Why yes, it does!\n if (matchedIndex !== -1) {\n // Let me fetch a map of controllers for th\n common.isObject.\n let controllerMap = root.__rememberedObjectIndicesToControllers[matchedIndex];\n\n // Ohp, I believe this is

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the first controller we've created for this\n // object. Lets make the map fresh.\n if (controllerMap ===
undefined) {\n controllerMap = {};\n root.__rememberedObjectIndecesToControllers[matchedIndex] =\n controllerMap;\n }\n\n // Keep track of this controller\n controllerMap[controller.property] = controller;\n\n // Okay, now have we saved any values for this controller?\n if (root.load && root.load.remembered) {\n const
presetMap = root.load.remembered;\n\n // Which preset are we trying to load?\n let preset;\n\n if
(presetMap[gui.preset]) {\n preset = presetMap[gui.preset];\n
} else if (presetMap[DEFAULT_DEFAULT_PRESET_NAME]) {\n // Uhh, you can have the default
instead?\n preset = presetMap[DEFAULT_DEFAULT_PRESET_NAME];\n } else {\n // Nada.\n
return;\n }\n\n // Did the loaded object remember thcommon.isObject? && Did we remember this particular
property?\n if (preset[matchedIndex] && preset[matchedIndex][controller.property] !== undefined) {\n //
We did remember something for this guy ...\n const value = preset[matchedIndex][controller.property];\n\n
// And that's what it is.\n controller.initialValue = value;\n controller.setValue(value);\n }\n }\n\n
}\n\nfunction add(gui, object, property, params) {\n if (object[property] === undefined) {\n throw new
Error('Object \''${object}\'' has no property \''${property}\'');\n }\n\n let controller;\n\n if (params.color) {\n
controller = new ColorController(object, property);\n } else {\n const factoryArgs = [object,
property].concat(params.factoryArgs);\n controller = ControllerFactory.apply(gui, factoryArgs);\n }\n\n if
(params.before instanceof Controller) {\n params.before = params.before.__li;\n }\n\n recallSavedValue(gui,
controller);\n\n dom.addClass(controller.domElement, 'c');\n\n const name = document.createElement('span');\n
dom.addClass(name, 'property-name');\n name.innerHTML = controller.property;\n\n const container =
document.createElement('div');\n container.appendChild(name);\n
container.appendChild(controller.domElement);\n\n const li = addRow(gui, container, params.before);\n\n
dom.addClass(li, GUI.CLASS_CONTROLLER_ROW);\n if (controller instanceof ColorController) {\n
dom.addClass(li, 'color');\n } else {\n dom.addClass(li, typeof controller.getValue());\n }\n\n
augmentController(gui, li, controller);\n\n gui.__controllers.push(controller);\n\n return controller;\n }\n\nfunction
getLocalStorageHash(gui, key) {\n // TODO how does this deal with
multiple GUI's?\n return document.location.href + '.' + key;\n }\n\nfunction addPresetOption(gui, name,
setSelected) {\n const opt = document.createElement('option');\n opt.innerHTML = name;\n opt.value = name;\n
gui.__preset_select.appendChild(opt);\n if (setSelected) {\n gui.__preset_select.selectedIndex =
gui.__preset_select.length - 1;\n }\n }\n\nfunction showHideExplain(gui, explain) {\n explain.style.display =
gui.useLocalStorage ? 'block' : 'none';\n }\n\nfunction addSaveMenu(gui) {\n const div = gui.__save_row =
document.createElement('li');\n\n dom.addClass(gui.domElement, 'has-save');\n\n gui.__ul.insertBefore(div,
gui.__ul.firstChild);\n\n dom.addClass(div, 'save-row');\n\n const gears = document.createElement('span');\n
gears.innerHTML = ' ';\n dom.addClass(gears, 'button gears');\n\n // TODO replace with
FunctionController\n const button = document.createElement('span');\n button.innerHTML = 'Save';\n
dom.addClass(button, 'button');\n dom.addClass(button,
'save');\n\n const button2 = document.createElement('span');\n button2.innerHTML = 'New';\n
dom.addClass(button2, 'button');\n dom.addClass(button2, 'save-as');\n\n const button3 =
document.createElement('span');\n button3.innerHTML = 'Revert';\n dom.addClass(button3, 'button');\n
dom.addClass(button3, 'revert');\n\n const select = gui.__preset_select = document.createElement('select');\n\n if
(gui.load && gui.load.remembered) {\n common.each(gui.load.remembered, function(value, key) {\n
addPresetOption(gui, key, key === gui.preset);\n });\n } else {\n addPresetOption(gui,
DEFAULT_DEFAULT_PRESET_NAME, false);\n }\n\n dom.bind(select, 'change', function() {\n for (let index
= 0; index < gui.__preset_select.length; index++) {\n gui.__preset_select[index].innerHTML =
gui.__preset_select[index].value;\n }\n\n gui.preset = this.value;\n });\n\n div.appendChild(select);\n
div.appendChild(gears);\n div.appendChild(button);\n div.appendChild(button2);\n
div.appendChild(button3);\n\n if (SUPPORTS_LOCAL_STORAGE) {\n const explain =
document.getElementById('dg-local-explain');\n const localStorageCheckBox = document.getElementById('dg-
local-storage');\n const saveLocally = document.getElementById('dg-save-locally');\n\n

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saveLocally.style.display = 'block';\n\n if (localStorage.getItem(getLocalStorageHash(gui, 'isLocal')) === 'true')
{\n localStorageCheckBox.setAttribute('checked', 'checked');\n }\n\n showHideExplain(gui, explain);\n\n //
TODO: Use a boolean controller, fool!\n dom.bind(localStorageCheckBox, 'change', function() {\n
gui.useLocalStorage = !gui.useLocalStorage;\n showHideExplain(gui, explain);\n });\n }\n\n const
newConstructorTextArea = document.getElementById('dg-new-constructor');\n\n
dom.bind(newConstructorTextArea, 'keydown', function(e) {\n if (e.metaKey && (e.which === 67 || e.keyCode
=== 67)) {\n SAVE_DIALOGUE.hide();\n }\n });\n\n dom.bind(gears,
'click', function() {\n newConstructorTextArea.innerHTML = JSON.stringify(gui.getSaveObject(), undefined,
2);\n SAVE_DIALOGUE.show();\n newConstructorTextArea.focus();\n newConstructorTextArea.select();\n
});\n\n dom.bind(button, 'click', function() {\n gui.save();\n });\n\n dom.bind(button2, 'click', function() {\n
const presetName = prompt('Enter a new preset name.);\n if (presetName) {\n gui.saveAs(presetName);\n }\n
});\n\n dom.bind(button3, 'click', function() {\n gui.revert();\n });\n\n //
div.appendChild(button2);\n\n\nfunction addResizeHandle(gui) {\n let pmouseX;\n\n gui.__resize_handle =
document.createElement('div');\n\n common.extend(gui.__resize_handle.style, {\n\n width: '6px',\n marginLeft:
'-3px',\n height: '200px',\n cursor: 'ew-resize',\n position: 'absolute'\n // border: '1px solid blue'\n\n });\n\n
function drag(e) {\n e.preventDefault();\n\n gui.width += pmouseX - e.clientX;\n gui.onResize();\n
 pmouseX = e.clientX;\n return false;\n }\n\n function dragStop() {\n dom.removeClass(gui.__closeButton,
GUI.CLASS_DRAG);\n dom.unbind(window, 'mousemove', drag);\n dom.unbind(window, 'mouseup',
dragStop);\n }\n\n function dragStart(e) {\n e.preventDefault();\n pmouseX = e.clientX;\n\n
dom.addClass(gui.__closeButton, GUI.CLASS_DRAG);\n dom.bind(window, 'mousemove', drag);\n
dom.bind(window, 'mouseup', dragStop);\n\n return false;\n }\n\n dom.bind(gui.__resize_handle, 'mousedown',
dragStart);\n dom.bind(gui.__closeButton, 'mousedown', dragStart);\n\n
gui.domElement.insertBefore(gui.__resize_handle, gui.domElement.firstChild);\n\n\nfunction
setWidth(gui, w) {\n gui.domElement.style.width = w + 'px';\n // Auto placed save-rows are position fixed, so we
have to\n // set the width manually if we want it to bleed to the edge\n if (gui.__save_row && gui.autoPlace) {\n
gui.__save_row.style.width = w + 'px';\n }\n if (gui.__closeButton)
{\n gui.__closeButton.style.width = w + 'px';\n }\n\n\nfunction getCurrentPreset(gui, useInitialValues) {\n
const toReturn = {};\n\n // For each object I'm remembering\n common.each(gui.__rememberedObjects,
function(val, index) {\n const savedValues = {};\n\n // The controllers I've made for thcommon.isObject by
property\n const controllerMap =\n gui.__rememberedObjectIndecesToControllers[index];\n\n // Remember
each value for each property\n common.each(controllerMap, function(controller, property) {\n
savedValues[property] = useInitialValues ? controller.initialValue : controller.getValue();\n });\n\n // Save the
values for thcommon.isObject\n toReturn[index] = savedValues;\n });\n\n return toReturn;\n\n\nfunction
setPresetSelectIndex(gui) {\n for (let index = 0; index < gui.__preset_select.length; index++) {\n if
(gui.__preset_select[index].value === gui.preset) {\n gui.__preset_select.selectedIndex = index;\n
 }\n }\n\n\nfunction updateDisplays(controllerArray) {\n if (controllerArray.length !== 0) {\n
requestAnimationFrame.call(window, function() {\n updateDisplays(controllerArray);\n });\n }\n\n
common.each(controllerArray, function(c) {\n c.updateDisplay();\n });\n }\n\n\nexport default GUI;\n", "// stats.js -
http://github.com/mrdoob/stats.js\n(function(f,e){\n"object"===typeof exports&&"undefined"!=="typeof
module?module.exports=e):\"function\"===typeof define&&define.amd?define(e):f.Stats=e)})(this,function(){var
f=function(){function e(a){c.appendChild(a.dom);return a}function u(a){for(var
d=0;d<c.children.length;d++)c.children[d].style.display=d===a?"block":"none";l=a}var
l=0,c=document.createElement(\"div\");c.style.cssText=\"position:fixed;top:0;left:0;cursor:pointer;opacity:0.9;z-
index:10000\";c.addEventListener(\"click\",function(a){a.preventDefault();\nu(++l%c.children.length)},!1);var
k=(performance||Date).now(),g=k,a=0,r=e(new f.Panel(\"FPS\",\"#0ff\", \"#002\")),h=e(new
f.Panel(\"MS\", \"#0f0\", \"#020\"));if(self.performance&&self.performance.memory)var t=e(new
f.Panel(\"MB\", \"#f08\", \"#201\"));u(0);return{ REVISION:16,dom:c,addPanel:e,showPanel:u,begin:function(){k=(p
erformance||Date).now(),end:function(){a++;var c=(performance||Date).now();h.update(c-

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k,200);if(c>g+1E3&&(r.update(1E3*a/(c-g),100),g=c,a=0,t)){var
d=performance.memory;t.update(d.usedJSHeapSize/\n1048576,d.jsHeapSizeLimit/1048576)}return
c},update:function(){k=this.end(),domElement:c,setName:u}};f.Panel=function(e,f,l){var
c=Infinity,k=0,g=Math.round,a=g(window.devicePixelRatio||1),r=80*a,h=48*a,t=3*a,v=2*a,d=3*a,m=15*a,n=74*a
,p=30*a,q=document.createElement("\ canvas");q.width=r;q.height=h;q.style.cssText="\ width:80px;height:48px";v
ar b=q.getContext("\ 2d");b.font="\ bold \"+9*a+"\ px Helvetica,Arial,sans-
serif";b.textBaseline="\ top";b.fillStyle=l;b.fillRect(0,0,r,h);b.fillStyle=f;b.fillText(e,t,v);\nb.fillRect(d,m,n,p);b.fill
Style=l;b.globalAlpha=.9;b.fillRect(d,m,n,p);return{dom:q,update:function(h,w){c=Math.min(c,h);k=Math.max(k,h
);b.fillStyle=l;b.globalAlpha=1;b.fillRect(0,0,r,m);b.fillStyle=f;b.fillText(g(h)+"
\ "+e+"\ (\ "+g(c)+" \ "+g(k)+" \")",t,v);b.drawImage(q,d+a,m,n-a,p,d,m,n-a,p);b.fillRect(d+n-
a,m,a,p);b.fillStyle=l;b.globalAlpha=.9;b.fillRect(d+n-a,m,a,g((1-h/w)*p))}};return f}};\n", "/*\n * @license\n
* Copyright 2019 Google LLC. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the
\ 'License');\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of
the License at\n * \n * http://www.apache.org/licenses/LICENSE-2.0\n * \n * Unless required by applicable
law or agreed to in writing, software\n * distributed under the License is distributed on an \ 'AS IS' BASIS,\n *
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License
for the specific language governing permissions and\n * limitations under
the License.\n *
===== \n
*/\nimport*as tf from'\ @tensorflow/tfjs-
core';import{util,tidy,div,sub,buffer,Tensor,browser,pad3d,scalar,concat,tensor2d,tensor}from'\ @tensorflow/tfjs-
core';import{loadGraphModel}from'\ @tensorflow/tfjs-converter';var
VALID_OUTPUT_STRIDES=[8,16,32];function assertValidOutputStride(e){util.assert("\ number"==typeof
e,function(){return"\ outputStride is not a
number"}),util.assert(VALID_OUTPUT_STRIDES.indexOf(e)>=0,function(){return"\ outputStride of \ "+e+" is
invalid. It must be either 8, 16, or 32"}))function assertValidResolution(e,t){util.assert("\ number"==typeof
e,function(){return"\ resolution is not a number"}),util.assert((e-1)%t==0,function(){return"\ resolution of \ "+e+" is
invalid for output stride \ "+t+"\ ."}))function toFloatIfInt(e){return
tidy(function(){return"\ int32"===e.dtype&&(e=e.toFloat()),e=div(e,127.5),sub(e,1))}var
MobileNet=function(){function e(e,t){this.model=e;var
r=this.model.inputs[0].shape;util.assert(-1===r[1]&&-1===r[2],function(){return"\ Input shape [\ "+r[1]+\ ",
\ "+r[2]+\ "] must both be -1"}),this.outputStride=t}return e.prototype.predict=function(e){var t=this;return
tidy(function(){var
r=toFloatIfInt(e).expandDims(0),n=t.model.predict(r),o=n[0],i=n[1],s=n[2],a=n[3];return{heatmapScores:i.squeeze(
).sigmoid(),offsets:o.squeeze(),displacementFwd:s.squeeze(),displacementBwd:a.squeeze()}}),e.prototype.dispose
=function(){this.model.dispose(),e();function half(e){return Math.floor(e/2)}var MaxHeap=function(){function
e(e,t){this.priorityQueue=new Array(e),this.numberOfElements=-1,this.getElementValue=t}return
e.prototype.enqueue=function(e){this.priorityQueue[++this.numberOfElements]=e,this.swim(this.numberOfElemen
ts)},e.prototype.dequeue=function(){var e=this.priorityQueue[0];return this.exchange(0,this.numberOfElements--
),this.sink(0),this.priorityQueue[this.numberOfElements+1]=null,e},e.prototype.empty=function(){return-
1===this.numberOfElements},e.prototype.size=function(){return
this.numberOfElements+1},e.prototype.all=function(){return
this.priorityQueue.slice(0,this.numberOfElements+1)},e.prototype.max=function(){return
this.priorityQueue[0]},e.prototype.swim=function(e){for(;e>0&&this.less(half(e),e);)this.exchange(e,half(e)),e=half
(e)},e.prototype.sink=function(e){for(;2*e<=this.numberOfElements;){var
t=2*e;if(t<this.numberOfElements&&this.less(t,t+1)&&t++,!this.less(e,t))break;this.exchange(e,t),e=t}},e.prototype
.getValueAt=function(e){return this.getElementValue(this.priorityQueue[e])},e.prototype.less=function(e,t){return
this.getValueAt(e)<this.getValueAt(t)},e.prototype.exchange=function(e,t){var

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r=this.priorityQueue[e];this.priorityQueue[e]=this.priorityQueue[t],this.priorityQueue[t]=r,e})();function
scoreIsMaximumInLocalWindow(e,t,r,n,o,i){for(var s=i.shape,a=s[0],u=s[1],l=!0,f=Math.max(r-
o,0),c=Math.min(r+o+1,a),d=f;d<c;++d){for(var p=Math.max(n-
o,0),h=Math.min(n+o+1,u),m=p;m<h;++m){if(i.get(d,m,e)>t){l=!1;break}if(!l)break}return
1}function buildPartWithScoreQueue(e,t,r){for(var n=r.shape,o=n[0],i=n[1],s=n[2],a=new
MaxHeap(o*i*s,function(e){return e.score}),u=0;u<o;++u)for(var l=0;l<i;++l)for(var f=0;f<s;++f){var
c=r.get(u,l,f);c<e||scoreIsMaximumInLocalWindow(f,c,u,l,t,r)&&a.enqueue({score:c,part:{heatmapY:u,heatmapX:l,
id:f}})}return a}var
partNames=["nose","leftEye","rightEye","leftEar","rightEar","leftShoulder","rightShoulder","leftElbow",
"rightElbow","leftWrist","rightWrist","leftHip","rightHip","leftKnee","rightKnee","leftAnkle","rightAn
kle"],NUM_KEYPOINTS=partNames.length,partIds=partNames.reduce(function(e,t,r){return
e[t]=r,e},{}),connectedPartNames=[["leftHip","leftShoulder"],["leftElbow","leftShoulder"],["leftElbow","lef
tWrist"],["leftHip","leftKnee"],["leftKnee","leftAnkle"],["rightHip","rightShoulder"],["rightElbow","righ
tShoulder"],["rightElbow","rightWrist"],["rightHip","rightKnee"],["rightKnee","rightAnkle"],["leftShould
er","rightShoulder"],["leftHip","rightHip"]],poseChain=[["nose","leftEye"],["leftEye","leftEar"],["nose",
"rightEye"],["rightEye","rightEar"],["nose","leftShoulder"],["leftShoulder","leftElbow"],["leftElbow","l
eftWrist"],["leftShoulder","leftHip"],["leftHip","leftKnee"],["leftKnee","leftAnkle"],["nose","rightShould
er"],["rightShoulder","rightElbow"],["rightElbow","rightWrist"],["rightShoulder","rightHip"],["rightHip",
"rightKnee"],["rightKnee","rightAnkle"]],connectedPartIndices=connectedPartNames.map(function(e){var
t=e[0],r=e[1];return[partIds[t],partIds[r]]}),partChannels=["left_face","right_face","right_upper_leg_front","rig
ht_lower_leg_back","right_upper_leg_back","left_lower_leg_front","left_upper_leg_front","left_upper_leg_ba
ck","left_lower_leg_back","right_feet","right_lower_leg_front","left_feet","torso_front","torso_back","rig
ht_upper_arm_front","right_upper_arm_back","right_lower_arm_back","left_lower_arm_front","left_upper_ar
m_front","left_upper_arm_back","left_lower_arm_back","right_hand","right_lower_arm_front","left_hand"]
;function
getOffsetPoint(e,t,r,n){return{y:n.get(e,t,r),x:n.get(e,t,r+NUM_KEYPOINTS)}}function getImageCoords(e,t,r){var
n=getOffsetPoint(e.heatmapY,e.heatmapX,e.id,r),o=n.y,i=n.x;return{x:e.heatmapX*t+i,y:e.heatmapY*t+o}}functio
n clamp(e,t,r){return e<t?t:e>r?r:e}function squaredDistance(e,t,r,n){var o=r-e,i=n-t;return o*o+i*i}function
addVectors(e,t){return{x:e.x+t.x,y:e.y+t.y}}var parentChildrenTuples=poseChain.map(function(e){var
t=e[0],r=e[1];return[partIds[t],partIds[r]]}),parentToChildEdges=parentChildrenTuples.map(function(e){return
e[1]}),childToParentEdges=parentChildrenTuples.map(function(e){return e[0]});function
getDisplacement(e,t,r){var n=r.shape[2]/2;return{y:r.get(t.y,t.x,e),x:r.get(t.y,t.x,n+e)}}function
getStridedIndexNearPoint(e,t,r,n){return{y:clamp(Math.round(e.y/t),0,r-1),x:clamp(Math.round(e.x/t),0,n-
1)}}function
traverseToTargetKeypoint(e,t,r,n,o,i,s,a){void 0===a&&(a=2);for(var
u=n.shape,l=u[0],f=u[1],c=getDisplacement(e,getStridedIndexNearPoint(t.position,i,l,f),s),d=addVectors(t.position,c
),p=0;p<a;p++){var
h=getStridedIndexNearPoint(d,i,l,f),m=getOffsetPoint(h.y,h.x,r,o);d=addVectors({x:h.x*i,y:h.y*i},{x:m.x,y:m.y})
var g=getStridedIndexNearPoint(d,i,l,f),_=n.get(g.y,g.x,r);return{position:d,part:partNames[r],score:_}}function
decodePose(e,t,r,n,o,i){var s=t.shape[2],a=parentToChildEdges.length,u=new
Array(s),l=e.part,f=e.score,c=getImageCoords(l,n,r);u[l.id]={score:f,part:partNames[l.id],position:c};for(var d=a-
1;d>=0;--d){var
p=parentToChildEdges[d],h=childToParentEdges[d];u[p]&&!u[h]&&(u[h]=traverseToTargetKeypoint(d,u[p],h,t,r,n
,i))for(d=0;d<a;++d){p=childToParentEdges[d],h=parentToChildEdges[d];u[p]&&!u[h]&&(u[h]=traverseToTarge
tKeypoint(d,u[p],h,t,r,n,o))}return u}function withinNmsRadiusOfCorrespondingPoint(e,t,r,n){var o=r.x,i=r.y;return
e.some(function(e){var r=e.keypoints[n].position;return squaredDistance(i,o,r.y,r.x)<=t})}function
getInstanceScore(e,t,r){return r.reduce(function(r,n,o){var i=n.position,s=n.score;return
withinNmsRadiusOfCorrespondingPoint(e,t,i,o)||r},0)/r.length}var kLocalMaximumRadius=1;function

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decodeMultiplePoses(e,t,r,n,o,i,s,a){ void 0===s&&(s=.5),void 0===a&&(a=20);for(var
u=[],l=buildPartWithScoreQueue(s,kLocalMaximumRadius,e),f=a*a;u.length<i&&!l.empty();){ var
c=l.dequeue();if(!withinNmsRadiusOfCorrespondingPoint(u,f.getImageCoords(c.part,o,t),c.part.id)){ var
d=decodePose(c,e,t,o,r,n),p=getInstanceScore(u,f,d);u.push({ keypoints:d,score:p})} }return u}var
__assign=function(){return(__assign=Object.assign||function(e){ for(var t,r=1,n=arguments.length;r<n;r++)for(var o
in t=arguments[r])Object.prototype.hasOwnProperty.call(t,o)&&(e[o]=t[o]);return
e}).apply(this,arguments)};function __awaiter(e,t,r,n){return new(r||(r=Promise))(function(o,i){function
s(e){try{u(n.next(e))}catch(e){i(e)}}function
a(e){try{u(n.throw(e))}catch(e){i(e)}}function u(e){e.done?o(e.value):new
r(function(t){t(e.value)}).then(s,a)}u((n=n.apply(e,t||[])).next())})}function __generator(e,t){ var
r,n,o,i,s={ label:0,sent:function(){if(1&o[0])throw o[1];return o[1]},trys:[],ops:[];return
i={ next:a(0),throw:a(1),return:a(2)},\"function\"==typeof Symbol&&(i[Symbol.iterator]=function(){ return
this}),i;function a(i){return function(a){return function(i){if(r)throw new TypeError(\"Generator is already
executing.\");for(;s);try{if(r=1,n&&(o=2&i[0]?n.return:i[0]?n.throw||((o=n.return)&&o.call(n),0):n.next)&&!(o=o.c
all(n,i[1])).done)return o;switch(n=0,o&&(i=[2&i[0],o.value]),i[0]){ case 0:case 1:o=i;break;case 4:return
s.label++,{ value:i[1],done:!1 };case 5:s.label++,n=i[1],i=[0];continue;case
7:i=s.ops.pop(),s.trys.pop();continue;default:if(!(o=(o=s.trys).length>0&&o[o.length-
1])&&(6===i[0][2]===i[0])){ s=0;continue;if(3===i[0]&&(!o||i[1]>o[0]&&i[1]<o[3])){ s.label=i[1];break }if(6===i[
0]&&s.label<o[1]){ s.label=o[1],o=i;break }if(o&&s.label<o[2]){ s.label=o[2],s.ops.push(i);break }o[2]&&s.ops.pop(
),s.trys.pop();continue }i=t.call(e,s)}catch(e){i=[6,e],n=0}finally{r=o=0}if(5&i[0])throw
i[1];return{ value:i[0]?i[1]:void 0,done:!0 }}([i,a])}}function eitherPointDoesntMeetConfidence(e,t,r){ return
e<r||t<r}function getAdjacentKeyPoints(e,t){return connectedPartIndices.reduce(function(r,n){ var
o=n[0],i=n[1];return eitherPointDoesntMeetConfidence(e[o].score,e[i].score,t)?r:(r.push([e[o],e[i]]),r),[])}var
NEGATIVE_INFINITY=Number.NEGATIVE_INFINITY,POSITIVE_INFINITY=Number.POSITIVE_INFINITY
;function getBoundingBox(e){return e.reduce(function(e,t){ var
r=e.maxX,n=e.maxY,o=e.minX,i=e.minY,s=t.position,a=s.x,u=s.y;return {maxX:Math.max(r,a),maxY:Math.max(n,
u),minX:Math.min(o,a),minY:Math.min(i,u)},},{maxX:NEGATIVE_INFINITY,maxY:NEGATIVE_INFINITY,min
X:POSITIVE_INFINITY,minY:POSITIVE_INFINITY})}function getBoundingBoxPoints(e){ var
t=getBoundingBox(e),r=t.minX,n=t.minY,o=t.maxX,i=t.maxY;return[{ x:r,y:n},{ x:o,y:n},{ x:o,y:i},{ x:r,y:i}] }functi
on
toTensorBuffer(e,t){return void 0===t&&(t=\"float32\"),__awaiter(this,void 0,void 0,function(){ var r;return
__generator(this,function(n){ switch(n.label){ case 0:return[4,e.data()];case 1:return
r=n.sent(),[2,buffer(e.shape,t,r)]})})}function toTensorBuffers3D(e){return __awaiter(this,void 0,void
0,function(){ return __generator(this,function(t){return[2,Promise.all(e.map(function(e){ return
toTensorBuffer(e,\"float32\")})])})})}function scalePose(e,t,r,n,o){return void 0===n&&(n=0),void
0===o&&(o=0),{ score:e.score,keypoints:e.keypoints.map(function(e){ var
i=e.score,s=e.part,a=e.position;return{ score:i,part:s,position:{ x:a.x*r+o,y:a.y*t+n }}})} }function
scalePoses(e,t,r,n,o){return void 0===n&&(n=0),void
0===o&&(o=0),1===r&&1===t&&0===n&&0===o?e:e.map(function(e){return scalePose(e,t,r,n,o)})}function
flipPoseHorizontal(e,t){return {score:e.score,keypoints:e.keypoints.map(function(e){ var
r=e.score,n=e.part,o=e.position;return{ score:r,part:n,position:{ x:t-1-o.x,y:o.y }}})} }function
flipPosesHorizontal(e,t){return t<=0?e:e.map(function(e){return flipPoseHorizontal(e,t)})}function
getInputTensorDimensions(e){return e instanceof Tensor?[e.shape[0],e.shape[1]]:[e.height,e.width]}function
toInputTensor(e){return e instanceof Tensor?e:browser.fromPixels(e)}function padAndResizeTo(e,t){ var
r=t[0],n=t[1],o=getInputTensorDimensions(e),i=o[0],s=o[1],a=n/r,u=[0,0,0,0],l=u[0],f=u[1],c=u[2],d=u[3];return
s/i<a?(l=0,f=0,c=Math.round(.5*(a*i-s)),d=Math.round(.5*(a*i-s)):(l=Math.round(.5*(1/a*s-
i)),f=Math.round(.5*(1/a*s-i)),c=0,d=0),{ resized:tidy(function(){ var
t=toInputTensor(e);return(t=pad3d(t,[l,f],[c,d],[0,0])).resizeBilinear([r,n])),padding:{ top:l,left:c,right:d,bottom:f}

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 } } function scaleAndFlipPoses(e,t,r,n,o){ var
i=t[0],s=t[1],a=r[0],u=r[1],l=scalePoses(e,(i+n.top+n.bottom)/a,(s+n.left+n.right)/u,-n.top,-n.left);return
o?flipPosesHorizontal(l,s):l}function mod(e,t){return tidy(function(){var r=e.div(scalar(t,"int32"));return
e.sub(r.mul(scalar(t,"int32"))))})}function
argmax2d(e){var t=e.shape,r=t[0],n=t[1],o=t[2];return tidy(function(){var
t=e.reshape([r*n,o]).argMax(0),i=t.div(scalar(n,"int32")).expandDims(1),s=mod(t,n).expandDims(1);return
concat([i,s],1)})}function getPointsConfidence(e,t){for(var r=t.shape[0],n=new Float32Array(r),o=0;o<r;o++){var
i=t.get(o,0),s=t.get(o,1);n[o]=e.get(i,s,o)}return n}function
getOffsetPoint$1(e,t,r,n){return {y:n.get(e,t,r),x:n.get(e,t+r+NUM_KEYPOINTS)}}function
getOffsetVectors(e,t){for(var r=[],n=0;n<NUM_KEYPOINTS;n++){var
o=getOffsetPoint$1(e.get(n,0).valueOf(),e.get(n,1).valueOf(),n,t),i=o.x,s=o.y;r.push(s),r.push(i)}return
tensor2d(r,[NUM_KEYPOINTS,2])}function getOffsetPoints(e,t,r){return tidy(function(){var
n=getOffsetVectors(e,r);return e.toTensor().mul(scalar(t,"int32")).toFloat().add(n)})}function
decodeSinglePose(e,t,r){return __awaiter(this,void 0,void 0,function(){var n,o,i,s,a,u,l,f,c,d;return
__generator(this,function(p){switch(p.label){case 0:return
n=0,o=argmax2d(e),[4,Promise.all([toTensorBuffer(e),toTensorBuffer(t),toTensorBuffer(o,"int32")]);case
1:return i=p.sent(),s=i[0],a=i[1],u=i[2],[4,toTensorBuffer(l=getOffsetPoints(u,r,a));case 2:return
f=p.sent(),c=Array.from(getPointsConfidence(s,u)),d=c.map(function(e,t){return
n+=e,{position:{y:f.get(t,0),x:f.get(t,1)},part:partNames[t],score:e}},o.dispose(),l.dispose(),[2,{keypoints:d,score:n
/d.length}]]))}}var MOBILENET_BASE_URL="https://storage.googleapis.com/tfjs-
models/savedmodel/posenet/mobilenet/",RESNET50_BASE_URL="https://storage.googleapis.com/tfjs-
models/savedmodel/posenet/resnet50/";function resNet50Checkpoint(e,t){var r="model-stride"+e+"\n.json";return
4==t?RESNET50_BASE_URL+"\nfloat/"+r:RESNET50_BASE_URL+"\nquant/"+t+"\n/"+r}function
mobileNetCheckpoint(e,t,r){var n={1:"100",.75:"075",.5:"050"},o="model-stride"+e+"\n.json";return
4==r?MOBILENET_BASE_URL+"\nfloat/"+n[t]+\n/"+o:MOBILENET_BASE_URL+"\nquant/"+r+"\n/"+n[t]+\n/"+
o}function toFloatIfInt$1(e){return
tidy(function(){var t=scalar(e.dtype)&&(e=e.toFloat());var t=tensor([-123.15,-115.9,-103.06]);return e.add(t)})}var
ResNet=function(){function e(e,t){this.model=e;var r=this.model.inputs[0].shape;util.assert(-1===r[1]&&-
1===r[2],function(){return"Input shape ["+r[1]+", "+r[2]+"] must both be equal to or -
1"})},this.outputStride=t)return e.prototype.predict=function(e){var t=this;return tidy(function(){var
r=toFloatIfInt$1(e).expandDims(0),n=t.model.predict(r),o=n[0],i=n[1],s=n[2];return {heatmapScores:n[3].squeeze().
sigmoid(),offsets:s.squeeze(),displacementFwd:o.squeeze(),displacementBwd:i.squeeze()}}),e.prototype.dispose=f
unction(){this.model.dispose(),e(),MOBILENET_V1_CONFIG={architecture:"MobileNetV1",outputStride:16,
multiplier:.75,inputResolution:257},VALID_ARCHITECTURE=["MobileNetV1","ResNet50"],VALID_STRID
E={MobileNetV1:[8,16,32],ResNet50:[32,16]},VALID_INPUT_RESOLUTION=[161,193,257,289,321,353,385,41
7,449,481,513,801],VALID_MULTIPLIER={MobileNetV1:[.5,.75,1],ResNet50:[1]},VALID_QUANT_BYTES=[1
,2,4];function
validateModelConfig(e){if(null==(e=e||MOBILENET_V1_CONFIG).architecture&&(e.architecture="MobileNetV
1"),VALID_ARCHITECTURE.indexOf(e.architecture)<0)throw new Error("Invalid architecture
"+e.architecture+". Should be one of
"+VALID_ARCHITECTURE);if(null==e.inputResolution&&(e.inputResolution=257),VALID_INPUT_RESOLU
TION.indexOf(e.inputResolution)<0)throw new Error("Invalid inputResolution "+e.inputResolution+". Should be
one of
"+VALID_INPUT_RESOLUTION);if(null==e.outputStride&&(e.outputStride=16),VALID_STRIDE[e.architectur
e].indexOf(e.outputStride)<0)throw new Error("Invalid outputStride "+e.outputStride+". Should be one of
"+VALID_STRIDE[e.architecture]+"] for architectre
"+e.architecture+");if(null==e.multiplier&&(e.multiplier=1),VALID_MULTIPLIER[e.architecture].indexOf(e.
multiplier)<0)throw new Error("Invalid multiplier "+e.multiplier+". Should be one of

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"+"+VALID_MULTIPLIER[e.architecture]+" for architectre
"+"+e.architecture+"."."");if(null==e.quantBytes&&(e.quantBytes=4),VALID_QUANT_BYTES.indexOf(e.quantByte
s)<0)throw
new Error("Invalid quantBytes '"+e.quantBytes+"'. Should be one of '"+VALID_QUANT_BYTES+" for
architectre '"+e.architecture+"."."");return e}var
SINGLE_PERSON_INFERENCE_CONFIG={flipHorizontal:!1},MULTI_PERSON_INFERENCE_CONFIG={fli
pHorizontal:!1,maxDetections:5,scoreThreshold:.5,nmsRadius:20};function validateMultiPersonInputConfig(e){var
t=e.maxDetections,r=e.scoreThreshold,n=e.nmsRadius;if(t<=0)throw new Error("Invalid maxDetections '"+t+"".
Should be > 0");if(r<0||r>1)throw new Error("Invalid scoreThreshold '"+r+"". Should be in range [0.0,
1.0]");if(n<=0)throw new Error("Invalid nmsRadius '"+n+"."."")}var PoseNet=function(){function
e(e,t){this.baseModel=e,this.inputResolution=t}return e.prototype.estimateMultiplePoses=function(e,t){return void
0===t&&(t=MULTI_PERSON_INFERENCE_CONFIG),__awaiter(this,void 0,void 0,function(){var
r,n,o,i,s,a,u,l,f,c,d,p,h,m,g,_,I,E,v,N,y;return
__generator(this,function(T){switch(T.label){case 0:return
r=__assign({ },MULTI_PERSON_INFERENCE_CONFIG,t),validateMultiPersonInputConfig(t),n=this.baseModel.
outputStride,o=this.inputResolution,assertValidOutputStride(n),assertValidResolution(this.inputResolution,n),i=getI
nputTensorDimensions(e),s=i[0],a=i[1],u=padAndResizeTo(e,[o,o]),l=u.resized,f=u.padding,c=this.baseModel.predi
ct(l),d=c.heatmapScores,p=c.offsets,h=c.displacementFwd,m=c.displacementBwd,[4,toTensorBuffers3D([d,p,h,m])]
);case 1:return
g=T.sent(),_=g[0],I=g[1],E=g[2],v=g[3],[4,decodeMultiplePoses(_,I,E,v,n,r.maxDetections,r.scoreThreshold,r.nmsR
adius)];case 2:return
N=T.sent(),y=scaleAndFlipPoses(N,[s,a],[o,o],f,r.flipHorizontal),d.dispose(),p.dispose(),h.dispose(),m.dispose(),l.di
spose(),[2,y]}})}},e.prototype.estimateSinglePose=function(e,t){return void
0===t&&(t=SINGLE_PERSON_INFERENCE_CONFIG),__awaiter(this,void 0,void 0,function(){var
r,n,o,i,s,a,u,l,f,c,d,p,h,m,g,_,return __generator(this,function(I){switch(I.label){case
0:return
r=__assign({ },SINGLE_PERSON_INFERENCE_CONFIG,t),n=this.baseModel.outputStride,o=this.inputResolutio
n,assertValidOutputStride(n),assertValidResolution(o,n),i=getInputTensorDimensions(e),s=i[0],a=i[1],u=padAndRe
sizeTo(e,[o,o]),l=u.resized,f=u.padding,c=this.baseModel.predict(l),d=c.heatmapScores,p=c.offsets,h=c.displacemen
tFwd,m=c.displacementBwd,[4,decodeSinglePose(d,p,n)];case 1:return
g=I.sent(),_=scaleAndFlipPoses([g],[s,a],[o,o],f,r.flipHorizontal),d.dispose(),p.dispose(),h.dispose(),m.dispose(),l.di
spose(),[2,_[0]]}})}},e.prototype.estimatePoses=function(e,t){return __awaiter(this,void 0,void 0,function(){return
__generator(this,function(r){switch(r.label){case 0:return"single-
person"!=t.decodingMethod?[3,2]:[4,this.estimateSinglePose(e,t)];case 1:return[2,[r.sent()]];case
2:return[2,this.estimateMultiplePoses(e,t)]}})}},e.prototype.dispose=function(){this.baseModel.dispose(),e}();fun
ction loadMobileNet(e){return __awaiter(this,void 0,void 0,function(){var
t,r,n,o,i,s;return __generator(this,function(a){switch(a.label){case
0:if(t=e.outputStride,r=e.quantBytes,n=e.multiplier,null==tf)throw new Error("Cannot find TensorFlow.js. If you
are using a <script> tag, please also include @tensorflow/tfjs on the page before using this\\n model.");return
o=mobileNetCheckpoint(t,n,r),[4,loadGraphModel(e.modelUrl||o)];case 1:return i=a.sent(),s=new
MobileNet(i,t),[2,new PoseNet(s,e.inputResolution)]}})}function loadResNet(e){return __awaiter(this,void 0,void
0,function(){var t,r,n,o,i;return __generator(this,function(s){switch(s.label){case
0:if(t=e.outputStride,r=e.quantBytes,null==tf)throw new Error("Cannot find TensorFlow.js. If you are using a
<script> tag, please also include @tensorflow/tfjs on the page before using this\\n model.");return
n=resNet50Checkpoint(t,r),[4,loadGraphModel(e.modelUrl||n)];case 1:return o=s.sent(),i=new ResNet(o,t),[2,new
PoseNet(i,e.inputResolution)]}})}function load(e){return void
0===e&&(e=MOBILENET_V1_CONFIG),__awaiter(this,void

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0,void 0,function(){return
__generator(this,function(t){return"ResNet50"===e.validateModelConfig(e).architecture?[2,loadResNet(e)]:"MobileNetV1"===e.architecture?[2,loadMobileNet(e)]:[2,null]}})}export{decodeMultiplePoses,decodeSinglePose,MobileNet,partChannels,partIds,partNames,poseChain,load,PoseNet,VALID_INPUT_RESOLUTION,getAdjacentKeyPoints,getBoundingBox,getBoundingBoxPoints,scalePose};\n","/*\n * @license\n * Copyright 2019 Google Inc. All Rights Reserved.\n * Licensed under the Apache License, Version 2.0 (the "License");\n * you may not use this file except in compliance with the License.\n * You may obtain a copy of the License at\n * https://www.apache.org/licenses/LICENSE-2.0\n * Unless required by applicable law or agreed to in writing, software\n * distributed under the License is distributed on an "AS IS" BASIS,\n * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.\n * See the License for the specific language governing permissions and\n * limitations under the License.\n *
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*/\nimport * as posenet from '@tensorflow-models/posenet';\nimport * as tf from '@tensorflow/tfjs-core';\n\nconst COLOR = 'aqua';\nconst BOUNDING_BOX_COLOR = 'red';\nconst LINE_WIDTH = 2;\n\nexport const TRY_RESNET_BUTTON_NAME = 'tryResNetButton';\nexport const TRY_RESNET_BUTTON_TEXT = '[New] Try ResNet50';\nconst TRY_RESNET_BUTTON_TEXT_CSS = 'width:100%;text-decoration:underline;';\nconst TRY_RESNET_BUTTON_BACKGROUND_CSS = 'background:#e61d5f;';\n\nfunction isAndroid() {\n return /Android/i.test(navigator.userAgent);\n}\n\nfunction isiOS() {\n return /iPhone|iPad|iPod/i.test(navigator.userAgent);\n}\n\nexport function isMobile() {\n return isAndroid() || isiOS();\n}\n\nfunction setDatGuiPropertyCss(propertyText, liCssString, spanCssString = '') {\n var spans = document.getElementsByClassName('property-name');\n for (var i = 0; i < spans.length; i++) {\n var text = spans[i].textContent || spans[i].innerText;\n if (text == propertyText) {\n spans[i].parentNode.parentNode.style = liCssString;\n if (spanCssString != '') {\n spans[i].style = spanCssString;\n }\n }\n }\n}\n\nexport function updateTryResNetButtonDatGuiCss() {\n setDatGuiPropertyCss(TRY_RESNET_BUTTON_TEXT, TRY_RESNET_BUTTON_BACKGROUND_CSS, TRY_RESNET_BUTTON_TEXT_CSS);\n}\n\n/*\n * Toggles between the loading UI and the main canvas UI.\n */\nexport function toggleLoadingUI(\n showLoadingUI, loadingDivId = 'loading', mainDivId = 'main') {\n if (showLoadingUI) {\n document.getElementById(loadingDivId).style.display = 'block';\n document.getElementById(mainDivId).style.display = 'none';\n } else {\n document.getElementById(loadingDivId).style.display = 'none';\n document.getElementById(mainDivId).style.display = 'block';\n }\n}\n\nexport function drawPoint(ctx, y, x, r, color) {\n ctx.beginPath();\n ctx.arc(x, y, r, 0, 2 * Math.PI);\n ctx.fillStyle = color;\n ctx.fill();\n}\n\n/*\n * Draws a line on a canvas, i.e. a joint\n */\nexport function drawSegment([ay, ax], [by, bx], color, scale, ctx) {\n ctx.beginPath();\n ctx.moveTo(ax * scale, ay * scale);\n ctx.lineTo(bx * scale, by * scale);\n ctx.lineWidth = LINE_WIDTH;\n ctx.strokeStyle = color;\n ctx.stroke();\n}\n\n/*\n * Draws a pose skeleton by looking up all adjacent keypoints/joints\n */\nexport function drawSkeleton(keypoints, minConfidence, ctx, scale = 1) {\n const adjacentKeyPoints = posenet.getAdjacentKeyPoints(keypoints, minConfidence);\n\n function toTuple({y, x}) {\n return [y, x];\n }\n\n adjacentKeyPoints.forEach((keypoints) => {\n drawSegment(toTuple(keypoints[0].position), toTuple(keypoints[1].position), COLOR, scale, ctx);\n });\n}\n\n/*\n * Draw pose keypoints onto a canvas\n */\nexport function drawKeypoints(keypoints, minConfidence, ctx, scale = 1) {\n for (let i = 0; i < keypoints.length; i++) {\n const keypoint = keypoints[i];\n\n if (keypoint.score < minConfidence) {\n continue;\n }\n\n const {y, x} = keypoint.position;\n drawPoint(ctx, y * scale, x * scale, 3, COLOR);\n }\n}\n\n/*\n * Draw the bounding box of a pose. For example, for a whole person standing\n * in an image, the bounding box will begin at the nose and extend to one of\n * ankles\n */\nexport function drawBoundingBox(keypoints, ctx) {\n const boundingBox = posenet.getBoundingBox(keypoints);\n\n ctx.rect(boundingBox.minX, boundingBox.minY,

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boundingBox.maxX - boundingBox.minX,\n boundingBox.maxY - boundingBox.minY);\n\n ctx.strokeStyle =
boundingBoxColor;\n ctx.stroke();\n}\n\n/**\n * Converts an array of pixel data into an ImageData object\n
*/\nexport async function renderToCanvas(a, ctx) {\n const [height, width] = a.shape;\n const imageData = new
ImageData(width, height);\n\n const data = await a.data();\n\n for (let i = 0; i < height * width; ++i) {\n const j = i * 4;\n const k = i * 3;\n\n imageData.data[j + 0] = data[k
+ 0];\n imageData.data[j + 1] = data[k + 1];\n imageData.data[j + 2] = data[k + 2];\n imageData.data[j + 3] =
255;\n }\n\n ctx.putImageData(imageData, 0, 0);\n}\n\n/**\n * Draw an image on a canvas\n
*/\nexport function
renderImageToCanvas(image, size, canvas) {\n canvas.width = size[0];\n canvas.height = size[1];\n const ctx =
canvas.getContext('2d');\n ctx.drawImage(image, 0, 0);\n}\n\n/**\n * Draw heatmap values, one of the model
outputs, on to the canvas\n
* Read our blog post for a description of PoseNet's heatmap outputs\n
*
https://medium.com/tensorflow/real-time-human-pose-estimation-in-the-browser-with-tensorflow-js-7dd0bc881cd5\n
*/\nexport function drawHeatMapValues(heatMapValues, outputStride, canvas) {\n const ctx =
canvas.getContext('2d');\n const radius = 5;\n const scaledValues = heatMapValues.mul(tf.scalar(outputStride,
'int32'));\n drawPoints(ctx, scaledValues, radius, COLOR);\n}\n\n/**\n * Used by the drawHeatMapValues
method to draw heatmap points on to\n
* the canvas\n
*/\nfunction drawPoints(ctx, points, radius, color) {\n const
data = points.buffer().values;\n\n for (let i = 0; i < data.length; i += 2) {\n const pointY = data[i];\n const pointX
= data[i + 1];\n\n if (pointX !== 0 && pointY !== 0) {\n ctx.beginPath();\n ctx.arc(pointX, pointY, radius,
0, 2 * Math.PI);\n ctx.fillStyle = color;\n ctx.fill();\n }\n }\n}\n\n/**\n * Draw offset vector values, one of
the model outputs, on to the canvas\n
* Read our blog post for a description of PoseNet's offset vector outputs\n
*
https://medium.com/tensorflow/real-time-human-pose-estimation-in-the-browser-with-tensorflow-js-7dd0bc881cd5\n
*/\nexport function drawOffsetVectors(\n heatMapValues, offsets, outputStride, scale = 1, ctx)
{\n const offsetPoints =\n posenet.singlePose.getOffsetPoints(heatMapValues,
outputStride, offsets);\n\n const heatmapData = heatMapValues.buffer().values;\n const offsetPointsData =
offsetPoints.buffer().values;\n\n for (let i = 0; i < heatmapData.length; i += 2) {\n const heatmapY =
heatmapData[i] * outputStride;\n const heatmapX = heatmapData[i + 1] * outputStride;\n const offsetPointY =
offsetPointsData[i];\n const offsetPointX = offsetPointsData[i + 1];\n\n drawSegment(\n [heatmapY,
heatmapX], [offsetPointY, offsetPointX], COLOR, scale, ctx);\n }\n}\n\n", "/*\n * @license\n * Copyright 2019
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*/\n\n
===== \n\n//
color schemes generated using d3-scale-chromatic:\n//
https://github.com/d3/d3-scale-chromatic\n\nexport const
rainbow = [\n [110, 64, 170], [143, 61, 178], [178, 60, 178], [210, 62, 167],\n [238, 67, 149], [255, 78, 125], [255,
94, 99], [255, 115, 75],\n [255, 140, 56], [239, 167, 47], [217, 194, 49], [194, 219, 64],\n [175, 240, 91], [135, 245,
87], [96, 247, 96], [64, 243, 115],\n [40, 234, 141], [28, 219, 169], [26, 199, 194], [33, 176, 213],\n [47, 150, 224],
[65, 125, 224], [84, 101, 214], [99, 81, 195];\n\n\nexport const warm = [\n [110, 64, 170], [106, 72, 183], [100, 81,
196], [92, 91, 206],\n [84, 101, 214], [75, 113, 221], [66, 125, 224], [56, 138, 226],\n [48, 150, 224], [40, 163,
220], [33, 176, 214], [29, 188, 205],\n [26, 199, 194], [26, 210, 182], [28, 219, 169], [33, 227, 155],\n [41, 234, 141], [51, 240, 128], [64, 243, 116], [79,
246, 105],\n [96, 247, 97], [115, 246, 91], [134, 245, 88], [155, 243, 88];\n\n\nexport const spectral = [\n [158, 1,
66], [181, 26, 71], [202, 50, 74], [219, 73, 74],\n [232, 94, 73], [242, 117, 75], [248, 142, 83], [251, 167,
96],\n [253, 190, 112], [254, 210, 129], [254, 227, 149], [254, 240, 166],\n [251, 248, 176], [243, 249, 172], [231,
245, 163], [213, 238, 159],\n [190, 229, 160], [164, 218, 163], [137, 207, 165], [110, 192, 168],\n [86, 173, 174],
[70, 150, 179], [67, 127, 180], [77, 103, 173];\n\n\n", "/*\n * @license\n * Copyright 2019 Google Inc. All Rights

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*/\nimport '@tensorflow/tfjs-backend-webgl';\nimport * as bodyPix from '@tensorflow-models/body-pix';\nimport dat from 'dat.gui';\nimport Stats from 'stats.js';\nimport {drawKeypoints, drawSkeleton, toggleLoadingUI, TRY_RESNET_BUTTON_NAME, TRY_RESNET_BUTTON_TEXT, updateTryResNetButtonDatGuiCss} from './demo_util';\nimport * as partColorScales from './part_color_scales';\n\nconst stats = new Stats();\nconst state = {\n video: null,\n stream: null,\n net: null,\n videoConstraints: {},\n // Triggers the TensorFlow model to reload\n changingArchitecture: false,\n changingMultiplier: false,\n changingStride: false,\n changingResolution: false,\n changingQuantBytes: false,\n};\n\nfunction isAndroid() {\n return /Android/i.test(navigator.userAgent);\n}\n\nfunction isiOS() {\n return /iPhone|iPod/i.test(navigator.userAgent);\n}\n\nfunction isMobile() {\n return isAndroid() || isiOS();\n}\n\nasync function getVideoInputs() {\n if (!navigator.mediaDevices || !navigator.mediaDevices.enumerateDevices) {\n console.log('enumerateDevices() not supported.);\n return [];\n }\n\n const devices = await navigator.mediaDevices.enumerateDevices();\n const videoDevices = devices.filter(device => device.kind === 'videoinput');\n return videoDevices;\n}\n\nfunction stopExistingVideoCapture() {\n if (state.video && state.video.srcObject) {\n state.video.srcObject.getTracks().forEach(track => {\n track.stop();\n });\n state.video.srcObject = null;\n }\n}\n\nasync function getDeviceIdForLabel(cameraLabel) {\n const videoInputs = await getVideoInputs();\n for (let i = 0; i < videoInputs.length; i++) {\n const videoInput = videoInputs[i];\n if (videoInput.label === cameraLabel) {\n return videoInput.deviceId;\n }\n }\n return null;\n}\n\n// on mobile, facing mode is the preferred way to select a camera.\n// Here we use the camera label to determine if its the environment or\n// user facing camera\nfunction getFacingMode(cameraLabel) {\n if (!cameraLabel) {\n return 'user';\n }\n if (cameraLabel.toLowerCase().includes('back')) {\n return 'environment';\n }\n else {\n return 'user';\n }\n}\n\nasync function getConstraints(cameraLabel) {\n let deviceId;\n let facingMode;\n if (cameraLabel) {\n deviceId = await getDeviceIdForLabel(cameraLabel);\n // on mobile, use the facing mode based on the camera.\n facingMode = isMobile() ? getFacingMode(cameraLabel) : null;\n }\n return {deviceId, facingMode};\n}\n\n//**\n * Loads a the camera to be used in the demo\n */\n\nasync function setupCamera(cameraLabel) {\n if (!navigator.mediaDevices || !navigator.mediaDevices.getUserMedia) {\n throw new Error('Browser API navigator.mediaDevices.getUserMedia not available');\n }\n\n const videoElement = document.getElementById('video');\n stopExistingVideoCapture();\n const videoConstraints = await getConstraints(cameraLabel);\n const stream = await navigator.mediaDevices.getUserMedia({\n 'audio': false,\n 'video': videoConstraints\n });\n videoElement.srcObject = stream;\n return new Promise((resolve) => {\n videoElement.onloadedmetadata = () => {\n videoElement.width = videoElement.videoWidth;\n videoElement.height = videoElement.videoHeight;\n resolve(videoElement);\n }\n });\n}\n\nasync function loadVideo(cameraLabel) {\n try {\n state.video = await setupCamera(cameraLabel);\n } catch (e) {\n let info = document.getElementById('info');\n info.textContent = 'this browser does not support video capture,' +\n 'or this device does not have a camera';\n info.style.display = 'block';\n throw e;\n }\n state.video.play();\n}\n\nconst defaultQuantBytes = 2;\nconst defaultMobileNetMultiplier = isMobile() ? 0.50 : 0.75;\nconst defaultMobileNetStride = 16;\nconst defaultMobileNetInternalResolution = 'medium';\nconst defaultResNetMultiplier = 1.0;\nconst defaultResNetStride = 16;\nconst defaultResNetInternalResolution = 'low';\nconst guiState = {\n algorithm: 'multi-person-instance',\n estimate: 'partmap',\n camera: null,\n
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flipHorizontal: true,\n input: {\n architecture: 'MobileNetV1',\n outputStride: 16,\n internalResolution: 'low',\n multiplier: 0.50,\n quantBytes: 2\n },\n multiPersonDecoding: {\n maxDetections: 5,\n scoreThreshold: 0.3,\n nmsRadius: 20,\n numKeypointForMatching: 17,\n refineSteps: 10\n },\n segmentation: {\n segmentationThreshold: 0.7,\n effect: 'mask',\n maskBackground: true,\n opacity: 0.7,\n backgroundBlurAmount: 3,\n maskBlurAmount: 0,\n edgeBlurAmount: 3\n },\n partMap: {\n colorScale: 'rainbow',\n effect: 'partMap',\n segmentationThreshold: 0.5,\n opacity: 0.9,\n blurBodyPartAmount: 3,\n bodyPartEdgeBlurAmount: 3\n },\n showFps: 'isMobile()\n';\n\nfunction toCameraOptions(cameras) {\n const result = {default: null};\n cameras.forEach(camera => {\n result[camera.label] = camera.label;\n })\n return result;\n}\n\n// Sets up dat.gui controller on the top-right of the window\n\nfunction setupGui(cameras) {\n const gui = new dat.GUI({ width: 300});\n let architectureController = null;\n guiState[TRY_RESNET_BUTTON_NAME] = function() {\n architectureController.setValue('ResNet50')\n };\n gui.add(guiState, TRY_RESNET_BUTTON_NAME).name(TRY_RESNET_BUTTON_TEXT);\n updateTryResNetButtonDatGuiCss();\n gui.add(guiState, 'camera', toCameraOptions(cameras)).onChange(async function(cameraLabel) {\n state.changingCamera = true;\n await loadVideo(cameraLabel);\n state.changingCamera = false;\n });\n gui.add(guiState, 'flipHorizontal');\n // There are two algorithms 'person' and 'multi-person-instance'.\n // The 'person' algorithm returns one single segmentation mask (or body\n // part map) for all people in the image. The 'multi-person-instance'\n // algorithm returns an array of segmentation mask (or body part map).\n // Each element in the array corresponding to one of the people. In other\n // words, 'multi-person-instance' algorithm does instance-level person\n // segmentation and body part segmentation for every person in the image.\n const algorithmController =\n gui.add(guiState, 'algorithm', ['person', 'multi-person-instance']);\n // Architecture: there are a few BodyPix models varying in size and\n // accuracy.\n // The input parameters have the most effect on accuracy and speed of the\n // network\n let input = gui.addFolder('Input');\n // Updates outputStride\n // Output stride: Internally, this parameter affects the height and width\n // of the layers in the neural network. The lower the value of the output\n // stride the higher the accuracy but slower the speed, the higher the\n // value the faster the speed but lower the accuracy.\n let outputStrideController = null;\n function updateGuiOutputStride(outputStride, outputStrideArray) {\n if (outputStrideController) {\n outputStrideController.remove();\n }\n guiState.input.outputStride = outputStride;\n outputStrideController =\n input.add(guiState.input, 'outputStride', outputStrideArray);\n outputStrideController.onChange(function(outputStride) {\n state.changingStride = true;\n guiState.input.outputStride = +outputStride;\n });\n }\n // Updates internal resolution\n // Internal resolution: Internally, this parameter affects the height and\n // width of the layers in the neural network. The higher the value of the\n // internal resolution the better the accuracy but slower the speed.\n let internalResolutionController = null;\n function updateGuiInternalResolution(\n internalResolution,\n internalResolutionArray,\n) {\n if (internalResolutionController) {\n internalResolutionController.remove();\n }\n guiState.input.internalResolution = internalResolution;\n internalResolutionController = input.add(\n guiState.input, 'internalResolution', internalResolutionArray);\n internalResolutionController.onChange(function(internalResolution) {\n guiState.input.internalResolution = internalResolution;\n });\n }\n // Updates depth multiplier\n // Multiplier: this parameter affects the number of feature map channels\n // in the MobileNet. The higher the value, the higher the accuracy but\n // slower the speed, the lower the value the faster the speed but lower\n // the accuracy.\n let multiplierController = null;\n function updateGuiMultiplier(multiplier, multiplierArray) {\n if (multiplierController) {\n multiplierController.remove();\n }\n guiState.input.multiplier = multiplier;\n multiplierController =\n input.add(guiState.input, 'multiplier', multiplierArray);\n multiplierController.onChange(function(multiplier) {\n state.changingMultiplier = true;\n guiState.input.multiplier = +multiplier;\n });\n }\n // updates quantBytes\n // QuantBytes: this parameter

```



```

affects weight quantization in the ResNet50\n // model. The available options are 1 byte, 2 bytes, and 4 bytes. The\n
// higher the value, the larger the model size and thus the longer the\n // loading time, the lower the value, the\n
shorter the loading time but\n // lower the accuracy.\n let quantBytesController = null;\n function
updateGuiQuantBytes(quantBytes, quantByteArray) {\n if (quantBytesController) {\n
quantBytesController.remove();\n }\n guiState.quantBytes = +quantBytes;\n guiState.input.quantBytes =
+quantBytes;\n quantBytesController
=\n input.add(guiState.input, 'quantBytes', quantByteArray);\n
quantBytesController.onChange(function(quantBytes) {\n state.changingQuantBytes = true;\n
guiState.input.quantBytes = +quantBytes;\n });\n }\n\n function updateGuiInputSection() {\n if
(guiState.input.architecture === 'MobileNetV1') {\n updateGuiInternalResolution(\n
defaultMobileNetInternalResolution,\n ['low', 'medium', 'high', 'full']);\n
updateGuiOutputStride(defaultMobileNetStride, [8, 16]);\n updateGuiMultiplier(defaultMobileNetMultiplier,
[0.50, 0.75, 1.0])\n } else { // guiState.input.architecture === 'ResNet50'\n updateGuiInternalResolution(\n
defaultResNetInternalResolution, ['low', 'medium', 'high', 'full']);\n
updateGuiOutputStride(defaultResNetStride, [32, 16]);\n updateGuiMultiplier(defaultResNetMultiplier, [1.0]);\n
}\n updateGuiQuantBytes(defaultQuantBytes, [1, 2, 4]);\n }\n\n // Architecture:
there are a few PoseNet models varying in size and\n // accuracy. 1.01 is the largest, but will be the slowest. 0.50 is
the\n // fastest, but least accurate.\n architectureController =\n input.add(guiState.input, 'architecture',
['ResNet50', 'MobileNetV1']);\n guiState.architecture = guiState.input.architecture;\n
architectureController.onChange(function(architecture) {\n // if architecture is ResNet50, then show ResNet50
options\n state.changingArchitecture = true;\n guiState.input.architecture = architecture;\n
updateGuiInputSection();\n });\n\n updateGuiInputSection();\n input.open();\n\n const estimateController =\n gui.add(guiState, 'estimate', ['segmentation', 'partmap']);\n\n let segmentation = gui.addFolder('Segmentation');\n
segmentation.add(guiState.segmentation, 'segmentationThreshold', 0.0, 1.0);\n const segmentationEffectController
=\n segmentation.add(guiState.segmentation, 'effect', ['mask', 'bokeh']);\n\n let multiPersonDecoding =
gui.addFolder('MultiPersonDecoding');\n multiPersonDecoding.add(\n guiState.multiPersonDecoding,
'maxDetections', 0, 20, 1);\n multiPersonDecoding.add(\n guiState.multiPersonDecoding, 'scoreThreshold', 0.0,
1.0);\n multiPersonDecoding.add(guiState.multiPersonDecoding, 'nmsRadius', 0, 30, 1);\n
multiPersonDecoding.add(\n guiState.multiPersonDecoding, 'numKeypointForMatching', 1, 17, 1);\n
multiPersonDecoding.add(\n guiState.multiPersonDecoding, 'refineSteps', 1, 10, 1);\n
multiPersonDecoding.open();\n\n algorithmController.onChange(function(value) {\n switch (guiState.algorithm)
{\n case 'single-person':\n multiPersonDecoding.close();\n singlePersonDecoding.open();\n break;\n
case 'multi-person':\n singlePersonDecoding.close();\n multiPersonDecoding.open();\n break;\n }\n
});\n\n let darknessLevel;\n let bokehBlurAmount;\n let edgeBlurAmount;\n let maskBlurAmount;\n let
maskBackground;\n\n segmentationEffectController.onChange(function(effectType)
{\n if (effectType === 'mask') {\n if (bokehBlurAmount) {\n bokehBlurAmount.remove();\n }\n if
(edgeBlurAmount) {\n edgeBlurAmount.remove();\n }\n darknessLevel =\n
segmentation.add(guiState.segmentation, 'opacity', 0.0, 1.0);\n maskBlurAmount =
segmentation.add(guiState.segmentation, 'maskBlurAmount')\n .min(0)\n
.max(20)\n .step(1);\n maskBackground =\n segmentation.add(guiState.segmentation,
'maskBackground');\n } else if (effectType === 'bokeh') {\n if (darknessLevel) {\n
darknessLevel.remove();\n }\n if (maskBlurAmount) {\n maskBlurAmount.remove();\n }\n if
(maskBackground) {\n maskBackground.remove();\n }\n bokehBlurAmount = segmentation\n
.add(\n guiState.segmentation,\n
'backgroundBlurAmount',\n)\n .min(1)\n
.max(20)\n .step(1);\n edgeBlurAmount = segmentation.add(guiState.segmentation,
'edgeBlurAmount')\n .min(0)\n .max(20)\n .step(1);\n }\n });\n\n
// manually set the effect so that the options are shown.\n

```

```

segmentationEffectController.setValue(guiState.segmentation.effect);\n\n let partMap = gui.addFolder('Part
Map');\n partMap.add(guiState.partMap, 'segmentationThreshold', 0.0, 1.0);\n partMap.add(\n guiState.partMap,
'effect', ['partMap', 'pixelation', 'blurBodyPart']);\n partMap.add(guiState.partMap, 'opacity', 0.0, 1.0);\n
partMap.add(guiState.partMap, 'colorScale', Object.keys(partColorScales))\n .onChange(colorScale => {\n
setShownPartColorScales(colorScale);\n });\n setShownPartColorScales(guiState.partMap.colorScale);\n
partMap.add(guiState.partMap, 'blurBodyPartAmount').min(1).max(20).step(1);\n partMap.add(guiState.partMap,
'bodyPartEdgeBlurAmount')\n .min(1)\n .max(20)\n .step(1);\n partMap.open();\n\n
estimateController.onChange(function(estimationType) {\n if (estimationType === 'segmentation') {\n
segmentation.open();\n partMap.close();\n document.getElementById('colors').style.display = 'none';\n }
else {\n segmentation.close();\n partMap.open();\n document.getElementById('colors').style.display =
'inline-block';\n }\n });\n\n gui.add(guiState, 'showFps').onChange(showFps => {\n if (showFps) {\n
document.body.appendChild(stats.dom);\n } else {\n document.body.removeChild(stats.dom);\n }\n
})\n\nfunction setShownPartColorScales(colorScale) {\n const colors = document.getElementById('colors');\n
colors.innerHTML = '';\n\n const partColors = partColorScales[colorScale];\n
const partNames = bodyPix.PART_CHANNELS;\n for (let i = 0; i < partColors.length; i++) {\n const
partColor = partColors[i];\n const child = document.createElement('li');\n\n child.innerHTML = `\n <div
class='color' style='background-color:rgb(${partColor[0]},${partColor[1]},${partColor[2]})' ></div>\n
${partNames[i]}`;\n colors.appendChild(child);\n }\n\n**\n * Sets up a frames per second panel on the top-
left of the window\n *\nfunction setupFPS() {\n stats.showPanel(0); // 0: fps, 1: ms, 2: mb, 3+: custom\n if
(guiState.showFps) {\n document.body.appendChild(stats.dom);\n }\n\nasync function estimateSegmentation()
{\n let multiPersonSegmentation = null;\n switch (guiState.algorithm) {\n case 'multi-person-instance':\n
return await state.net.segmentMultiPerson(state.video, {\n internalResolution:
guiState.input.internalResolution,\n segmentationThreshold: guiState.segmentation.segmentationThreshold,\n
maxDetections: guiState.multiPersonDecoding.maxDetections,\n scoreThreshold:
guiState.multiPersonDecoding.scoreThreshold,\n nmsRadius: guiState.multiPersonDecoding.nmsRadius,\n
numKeypointForMatching: guiState.multiPersonDecoding.numKeypointForMatching,\n refineSteps:
guiState.multiPersonDecoding.refineSteps\n });\n case 'person':\n return await
state.net.segmentPerson(state.video, {\n internalResolution: guiState.input.internalResolution,\n
segmentationThreshold: guiState.segmentation.segmentationThreshold,\n maxDetections:
guiState.multiPersonDecoding.maxDetections,\n scoreThreshold:
guiState.multiPersonDecoding.scoreThreshold,\n nmsRadius: guiState.multiPersonDecoding.nmsRadius,\n
});\n default:\n break;\n });\n return multiPersonSegmentation;\n }\n\nasync function
estimatePartSegmentation() {\n switch (guiState.algorithm) {\n case 'multi-person-instance':\n return await
state.net.segmentMultiPersonParts(state.video, {\n internalResolution: guiState.input.internalResolution,\n
segmentationThreshold: guiState.segmentation.segmentationThreshold,\n maxDetections:
guiState.multiPersonDecoding.maxDetections,\n scoreThreshold:
guiState.multiPersonDecoding.scoreThreshold,\n nmsRadius: guiState.multiPersonDecoding.nmsRadius,\n
numKeypointForMatching: guiState.multiPersonDecoding.numKeypointForMatching,\n refineSteps:
guiState.multiPersonDecoding.refineSteps\n });\n case 'person':\n return await
state.net.segmentPersonParts(state.video, {\n internalResolution: guiState.input.internalResolution,\n
segmentationThreshold: guiState.segmentation.segmentationThreshold,\n maxDetections:
guiState.multiPersonDecoding.maxDetections,\n scoreThreshold:
guiState.multiPersonDecoding.scoreThreshold,\n nmsRadius: guiState.multiPersonDecoding.nmsRadius,\n
});\n
default:\n break;\n });\n return multiPersonPartSegmentation;\n }\n\nfunction
drawPoses(personOrPersonPartSegmentation, flipHorizontally, ctx) {\n if
(Array.isArray(personOrPersonPartSegmentation)) {\n
personOrPersonPartSegmentation.forEach(personSegmentation => {\n let pose = personSegmentation.pose;\n

```

```

if (flipHorizontally) {\n pose = bodyPix.flipPoseHorizontal(pose, personSegmentation.width);\n }\n
drawKeypoints(pose.keypoints, 0.1, ctx);\n drawSkeleton(pose.keypoints, 0.1, ctx);\n });\n } else {\n
personOrPersonPartSegmentation.allPoses.forEach(pose => {\n if (flipHorizontally) {\n pose =
bodyPix.flipPoseHorizontal(\n pose, personOrPersonPartSegmentation.width);\n }\n
drawKeypoints(pose.keypoints, 0.1, ctx);\n drawSkeleton(pose.keypoints, 0.1, ctx);\n });\n }\n}\n\nasync
function loadBodyPix() {\n toggleLoadingUI(true);\n state.net = await bodyPix.load({\n architecture:
guiState.input.architecture,\n
 outputStride: guiState.input.outputStride,\n multiplier: guiState.input.multiplier,\n quantBytes:
guiState.input.quantBytes\n });\n toggleLoadingUI(false);\n }\n\n\n**\n * Feeds an image to BodyPix to estimate
segmentation - this is where the\n * magic happens. This function loops with a requestAnimationFrame method.\n
*\n\nfunction segmentBodyInRealTime() {\n const canvas = document.getElementById('output');\n // since images
are being fed from a webcam\n\n async function bodySegmentationFrame() {\n // if changing the model or the
camera, wait a second for it to complete\n // then try again.\n if (state.changingArchitecture ||
state.changingMultiplier ||\n state.changingCamera || state.changingStride ||\n state.changingQuantBytes)
{\n console.log('load model...');\n loadBodyPix();\n state.changingArchitecture = false;\n
state.changingMultiplier = false;\n state.changingStride = false;\n state.changingQuantBytes
= false;\n }\n\n // Begin monitoring code for frames per second\n stats.begin();\n\n const flipHorizontally =
guiState.flipHorizontal;\n\n switch (guiState.estimate) {\n case 'segmentation':\n const
multiPersonSegmentation = await estimateSegmentation();\n switch (guiState.segmentation.effect) {\n
case 'mask':\n const ctx = canvas.getContext('2d');\n const foregroundColor = {r: 255, g: 255, b: 255,
a: 255};\n const backgroundColor = {r: 0, g: 0, b: 0, a: 255};\n const mask = bodyPix.toMask(\n
multiPersonSegmentation, foregroundColor, backgroundColor,\n true);\n\n bodyPix.drawMask(\n
canvas, state.video, mask, guiState.segmentation.opacity,\n
guiState.segmentation.maskBlurAmount, flipHorizontally);\n drawPoses(multiPersonSegmentation,
flipHorizontally, ctx);\n break;\n case 'bokeh':\n bodyPix.drawBokehEffect(\n
canvas, state.video, multiPersonSegmentation,\n
+guiState.segmentation.backgroundBlurAmount,\n guiState.segmentation.edgeBlurAmount,
flipHorizontally);\n break;\n }\n\n break;\n case 'partmap':\n const ctx =
canvas.getContext('2d');\n const multiPersonPartSegmentation = await estimatePartSegmentation();\n const
coloredPartImageData = bodyPix.toColoredPartMask(\n multiPersonPartSegmentation,\n
partColorScales[guiState.partMap.colorScale]);\n\n const maskBlurAmount = 0;\n switch
(guiState.partMap.effect) {\n case 'pixelation':\n const pixelCellWidth = 10.0;\n\n bodyPix.drawPixelatedMask(\n
canvas, state.video, coloredPartImageData,\n
guiState.partMap.opacity, maskBlurAmount, flipHorizontally,\n pixelCellWidth);\n break;\n case 'partMap':\n bodyPix.drawMask(\n
canvas, state.video, coloredPartImageData, guiState.opacity,\n
maskBlurAmount, flipHorizontally);\n break;\n case 'blurBodyPart':\n const blurBodyPartIds =
[0, 1];\n bodyPix.blurBodyPart(\n
canvas, state.video, multiPersonPartSegmentation,\n
blurBodyPartIds, guiState.partMap.blurBodyPartAmount,\n guiState.partMap.edgeBlurAmount,
flipHorizontally);\n }\n drawPoses(multiPersonPartSegmentation, flipHorizontally, ctx);\n break;\n default:\n break;\n }\n\n // End monitoring code for frames per second\n stats.end();\n\n requestAnimationFrame(bodySegmentationFrame);\n }\n\n bodySegmentationFrame();\n }\n\n\n**\n * Kicks off the
demo.\n\n\nexport async function bindPage() {\n // Load the BodyPix model weights with architecture 0.75\n
await loadBodyPix();\n document.getElementById('loading').style.display
= 'none';\n document.getElementById('main').style.display = 'inline-block';\n\n await
loadVideo(guiState.camera);\n\n let cameras = await getVideoInputs();\n setupFPS();\n setupGui(cameras);\n\n segmentBodyInRealTime();\n\n\n\nnavigator.getUserMedia = navigator.getUserMedia ||\n navigator.webkitGetUserMedia || navigator.mozGetUserMedia;\n // kick off the demo\n bindPage();\n}

```

Found in path(s):

\* /tensorflow-models-zip/@tensorflow-models/body-pix/demos/dist/demos.ab0c720b.js.map

# 1.318 pydantic 1.9.0

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# 1.319 pymongo 3.12.3

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ISO C9x compliant stdint.h for Microsoft Visual Studio

Based on ISO/IEC 9899:TC2 Committee draft (May 6, 2005) WG14/N1124

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\* /hdrhistogram-2-1-12-sources-jar/org/HdrHistogram/PackedHistogram.java

\* /hdrhistogram-2-1-12-sources-jar/org/HdrHistogram/SingleWriterDoubleRecorder.java



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*
/hdrhistogram-2-1-12-sources-jar/org/HdrHistogram/DoubleRecorder.java
* /hdrhistogram-2-1-12-sources-jar/org/HdrHistogram/DoubleHistogramIterationValue.java
* /hdrhistogram-2-1-12-sources-jar/org/HdrHistogram/AbstractHistogramIterator.java
* /hdrhistogram-2-1-12-sources-jar/org/HdrHistogram/SynchronizedDoubleHistogram.java
* /hdrhistogram-2-1-12-sources-jar/org/HdrHistogram/PercentileIterator.java
* /hdrhistogram-2-1-12-sources-jar/org/HdrHistogram/PackedConcurrentHistogram.java
* /hdrhistogram-2-1-12-sources-jar/org/HdrHistogram/DoubleRecordedValuesIterator.java
* /hdrhistogram-2-1-12-sources-jar/org/HdrHistogram/DoubleAllValuesIterator.java
* /hdrhistogram-2-1-12-sources-jar/org/HdrHistogram/SingleWriterRecorder.java
* /hdrhistogram-2-1-12-sources-jar/org/HdrHistogram/DoubleLogarithmicIterator.java
* /hdrhistogram-2-1-12-sources-jar/org/HdrHistogram/ShortCountsHistogram.java
* /hdrhistogram-2-1-12-sources-jar/org/HdrHistogram/EncodableHistogram.java
*
/hdrhistogram-2-1-12-sources-jar/org/HdrHistogram/HistogramLogScanner.java
* /hdrhistogram-2-1-12-sources-jar/org/HdrHistogram/packedarray/PackedArrayRecorder.java
* /hdrhistogram-2-1-12-sources-jar/org/HdrHistogram/ConcurrentHistogram.java
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```

```

/*
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* as explained at http://creativecommons.org/publicdomain/zero/1.0/
*
* @author Gil Tene
*/

```

```

Found in path(s):
* /hdrhistogram-2-1-12-sources-jar/org/HdrHistogram/AbstractHistogram.java
* /hdrhistogram-2-1-12-sources-jar/org/HdrHistogram/DoubleHistogram.java
No license file was found, but licenses were detected in source scan.

```

```

/**
* Written by Gil Tene of Azul Systems, and released to the public domain,
* as explained at http://creativecommons.org/publicdomain/zero/1.0/
*
* @author Gil Tene
*/

```

```

package org.HdrHistogram;

```

```

final class Version {
 public static final String version="$VERSION$";
 public static final String build_time="$BUILD_TIME$";
}

```

```

Found in path(s):
* /hdrhistogram-2-1-12-sources-jar/org/HdrHistogram/Version.java.template

```

No license file was found, but licenses were detected in source scan.

```
/*
 * package-info.java
 * Written by Gil Tene of Azul Systems, and released to the public domain,
 * as explained at http://creativecommons.org/publicdomain/zero/1.0/
 */
```

Found in path(s):

```
* /hdrhistogram-2-1-12-sources-jar/org/HdrHistogram/package-info.java
```

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```
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 * Written by Gil Tene of Azul Systems, and released to the public domain,
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 */
```

Found in path(s):

```
* /hdrhistogram-2-1-12-sources-jar/org/HdrHistogram/WriterReaderPhaser.java
```

## 1.323 hikaricp 3.4.5

### 1.323.1 Available under license :

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 * WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.
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 */
```

Found in path(s):

```
* /hikaricp-3-4-5-sources-jar/com/zaxxer/hikari/util/PropertyElf.java
* /hikaricp-3-4-5-sources-jar/com/zaxxer/hikari/util/UtilityElf.java
* /hikaricp-3-4-5-sources-jar/com/zaxxer/hikari/pool/ProxyStatement.java
* /hikaricp-3-4-5-sources-jar/com/zaxxer/hikari/pool/ProxyPreparedStatement.java
* /hikaricp-3-4-5-sources-jar/com/zaxxer/hikari/HikariDataSource.java
```

```
*
/hikaricp-3-4-5-sources-jar/com/zaxxer/hikari/metrics/prometheus/PrometheusHistogramMetricsTracker.java
* /hikaricp-3-4-5-sources-jar/com/zaxxer/hikari/hibernate/HikariConnectionProvider.java
* /hikaricp-3-4-5-sources-jar/com/zaxxer/hikari/metrics/prometheus/PrometheusMetricsTracker.java
* /hikaricp-3-4-5-sources-jar/com/zaxxer/hikari/hibernate/HikariConfigurationUtil.java
* /hikaricp-3-4-5-sources-jar/com/zaxxer/hikari/HikariPoolMXBean.java
* /hikaricp-3-4-5-sources-jar/com/zaxxer/hikari/pool/ProxyCallableStatement.java
* /hikaricp-3-4-5-sources-jar/com/zaxxer/hikari/metrics/dropwizard/CodahaleMetricsTrackerFactory.java
* /hikaricp-3-4-5-sources-jar/com/zaxxer/hikari/HikariConfigMXBean.java
No license file was found, but licenses were detected in source scan.
```

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```

Found in path(s):

```
* /hikaricp-3-4-5-sources-jar/com/zaxxer/hikari/metrics/IMetricsTracker.java
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```

```
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*/
```

Found in path(s):

\* /hikaricp-3-4-5-sources-jar/com/zaxxer/hikari/util/ClockSource.java

\* /hikaricp-3-4-5-sources-jar/com/zaxxer/hikari/metrics/PoolStats.java

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Found in path(s):

\* /hikaricp-3-4-5-sources-

jar/com/zaxxer/hikari/metrics/prometheus/PrometheusHistogramMetricsTrackerFactory.java

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Found in path(s):

\* /hikaricp-3-4-5-sources-jar/com/zaxxer/hikari/pool/HikariPool.java

\* /hikaricp-3-4-5-sources-jar/com/zaxxer/hikari/HikariJNDIFactory.java

\* /hikaricp-3-4-5-sources-jar/com/zaxxer/hikari/metrics/dropwizard/CodaHaleMetricsTracker.java

\* /hikaricp-3-4-5-sources-jar/com/zaxxer/hikari/metrics/MetricsTracker.java

\*

/hikaricp-3-4-5-sources-jar/com/zaxxer/hikari/metrics/MetricsTrackerFactory.java

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Found in path(s):

\* /hikaricp-3-4-5-sources-jar/com/zaxxer/hikari/metrics/dropwizard/CodahaleHealthChecker.java

\* /hikaricp-3-4-5-sources-jar/com/zaxxer/hikari/pool/PoolEntry.java

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Found in path(s):

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\* /hikaricp-3-4-5-sources-jar/com/zaxxer/hikari/util/IsolationLevel.java

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\* /hikaricp-3-4-5-sources-jar/com/zaxxer/hikari/pool/PoolBase.java

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- \* /hikaricp-3-4-5-sources-jar/com/zaxxer/hikari/metrics/prometheus/HikariCPCollector.java
- \* /hikaricp-3-4-5-sources-jar/com/zaxxer/hikari/util/ConcurrentBag.java
- \* /hikaricp-3-4-5-sources-jar/com/zaxxer/hikari/pool/ProxyResultSet.java
- \* /hikaricp-3-4-5-sources-jar/com/zaxxer/hikari/util/DriverDataSource.java
- \*
- /hikaricp-3-4-5-sources-jar/com/zaxxer/hikari/util/SuspendResumeLock.java
- \* /hikaricp-3-4-5-sources-jar/com/zaxxer/hikari/util/JavassistProxyFactory.java
- \* /hikaricp-3-4-5-sources-jar/com/zaxxer/hikari/HikariConfig.java
- \* /hikaricp-3-4-5-sources-jar/com/zaxxer/hikari/pool/ProxyConnection.java
- \* /hikaricp-3-4-5-sources-jar/com/zaxxer/hikari/pool/ProxyLeakTaskFactory.java
- \* /hikaricp-3-4-5-sources-jar/com/zaxxer/hikari/pool/ProxyFactory.java
- \* /hikaricp-3-4-5-sources-jar/com/zaxxer/hikari/util/FastList.java
- \* /hikaricp-3-4-5-sources-jar/com/zaxxer/hikari/pool/ProxyLeakTask.java

# 1.324 statistics 2.1

## 1.324.1 Available under license :

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```
<project xmlns="http://maven.apache.org/POM/4.0.0" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="http://maven.apache.org/POM/4.0.0 http://maven.apache.org/maven-v4_0_0.xsd">
 <modelVersion>4.0.0</modelVersion>

 <artifactId>jctools-core</artifactId>
 <groupId>org.jctools</groupId>
 <version>3.0.0</version>
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 <description>Java Concurrency Tools Core Library</description>
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 <dependency>
 <groupId>org.hamcrest</groupId>
 <artifactId>hamcrest-all</artifactId>
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 </dependency>

 <dependency>
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 <groupId>com.google.guava</groupId>
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 </dependency>
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 <plugin>
 <groupId>org.apache.maven.plugins</groupId>
 <artifactId>maven-surefire-plugin</artifactId>
 <version>3.0.0-M3</version>
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 </plugins>
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</project>
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 <groupId>org.apache.felix</groupId>
 <artifactId>maven-bundle-plugin</artifactId>
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 <extensions>true</extensions>
 <configuration>
 <instructions>
 <Import-Package>sun.misc;resolution:=optional</Import-Package>
 </instructions>
 </configuration>
</plugin>
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 </executions>
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</plugins>
</build>

```

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<distributionManagement>

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 <url>https://api.bintray.com/maven/jctools/jctools/jctools-core/;publish=1</url>
</repository>
</distributionManagement>
```

```
<url>https://github.com/JCTools</url>
<inceptionYear>2013</inceptionYear>
```

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<licenses>
 <license>
 <name>Apache
License, Version 2.0</name>
 <url>http://www.apache.org/licenses/LICENSE-2.0.txt</url>
 <distribution>repo</distribution>
 </license>
</licenses>
```

```
<scm>
 <url>https://github.com/JCTools/JCTools</url>
 <connection>scm:git:https://github.com/JCTools/JCTools</connection>
 <tag>HEAD</tag>
</scm>
```

```
<developers>
 <developer>
 <url>https://github.com/nitsanw</url>
 </developer>
 <developer>
 <url>https://github.com/mjpt777</url>
 </developer>
 <developer>
 <url>https://github.com/RichardWarburton</url>
 </developer>
 <developer>
 <url>https://github.com/kay</url>
 </developer>
 <developer>
 <url>https://github.com/franz1981</url>
 </developer>
</developers>
```

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<prerequisites>
 <maven>3.5.0</maven>
</prerequisites>
```

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<properties>
```

```

<project.build.sourceEncoding>UTF-8</project.build.sourceEncoding>
<java.version>1.6</java.version>
<java.test.version>1.8</java.test.version>

<maven.compiler.source>${java.version}</maven.compiler.source>
<maven.compiler.target>${java.version}</maven.compiler.target>
<maven.compiler.testSource>${java.test.version}</maven.compiler.testSource>
<maven.compiler.testTarget>${java.test.version}</maven.compiler.testTarget>

<hamcrest.version>1.3</hamcrest.version>
<junit.version>4.12</junit.version>
<guava-testlib.version>21.0</guava-testlib.version>
</properties>
</project>

```

#### Found

in path(s):

\* /jctools-core-3-0-0-sources-jar/META-INF/maven/org.jctools/jctools-core/pom.xml

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/\*

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*/

```

Found in path(s):

```

* /jctools-core-3-0-0-sources-jar/org/jctools/queues/MessagePassingQueueUtil.java
* /jctools-core-3-0-0-sources-jar/org/jctools/util/UnsafeJvmInfo.java
* /jctools-core-3-0-0-sources-jar/org/jctools/queues/atomic/MpscAtomicArrayQueue.java
* /jctools-core-3-0-0-sources-jar/org/jctools/queues/atomic/MpscLinkedAtomicQueue.java
* /jctools-core-3-0-0-sources-jar/org/jctools/queues/atomic/MpmcAtomicArrayQueue.java
*
* /jctools-core-3-0-0-sources-jar/org/jctools/queues/SpSCGrowArrayQueue.java
* /jctools-core-3-0-0-sources-jar/org/jctools/queues/SpSCArrayQueue.java
* /jctools-core-3-0-0-sources-jar/org/jctools/maps/ConcurrentAutoTable.java
* /jctools-core-3-0-0-sources-jar/org/jctools/maps/NonBlockingIdentityHashMap.java
* /jctools-core-3-0-0-sources-jar/org/jctools/queues/MpscGrowArrayQueue.java
* /jctools-core-3-0-0-sources-jar/org/jctools/util/Pow2.java
* /jctools-core-3-0-0-sources-jar/org/jctools/queues/spec/ConcurrentQueueSpec.java

```

- \* /jctools-core-3-0-0-sources-jar/org/jctools/queues/BaseLinkedQueue.java
- \* /jctools-core-3-0-0-sources-jar/org/jctools/util/InternalAPI.java
- \* /jctools-core-3-0-0-sources-jar/org/jctools/queues/MpmcUnboundedXaddArrayQueue.java
- \* /jctools-core-3-0-0-sources-jar/org/jctools/queues/SpSCLinkedQueue.java
- \* /jctools-core-3-0-0-sources-jar/org/jctools/queues/atomic/SpSCChunkedAtomicArrayQueue.java
- \* /jctools-core-3-0-0-sources-jar/org/jctools/queues/spec/Ordering.java
- \*
- /jctools-core-3-0-0-sources-jar/org/jctools/queues/spec/Preference.java
- \* /jctools-core-3-0-0-sources-jar/org/jctools/maps/AbstractEntry.java
- \* /jctools-core-3-0-0-sources-jar/org/jctools/queues/atomic/MpscGrowableAtomicArrayQueue.java
- \* /jctools-core-3-0-0-sources-jar/org/jctools/queues/atomic/BaseMpscLinkedAtomicArrayQueue.java
- \* /jctools-core-3-0-0-sources-jar/org/jctools/queues/MpscLinkedQueue.java
- \* /jctools-core-3-0-0-sources-jar/org/jctools/queues/package-info.java
- \* /jctools-core-3-0-0-sources-jar/org/jctools/util/RangeUtil.java
- \* /jctools-core-3-0-0-sources-jar/org/jctools/util/PortableJvmInfo.java
- \* /jctools-core-3-0-0-sources-jar/org/jctools/queues/MpscArrayQueue.java
- \* /jctools-core-3-0-0-sources-jar/org/jctools/queues/QueueFactory.java
- \* /jctools-core-3-0-0-sources-jar/org/jctools/queues/atomic/MpscChunkedAtomicArrayQueue.java
- \* /jctools-core-3-0-0-sources-jar/org/jctools/queues/MpscBlockingConsumerArrayQueue.java
- \*
- /jctools-core-3-0-0-sources-jar/org/jctools/queues/ConcurrentSequencedCircularArrayQueue.java
- \* /jctools-core-3-0-0-sources-jar/org/jctools/maps/NonBlockingHashSet.java
- \* /jctools-core-3-0-0-sources-jar/org/jctools/queues/IndexedQueueSizeUtil.java
- \* /jctools-core-3-0-0-sources-jar/org/jctools/queues/atomic/LinkedQueueAtomicNode.java
- \* /jctools-core-3-0-0-sources-jar/org/jctools/queues/MpscCompoundQueue.java
- \* /jctools-core-3-0-0-sources-jar/org/jctools/queues/MpscUnboundedArrayQueue.java
- \* /jctools-core-3-0-0-sources-jar/org/jctools/queues/atomic/SpmcAtomicArrayQueue.java
- \* /jctools-core-3-0-0-sources-jar/org/jctools/queues/MpscUnboundedXaddChunk.java
- \* /jctools-core-3-0-0-sources-jar/org/jctools/queues/atomic/SpSCAtomicArrayQueue.java
- \* /jctools-core-3-0-0-sources-jar/org/jctools/queues/SupportsIterator.java
- \* /jctools-core-3-0-0-sources-jar/org/jctools/queues/atomic/SpSCGrowableAtomicArrayQueue.java
- \* /jctools-core-3-0-0-sources-jar/org/jctools/queues/BaseMpscLinkedArrayQueue.java
- \*
- /jctools-core-3-0-0-sources-jar/org/jctools/queues/atomic/AtomicReferenceArrayQueue.java
- \* /jctools-core-3-0-0-sources-jar/org/jctools/queues/atomic/BaseLinkedAtomicQueue.java
- \* /jctools-core-3-0-0-sources-jar/org/jctools/queues/SpmcArrayQueue.java
- \* /jctools-core-3-0-0-sources-jar/org/jctools/queues/SpSCUnboundedArrayQueue.java
- \* /jctools-core-3-0-0-sources-jar/org/jctools/maps/NonBlockingHashMapLong.java
- \* /jctools-core-3-0-0-sources-jar/org/jctools/queues/ConcurrentCircularArrayQueue.java
- \* /jctools-core-3-0-0-sources-jar/org/jctools/maps/NonBlockingSetInt.java
- \* /jctools-core-3-0-0-sources-jar/org/jctools/queues/MpmcUnboundedXaddChunk.java
- \* /jctools-core-3-0-0-sources-jar/org/jctools/queues/atomic/BaseSpSCLinkedAtomicArrayQueue.java
- \* /jctools-core-3-0-0-sources-jar/org/jctools/queues/MpscChunkedArrayQueue.java
- \* /jctools-core-3-0-0-sources-jar/org/jctools/maps/NonBlockingHashMap.java
- \* /jctools-core-3-0-0-sources-jar/org/jctools/util/UnsafeLongArrayAccess.java
- \* /jctools-core-3-0-0-sources-jar/org/jctools/queues/atomic/SpSCLinkedAtomicQueue.java
- \*



```

/jctools-core-3-0-0-sources-jar/org/jctools/queues/MpscUnboundedXaddArrayQueue.java
* /jctools-core-3-0-0-sources-jar/org/jctools/queues/atomic/MpscUnboundedAtomicArrayQueue.java
* /jctools-core-3-0-0-sources-jar/org/jctools/queues/MessagePassingQueue.java
* /jctools-core-3-0-0-sources-jar/org/jctools/queues/atomic/SequencedAtomicReferenceArrayQueue.java
* /jctools-core-3-0-0-sources-jar/org/jctools/queues/BaseSpSCLinkedArrayQueue.java
* /jctools-core-3-0-0-sources-jar/org/jctools/queues/LinkedQueueNode.java
* /jctools-core-3-0-0-sources-jar/org/jctools/queues/MpmcArrayQueue.java
* /jctools-core-3-0-0-sources-jar/org/jctools/util/UnsafeAccess.java
* /jctools-core-3-0-0-sources-jar/org/jctools/util/UnsafeRefArrayAccess.java
* /jctools-core-3-0-0-sources-jar/org/jctools/queues/SpSCChunkedArrayQueue.java
* /jctools-core-3-0-0-sources-jar/org/jctools/queues/atomic/SpSCUnboundedAtomicArrayQueue.java
* /jctools-core-3-0-0-sources-jar/org/jctools/queues/atomic/AtomicQueueFactory.java

```

## 1.326 jansi-osx 1.8

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```

Found in path(s):

```

* /jansi-osx-1-8-sources-jar/org/fusesource/jansi/internal/Kernel32.java
* /jansi-osx-1-8-sources-jar/org/fusesource/jansi/internal/WindowsSupport.java
* /jansi-osx-1-8-sources-jar/org/fusesource/jansi/internal/CLibrary.java

```

## 1.327 hawtjni-runtime 1.17

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 */
```

Found in path(s):

```
* /jansi-native-1-8-sources-jar/org/fusesource/jansi/internal/WindowsSupport.java
* /jansi-native-1-8-sources-jar/org/fusesource/jansi/internal/CLibrary.java
* /jansi-native-1-8-sources-jar/org/fusesource/jansi/internal/Kernel32.java
```

# 1.329 ehcache-api 3.8.1

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```

Found in path(s):

- \* /ehcache-api-3-8-1-sources-jar/org/ehcache/spi/serialization/SerializerException.java
- \* /ehcache-api-3-8-1-sources-jar/org/ehcache/Status.java
- \* /ehcache-api-3-8-1-sources-jar/org/ehcache/expiry/Expiry.java
- \* /ehcache-api-3-8-1-sources-jar/org/ehcache/spi/resilience/ResilienceStrategy.java
- \* /ehcache-api-3-8-1-sources-jar/org/ehcache/expiry/Expirations.java
- \*
- /ehcache-api-3-8-1-sources-jar/org/ehcache/spi/service/Service.java
- \* /ehcache-api-3-8-1-sources-jar/org/ehcache/spi/serialization/SerializationProvider.java
- \* /ehcache-api-3-8-1-sources-jar/org/ehcache/spi/loaderwriter/CacheWritingException.java
- \* /ehcache-api-3-8-1-sources-jar/org/ehcache/spi/loaderwriter/CacheLoaderWriterConfiguration.java
- \* /ehcache-api-3-8-1-sources-jar/org/ehcache/spi/service/OptionalServiceDependencies.java
- \* /ehcache-api-3-8-1-sources-jar/org/ehcache/CacheManager.java
- \* /ehcache-api-3-8-1-sources-jar/org/ehcache/StateTransitionException.java
- \* /ehcache-api-3-8-1-sources-jar/org/ehcache/spi/persistence/StateHolder.java
- \* /ehcache-api-3-8-1-sources-jar/org/ehcache/spi/resilience/RecoveryStore.java
- \* /ehcache-api-3-8-1-sources-jar/org/ehcache/package-info.java
- \* /ehcache-api-3-8-1-sources-jar/org/ehcache/spi/copy/Copier.java
- \* /ehcache-api-3-8-1-sources-jar/org/ehcache/expiry/ExpiryPolicy.java
- \* /ehcache-api-3-8-1-sources-jar/org/ehcache/config/units/package-info.java
- \*
- /ehcache-api-3-8-1-sources-jar/org/ehcache/spi/service/MaintainableService.java
- \* /ehcache-api-3-8-1-sources-jar/org/ehcache/spi/resilience/StoreAccessException.java
- \* /ehcache-api-3-8-1-sources-jar/org/ehcache/config/Eviction.java
- \* /ehcache-api-3-8-1-sources-jar/org/ehcache/config/CacheConfiguration.java
- \* /ehcache-api-3-8-1-sources-jar/org/ehcache/event/EventOrdering.java
- \* /ehcache-api-3-8-1-sources-jar/org/ehcache/spi/persistence/PersistableResourceService.java
- \* /ehcache-api-3-8-1-sources-jar/org/ehcache/event/package-info.java
- \* /ehcache-api-3-8-1-sources-jar/org/ehcache/config/FluentConfigurationBuilder.java
- \* /ehcache-api-3-8-1-sources-jar/org/ehcache/config/Configuration.java
- \* /ehcache-api-3-8-1-sources-jar/org/ehcache/spi/service/ServiceDependencies.java
- \* /ehcache-api-3-8-1-sources-jar/org/ehcache/ValueSupplier.java
- \* /ehcache-api-3-8-1-sources-jar/org/ehcache/spi/loaderwriter/BulkCacheLoadingException.java
- \* /ehcache-api-3-8-1-sources-jar/org/ehcache/spi/serialization/package-info.java
- \*
- /ehcache-api-3-8-1-sources-jar/org/ehcache/spi/loaderwriter/CacheLoadingException.java
- \* /ehcache-api-3-8-1-sources-jar/org/ehcache/config/ResourceType.java
- \* /ehcache-api-3-8-1-sources-jar/org/ehcache/spi/copy/package-info.java
- \* /ehcache-api-3-8-1-sources-jar/org/ehcache/spi/loaderwriter/WriteBehindConfiguration.java
- \* /ehcache-api-3-8-1-sources-jar/org/ehcache/spi/persistence/package-info.java
- \* /ehcache-api-3-8-1-sources-jar/org/ehcache/event/EventType.java
- \* /ehcache-api-3-8-1-sources-jar/org/ehcache/PersistentUserManagedCache.java
- \* /ehcache-api-3-8-1-sources-jar/org/ehcache/config/ResourcePool.java
- \* /ehcache-api-3-8-1-sources-jar/org/ehcache/config/EvictionAdvisor.java
- \* /ehcache-api-3-8-1-sources-jar/org/ehcache/CacheIterationException.java
- \* /ehcache-api-3-8-1-sources-jar/org/ehcache/spi/service/PluralService.java
- \* /ehcache-api-3-8-1-sources-jar/org/ehcache/spi/service/package-info.java

- \* /ehcache-api-3-8-1-sources-jar/org/ehcache/event/CacheEventListener.java
- \*
- /ehcache-api-3-8-1-sources-jar/org/ehcache/config/ResourceUnit.java
- \* /ehcache-api-3-8-1-sources-jar/org/ehcache/config/Builder.java
- \* /ehcache-api-3-8-1-sources-jar/org/ehcache/spi/loaderwriter/BulkCacheWritingException.java
- \* /ehcache-api-3-8-1-sources-jar/org/ehcache/Cache.java
- \* /ehcache-api-3-8-1-sources-jar/org/ehcache/config/units/MemoryUnit.java
- \* /ehcache-api-3-8-1-sources-jar/org/ehcache/spi/resilience/ResilienceStrategyProvider.java
- \* /ehcache-api-3-8-1-sources-jar/org/ehcache/spi/loaderwriter/package-info.java
- \* /ehcache-api-3-8-1-sources-jar/org/ehcache/spi/loaderwriter/CacheLoaderWriterProvider.java
- \* /ehcache-api-3-8-1-sources-jar/org/ehcache/event/EventFiring.java
- \* /ehcache-api-3-8-1-sources-jar/org/ehcache/UserManagedCache.java
- \* /ehcache-api-3-8-1-sources-jar/org/ehcache/expiry/Duration.java
- \* /ehcache-api-3-8-1-sources-jar/org/ehcache/config/ResourcePools.java
- \* /ehcache-api-3-8-1-sources-jar/org/ehcache/spi/loaderwriter/WriteBehindProvider.java
- \*
- /ehcache-api-3-8-1-sources-jar/org/ehcache/event/CacheEvent.java
- \* /ehcache-api-3-8-1-sources-jar/org/ehcache/config/CacheRuntimeConfiguration.java
- \* /ehcache-api-3-8-1-sources-jar/org/ehcache/config/package-info.java
- \* /ehcache-api-3-8-1-sources-jar/org/ehcache/spi/loaderwriter/CacheLoaderWriter.java
- \* /ehcache-api-3-8-1-sources-jar/org/ehcache/spi/service/ServiceCreationConfiguration.java
- \* /ehcache-api-3-8-1-sources-jar/org/ehcache/spi/copy/CopyProvider.java
- \* /ehcache-api-3-8-1-sources-jar/org/ehcache/expiry/package-info.java
- \* /ehcache-api-3-8-1-sources-jar/org/ehcache/spi/service/ServiceProvider.java
- \* /ehcache-api-3-8-1-sources-jar/org/ehcache/PersistentCacheManager.java
- \* /ehcache-api-3-8-1-sources-jar/org/ehcache/spi/serialization/StatefulSerializer.java
- \* /ehcache-api-3-8-1-sources-jar/org/ehcache/spi/serialization/UnsupportedTypeException.java
- \* /ehcache-api-3-8-1-sources-jar/org/ehcache/config/FluentCacheConfigurationBuilder.java
- \*
- /ehcache-api-3-8-1-sources-jar/org/ehcache/spi/resilience/package-info.java
- \* /ehcache-api-3-8-1-sources-jar/org/ehcache/spi/service/ServiceConfiguration.java
- \* /ehcache-api-3-8-1-sources-jar/org/ehcache/CachePersistenceException.java
- \* /ehcache-api-3-8-1-sources-jar/org/ehcache/config/units/EntryUnit.java
- \* /ehcache-api-3-8-1-sources-jar/org/ehcache/spi/serialization/Serializer.java
- \* /ehcache-api-3-8-1-sources-jar/org/ehcache/spi/persistence/StateRepository.java
- \* /ehcache-api-3-8-1-sources-jar/org/ehcache/config/SizedResourcePool.java

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## 1.331 sequence-generator 5.7.3

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Found in path(s):

\* /sequence-generator-5-7-3-jar/META-INF/maven/org.terracotta.management/sequence-generator/pom.xml

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Manifest-Version: 1.0

Bnd-LastModified: 1563545580901

Build-Jdk: 1.8.0\_202

Built-By: jenkins-slave

Bundle-Description: A set of Java modules for management and monitoring,  
common to several Terracotta products

Bundle-License: <http://www.apache.org/licenses/LICENSE-2.0.txt>

Bundle-ManifestVersion: 2

Bundle-Name: Terracotta Management :: Sequence Generator

Bundle-SymbolicName: org.terracotta.management.sequence-generator  
Bundle-Version: 5.7.3  
Created-By: Apache Maven Bundle Plugin  
Export-Package: org.terracotta.management.sequence;version="5.7.3",org.terracotta.management.sequence.perf;version="5.7.3"  
Main-Class: org.terracotta.management.sequence.perf.PerfTest  
Require-Capability: osgi.ee;filter="(&(osgi.ee=JavaSE)(version=1.8))"  
Tool: Bnd-2.4.1.201501161923

Found in path(s):

\* /sequence-generator-5-7-3-jar/META-INF/MANIFEST.MF

## 1.332 ehcache-107 3.8.1

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```

Found in path(s):

```
* /ehcache-107-3-8-1-sources-jar/org/ehcache/jsr107/internal/Jsr107ServiceConfigurationParser.java
* /ehcache-107-3-8-1-sources-jar/org/ehcache/jsr107/ConfigurationMerger.java
* /ehcache-107-3-8-1-sources-jar/org/ehcache/jsr107/config/Jsr107Configuration.java
* /ehcache-107-3-8-1-sources-jar/org/ehcache/jsr107/config/package-info.java
*
* /ehcache-107-3-8-1-sources-jar/org/ehcache/jsr107/internal/Jsr107CacheConfigurationParser.java
* /ehcache-107-3-8-1-sources-jar/org/ehcache/jsr107/Eh107CacheLoaderWriterProvider.java
* /ehcache-107-3-8-1-sources-jar/org/ehcache/jsr107/Eh107IdentityCopier.java
* /ehcache-107-3-8-1-sources-jar/org/ehcache/jsr107/config/Jsr107CacheConfiguration.java
* /ehcache-107-3-8-1-sources-jar/org/ehcache/jsr107/Jsr107Service.java
* /ehcache-107-3-8-1-sources-jar/org/ehcache/jsr107/EhcacheCachingProvider.java
* /ehcache-107-3-8-1-sources-jar/org/ehcache/jsr107/Eh107Configuration.java
* /ehcache-107-3-8-1-sources-jar/org/ehcache/jsr107/Eh107CacheLoaderWriter.java
```

- \* /ehcache-107-3-8-1-sources-jar/org/ehcache/jsr107/EventListenerAdaptors.java
- \* /ehcache-107-3-8-1-sources-jar/org/ehcache/jsr107/Eh107CacheManager.java
- \* /ehcache-107-3-8-1-sources-jar/org/ehcache/jsr107/DefaultConfigurationResolver.java
- \* /ehcache-107-3-8-1-sources-jar/org/ehcache/jsr107/Eh107CacheMXBean.java
- \* /ehcache-107-3-8-1-sources-jar/org/ehcache/jsr107/Eh107ReverseConfiguration.java
- \*
- /ehcache-107-3-8-1-sources-jar/org/ehcache/jsr107/package-info.java
- \* /ehcache-107-3-8-1-sources-jar/org/ehcache/jsr107/Eh107Expiry.java
- \* /ehcache-107-3-8-1-sources-jar/org/ehcache/jsr107/Eh107CompleteConfiguration.java
- \* /ehcache-107-3-8-1-sources-jar/org/ehcache/jsr107/EhcacheExpiryWrapper.java
- \* /ehcache-107-3-8-1-sources-jar/org/ehcache/jsr107/internal/Js107CacheLoaderWriter.java
- \* /ehcache-107-3-8-1-sources-jar/org/ehcache/jsr107/Eh107CacheEntryEvent.java
- \* /ehcache-107-3-8-1-sources-jar/org/ehcache/jsr107/CacheResources.java
- \* /ehcache-107-3-8-1-sources-jar/org/ehcache/jsr107/Eh107MXBean.java
- \* /ehcache-107-3-8-1-sources-jar/org/ehcache/jsr107/CloseUtil.java
- \* /ehcache-107-3-8-1-sources-jar/org/ehcache/jsr107/config/ConfigurationElementState.java
- \* /ehcache-107-3-8-1-sources-jar/org/ehcache/jsr107/Eh107CacheStatisticsMXBean.java
- \* /ehcache-107-3-8-1-sources-jar/org/ehcache/jsr107/ExpiryPolicyToEhcacheExpiry.java
- \*
- /ehcache-107-3-8-1-sources-jar/org/ehcache/jsr107/Unwrap.java
- \* /ehcache-107-3-8-1-sources-jar/org/ehcache/jsr107/NullCompletionListener.java
- \* /ehcache-107-3-8-1-sources-jar/org/ehcache/jsr107/internal/tck/Eh107MBeanServerBuilder.java
- \* /ehcache-107-3-8-1-sources-jar/org/ehcache/jsr107/internal/DefaultJs107Service.java
- \* /ehcache-107-3-8-1-sources-jar/org/ehcache/jsr107/Eh107Cache.java
- \* /ehcache-107-3-8-1-sources-jar/org/ehcache/jsr107/internal/WrappedCacheLoaderWriter.java
- \* /ehcache-107-3-8-1-sources-jar/org/ehcache/jsr107/ListenerResources.java

## 1.333 ehcache-core 3.8.1

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```

Found in path(s):

- \* /ehcache-core-3-8-1-sources-jar/org/ehcache/core/statistics/ZeroOperationStatistic.java
- \* /ehcache-core-3-8-1-sources-jar/org/ehcache/core/EhcacheManager.java
- \* /ehcache-core-3-8-1-sources-jar/org/ehcache/core/spi/time/TimeSource.java
- \* /ehcache-core-3-8-1-sources-jar/org/ehcache/core/PersistentUserManagedEhcache.java
- \*
- /ehcache-core-3-8-1-sources-jar/org/ehcache/core/exceptions/ExceptionFactory.java
- \* /ehcache-core-3-8-1-sources-jar/org/ehcache/core/spi/LifeCycledAdapter.java
- \* /ehcache-core-3-8-1-sources-jar/org/ehcache/core/spi/store/events/StoreEventFilter.java
- \* /ehcache-core-3-8-1-sources-jar/org/ehcache/core/spi/store/package-info.java
- \* /ehcache-core-3-8-1-sources-jar/org/ehcache/core/spi/time/package-info.java
- \* /ehcache-core-3-8-1-sources-jar/org/ehcache/core/InternalStatus.java
- \* /ehcache-core-3-8-1-sources-jar/org/ehcache/core/statistics/LatencyHistogramConfiguration.java
- \* /ehcache-core-3-8-1-sources-jar/org/ehcache/core/package-info.java
- \* /ehcache-core-3-8-1-sources-jar/org/ehcache/core/events/EventListenerWrapper.java
- \* /ehcache-core-3-8-1-sources-jar/org/ehcache/core/config/store/StoreEventSourceConfiguration.java
- \* /ehcache-core-3-8-1-sources-jar/org/ehcache/core/store/StoreConfigurationImpl.java
- \* /ehcache-core-3-8-1-sources-jar/org/ehcache/core/spi/package-info.java
- \* /ehcache-core-3-8-1-sources-jar/org/ehcache/core/statistics/CacheOperationOutcomes.java
- \*
- /ehcache-core-3-8-1-sources-jar/org/ehcache/core/osgi/EhcacheActivator.java
- \* /ehcache-core-3-8-1-sources-jar/org/ehcache/core/spi/service/CacheManagerProviderService.java
- \* /ehcache-core-3-8-1-sources-jar/org/ehcache/core/events/StoreEventSink.java
- \* /ehcache-core-3-8-1-sources-jar/org/ehcache/core/events/CacheEvents.java
- \* /ehcache-core-3-8-1-sources-jar/org/ehcache/core/Jsr107Cache.java
- \* /ehcache-core-3-8-1-sources-jar/org/ehcache/core/statistics/Jsr107LatencyMonitor.java
- \* /ehcache-core-3-8-1-sources-jar/org/ehcache/core/internal/util/ValueSuppliers.java
- \* /ehcache-core-3-8-1-sources-jar/org/ehcache/core/statistics/DefaultStatisticsServiceFactory.java
- \* /ehcache-core-3-8-1-sources-jar/org/ehcache/core/events/CacheEventDispatcher.java
- \* /ehcache-core-3-8-1-sources-jar/org/ehcache/core/events/CacheEventDispatcherFactory.java
- \* /ehcache-core-3-8-1-sources-jar/org/ehcache/core/internal/resilience/ThrowingResilienceStrategy.java
- \*
- /ehcache-core-3-8-1-sources-jar/org/ehcache/core/config/DefaultConfiguration.java
- \* /ehcache-core-3-8-1-sources-jar/org/ehcache/core/statistics/OperationStatistic.java
- \* /ehcache-core-3-8-1-sources-jar/org/ehcache/core/events/package-info.java
- \* /ehcache-core-3-8-1-sources-jar/org/ehcache/core/statistics/ValueStatistic.java
- \* /ehcache-core-3-8-1-sources-jar/org/ehcache/core/util/CollectionUtil.java
- \* /ehcache-core-3-8-1-sources-jar/org/ehcache/core/spi/store/tiering/package-info.java
- \* /ehcache-core-3-8-1-sources-jar/org/ehcache/core/spi/store/tiering/LowerCachingTier.java
- \* /ehcache-core-3-8-1-sources-jar/org/ehcache/core/EhcacheBase.java
- \* /ehcache-core-3-8-1-sources-jar/org/ehcache/core/config/store/StoreStatisticsConfiguration.java
- \* /ehcache-core-3-8-1-sources-jar/org/ehcache/core/statistics/StatsUtils.java
- \* /ehcache-core-3-8-1-sources-jar/org/ehcache/core/spi/store/ConfigurationChangeSupport.java
- \* /ehcache-core-3-8-1-sources-jar/org/ehcache/core/statistics/package-info.java
- \*
- /ehcache-core-3-8-1-sources-jar/org/ehcache/core/statistics/TierStatistics.java
- \* /ehcache-core-3-8-1-sources-jar/org/ehcache/core/HumanReadable.java

- \* /ehcache-core-3-8-1-sources-jar/org/ehcache/core/spi/service/LocalPersistenceService.java
- \* /ehcache-core-3-8-1-sources-jar/org/ehcache/core/spi/service/StatisticsService.java
- \* /ehcache-core-3-8-1-sources-jar/org/ehcache/core/events/CacheEventListenerConfiguration.java
- \* /ehcache-core-3-8-1-sources-jar/org/ehcache/core/exceptions/StorePassThroughException.java
- \* /ehcache-core-3-8-1-sources-jar/org/ehcache/core/StatusTransitioner.java
- \* /ehcache-core-3-8-1-sources-jar/org/ehcache/core/Ehcache.java
- \* /ehcache-core-3-8-1-sources-jar/org/ehcache/core/spi/time/TickingTimeSource.java
- \* /ehcache-core-3-8-1-sources-jar/org/ehcache/core/events/CacheEventListenerProvider.java
- \* /ehcache-core-3-8-1-sources-jar/org/ehcache/core/SpecIterator.java
- \* /ehcache-core-3-8-1-sources-jar/org/ehcache/core/spi/store/heap/package-info.java
- \*
- /ehcache-core-3-8-1-sources-jar/org/ehcache/core/statistics/LowerCachingTierOperationsOutcome.java
- \* /ehcache-core-3-8-1-sources-jar/org/ehcache/core/statistics/HigherCachingTierOperationOutcomes.java
- \* /ehcache-core-3-8-1-sources-jar/org/ehcache/core/events/CacheManagerListener.java
- \* /ehcache-core-3-8-1-sources-jar/org/ehcache/core/spi/store/heap/SizeOfEngineProvider.java
- \* /ehcache-core-3-8-1-sources-jar/org/ehcache/core/events/StateChangeListener.java
- \* /ehcache-core-3-8-1-sources-jar/org/ehcache/core/CacheConfigurationProperty.java
- \* /ehcache-core-3-8-1-sources-jar/org/ehcache/core/spi/store/Store.java
- \* /ehcache-core-3-8-1-sources-jar/org/ehcache/core/InternalCache.java
- \* /ehcache-core-3-8-1-sources-jar/org/ehcache/core/spi/store/tiering/HigherCachingTier.java
- \* /ehcache-core-3-8-1-sources-jar/org/ehcache/core/config/CoreConfigurationBuilder.java
- \* /ehcache-core-3-8-1-sources-jar/org/ehcache/core/spi/service/FileBasedPersistenceContext.java
- \* /ehcache-core-3-8-1-sources-jar/org/ehcache/core/spi/store/tiering/AuthoritativeTier.java
- \*
- /ehcache-core-3-8-1-sources-jar/org/ehcache/core/events/NullStoreEventDispatcher.java
- \* /ehcache-core-3-8-1-sources-jar/org/ehcache/core/statistics/DefaultStatisticsService.java
- \* /ehcache-core-3-8-1-sources-jar/org/ehcache/core/spi/store/WrapperStore.java
- \* /ehcache-core-3-8-1-sources-jar/org/ehcache/core/statistics/CachingTierOperationOutcomes.java
- \* /ehcache-core-3-8-1-sources-jar/org/ehcache/core/spi/service/ExecutionService.java
- \* /ehcache-core-3-8-1-sources-jar/org/ehcache/core/collections/ConcurrentWeakIdentityHashMap.java
- \* /ehcache-core-3-8-1-sources-jar/org/ehcache/core/events/StoreEventDispatcher.java
- \* /ehcache-core-3-8-1-sources-jar/org/ehcache/core/config/package-info.java
- \* /ehcache-core-3-8-1-sources-jar/org/ehcache/core/spi/LifeCycled.java
- \* /ehcache-core-3-8-1-sources-jar/org/ehcache/core/spi/service/package-info.java
- \* /ehcache-core-3-8-1-sources-jar/org/ehcache/core/InternalRuntimeConfiguration.java
- \*
- /ehcache-core-3-8-1-sources-jar/org/ehcache/core/spi/store/heap/LimitExceededException.java
- \* /ehcache-core-3-8-1-sources-jar/org/ehcache/core/statistics/OperationObserver.java
- \* /ehcache-core-3-8-1-sources-jar/org/ehcache/core/statistics/SourceStatistic.java
- \* /ehcache-core-3-8-1-sources-jar/org/ehcache/core/statistics/TierOperationOutcomes.java
- \* /ehcache-core-3-8-1-sources-jar/org/ehcache/core/statistics/CacheStatistics.java
- \* /ehcache-core-3-8-1-sources-jar/org/ehcache/core/statistics/DefaultCacheStatistics.java
- \* /ehcache-core-3-8-1-sources-jar/org/ehcache/core/spi/service/DiskResourceService.java
- \* /ehcache-core-3-8-1-sources-jar/org/ehcache/core/EhcacheRuntimeConfiguration.java
- \* /ehcache-core-3-8-1-sources-jar/org/ehcache/core/statistics/StoreOperationOutcomes.java
- \* /ehcache-core-3-8-1-sources-jar/org/ehcache/core/resilience/DefaultRecoveryStore.java
- \* /ehcache-core-3-8-1-sources-jar/org/ehcache/core/exceptions/package-info.java
- \* /ehcache-core-3-8-1-sources-jar/org/ehcache/core/CacheConfigurationChangeEvent.java

```

*
/ehcache-core-3-8-1-sources-jar/org/ehcache/core/statistics/BulkOps.java
* /ehcache-core-3-8-1-sources-jar/org/ehcache/core/statistics/DelegatingOperationStatistic.java
* /ehcache-core-3-8-1-sources-jar/org/ehcache/core/spi/store/events/StoreEventSource.java
* /ehcache-core-3-8-1-sources-jar/org/ehcache/core/spi/service/ServiceUtils.java
* /ehcache-core-3-8-1-sources-jar/org/ehcache/core/spi/ServiceLocator.java
* /ehcache-core-3-8-1-sources-jar/org/ehcache/core/spi/store/events/StoreEvent.java
* /ehcache-core-3-8-1-sources-jar/org/ehcache/core/statistics/AuthoritativeTierOperationOutcomes.java
* /ehcache-core-3-8-1-sources-jar/org/ehcache/core/osgi/SafeOsgi.java
* /ehcache-core-3-8-1-sources-jar/org/ehcache/core/statistics/DelegatingOperationObserver.java
* /ehcache-core-3-8-1-sources-jar/org/ehcache/core/CacheConfigurationChangeListener.java
* /ehcache-core-3-8-1-sources-jar/org/ehcache/core/util/ClassLoading.java
* /ehcache-core-3-8-1-sources-jar/org/ehcache/core/util/ByteBufferInputStream.java
*
/ehcache-core-3-8-1-sources-jar/org/ehcache/core/spi/store/InternalCacheManager.java
* /ehcache-core-3-8-1-sources-jar/org/ehcache/core/statistics/SuppliedValueStatistic.java
* /ehcache-core-3-8-1-sources-jar/org/ehcache/core/statistics/DefaultTierStatistics.java
* /ehcache-core-3-8-1-sources-jar/org/ehcache/core/spi/store/events/package-info.java
* /ehcache-core-3-8-1-sources-jar/org/ehcache/core/DefaultCacheManagerProviderService.java
* /ehcache-core-3-8-1-sources-jar/org/ehcache/core/config/store/package-info.java
* /ehcache-core-3-8-1-sources-jar/org/ehcache/core/statistics/ChainedObserver.java
* /ehcache-core-3-8-1-sources-jar/org/ehcache/core/config/ExpiryUtils.java
* /ehcache-core-3-8-1-sources-jar/org/ehcache/core/spi/store/AbstractWrapperStoreProvider.java
* /ehcache-core-3-8-1-sources-jar/org/ehcache/core/statistics/ChainedOperationObserver.java
* /ehcache-core-3-8-1-sources-jar/org/ehcache/core/store/StoreSupport.java
*
/ehcache-core-3-8-1-sources-jar/org/ehcache/core/spi/store/tiering/CachingTier.java
* /ehcache-core-3-8-1-sources-jar/org/ehcache/core/spi/service/ServiceFactory.java
* /ehcache-core-3-8-1-sources-jar/org/ehcache/core/spi/store/AbstractValueHolder.java
* /ehcache-core-3-8-1-sources-jar/org/ehcache/core/spi/time/SystemTimeSource.java
* /ehcache-core-3-8-1-sources-jar/org/ehcache/core/spi/store/heap/SizeOfEngine.java
* /ehcache-core-3-8-1-sources-jar/org/ehcache/core/osgi/OsgiServiceLoader.java
* /ehcache-core-3-8-1-sources-jar/org/ehcache/core/spi/time/TimeSourceService.java
* /ehcache-core-3-8-1-sources-jar/org/ehcache/core/spi/store/events/StoreEventListener.java
* /ehcache-core-3-8-1-sources-jar/org/ehcache/core/statistics/DelegatedMappedOperationStatistics.java

```

## 1.334 management-model 5.7.3

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Found in path(s):

- \* /management-model-5-7-3-sources-jar/org/terracotta/management/model/message/DefaultManagementCallMessage.java
- \* /management-model-5-7-3-sources-jar/org/terracotta/management/model/stats/Sample.java
- \* /management-model-5-7-3-sources-jar/org/terracotta/management/model/call/ContextualCall.java
- \* /management-model-5-7-3-sources-jar/org/terracotta/management/model/stats/DelegatingStatistic.java
- \*
- /management-model-5-7-3-sources-jar/org/terracotta/management/model/capabilities/descriptors/Descriptor.java
- \* /management-model-5-7-3-sources-jar/org/terracotta/management/model/stats/Statistic.java
- \* /management-model-5-7-3-sources-jar/org/terracotta/management/model/capabilities/context/CapabilityContext.java
- \* /management-model-5-7-3-sources-jar/org/terracotta/management/model/call/Parameter.java
- \* /management-model-5-7-3-sources-jar/org/terracotta/management/model/capabilities/descriptors/CallDescriptor.java
- \* /management-model-5-7-3-sources-jar/org/terracotta/management/model/stats/ContextualStatistics.java
- \* /management-model-5-7-3-sources-jar/org/terracotta/management/model/capabilities/descriptors/StatisticDescriptor.java
- \* /management-model-5-7-3-sources-jar/org/terracotta/management/model/capabilities/DefaultCapability.java
- \* /management-model-5-7-3-sources-jar/org/terracotta/management/model/context/ContextContainer.java
- \*
- /management-model-5-7-3-sources-jar/org/terracotta/management/model/context/Context.java
- \* /management-model-5-7-3-sources-jar/org/terracotta/management/model/capabilities/Capability.java
- \* /management-model-5-7-3-sources-jar/org/terracotta/management/model/message/ManagementCallMessage.java
- \* /management-model-5-7-3-sources-jar/org/terracotta/management/model/stats/StatisticRegistry.java
- \* /management-model-5-7-3-sources-jar/org/terracotta/management/model/message/DefaultMessage.java
- \* /management-model-5-7-3-sources-jar/org/terracotta/management/model/call/ContextualReturn.java
- \* /management-model-5-7-3-sources-jar/org/terracotta/management/model/message/Message.java
- \* /management-model-5-7-3-sources-jar/org/terracotta/management/model/cluster/ClientIdentifier.java
- \* /management-model-5-7-3-sources-jar/org/terracotta/management/model/capabilities/descriptors/Settings.java
- \* /management-model-5-7-3-sources-jar/org/terracotta/management/model/notification/ContextualNotification.java
- \*
- /management-model-5-7-3-sources-jar/org/terracotta/management/model/context/Contextual.java
- \* /management-model-5-7-3-sources-jar/org/terracotta/management/model/stats/StatisticType.java
- \* /management-model-5-7-3-sources-jar/org/terracotta/management/model/stats/DelegatingSample.java

# 1.335 ehcache-xml 3.8.1

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 */
```

Found in path(s):

```
* /ehcache-xml-3-8-1-sources-jar/org/ehcache/xml/BaseConfigParser.java
* /ehcache-xml-3-8-1-sources-jar/org/ehcache/xml/service/OffHeapDiskStoreConfigurationParser.java
* /ehcache-xml-3-8-1-sources-jar/org/ehcache/xml/exceptions/XmlConfigurationException.java
* /ehcache-xml-3-8-1-sources-jar/org/ehcache/xml/JaxbHelper.java
*
* /ehcache-xml-3-8-1-sources-jar/org/ehcache/xml/provider/ThreadPoolServiceCreationConfigurationParser.java
* /ehcache-xml-3-8-1-sources-jar/org/ehcache/xml/DomUtil.java
* /ehcache-xml-3-8-1-sources-jar/org/ehcache/xml/XmlModel.java
* /ehcache-xml-3-8-1-sources-jar/org/ehcache/xml/provider/WriteBehindProviderConfigurationParser.java
* /ehcache-xml-3-8-1-sources-jar/org/ehcache/xml/ServiceConfigurationParser.java
* /ehcache-xml-3-8-1-sources-jar/org/ehcache/xml/ServiceCreationConfigurationParser.java
* /ehcache-xml-3-8-1-sources-jar/org/ehcache/xml/ResourceConfigurationParser.java
* /ehcache-xml-3-8-1-sources-jar/org/ehcache/xml/CacheServiceConfigurationParser.java
* /ehcache-xml-3-8-1-sources-jar/org/ehcache/xml/CoreCacheConfigurationParser.java
* /ehcache-xml-3-8-1-sources-jar/org/ehcache/xml/CacheManagerServiceConfigurationParser.java
* /ehcache-xml-3-8-1-sources-jar/org/ehcache/xml/service/DefaultCopierConfigurationParser.java
* /ehcache-xml-3-8-1-sources-jar/org/ehcache/xml/CoreServiceConfigurationParser.java
*
* /ehcache-xml-3-8-1-sources-jar/org/ehcache/xml/provider/CacheEventDispatcherFactoryConfigurationParser.java
* /ehcache-xml-3-8-1-sources-jar/org/ehcache/xml/provider/DefaultSizeOfEngineProviderConfigurationParser.java
* /ehcache-xml-3-8-1-sources-jar/org/ehcache/xml/service/DefaultCacheEventListenerConfigurationParser.java
* /ehcache-xml-3-8-1-sources-jar/org/ehcache/xml/model/SizeOfEngineLimits.java
* /ehcache-xml-3-8-1-sources-jar/org/ehcache/xml/model/ListenersConfig.java
* /ehcache-xml-3-8-1-sources-jar/org/ehcache/xml/model/Expiry.java
* /ehcache-xml-3-8-1-sources-jar/org/ehcache/xml/multi/XmlMultiConfiguration.java
```



```

* /ehcache-xml-3-8-1-sources-jar/org/ehcache/xml/provider/PooledExecutionServiceConfigurationParser.java
* /ehcache-xml-3-8-1-sources-jar/org/ehcache/xml/service/DefaultSerializerConfigurationParser.java
* /ehcache-xml-3-8-1-sources-jar/org/ehcache/xml/service/SimpleCoreServiceConfigurationParser.java
* /ehcache-xml-3-8-1-sources-jar/org/ehcache/xml/service/DefaultCacheEventDispatcherConfigurationParser.java
*
/ehcache-xml-3-8-1-sources-jar/org/ehcache/xml/provider/DefaultCopyProviderConfigurationParser.java
* /ehcache-xml-3-8-1-sources-jar/org/ehcache/xml/XmlConfiguration.java
* /ehcache-xml-3-8-1-sources-jar/org/ehcache/xml/service/DefaultCacheLoaderWriterConfigurationParser.java
* /ehcache-xml-3-8-1-sources-jar/org/ehcache/xml/model/CacheTemplate.java
* /ehcache-xml-3-8-1-sources-jar/org/ehcache/xml/CoreServiceCreationConfigurationParser.java
* /ehcache-xml-3-8-1-sources-jar/org/ehcache/xml/ConfigurationParser.java
* /ehcache-xml-3-8-1-sources-jar/org/ehcache/xml/provider/DefaultSerializationProviderConfigurationParser.java
* /ehcache-xml-3-8-1-sources-jar/org/ehcache/xml/service/DefaultResilienceStrategyConfigurationParser.java
* /ehcache-xml-3-8-1-sources-jar/org/ehcache/xml/service/DefaultSizeOfEngineConfigurationParser.java
* /ehcache-xml-3-8-1-sources-jar/org/ehcache/xml/provider/SimpleCoreServiceCreationConfigurationParser.java
*
/ehcache-xml-3-8-1-sources-jar/org/ehcache/xml/service/DefaultWriteBehindConfigurationParser.java
* /ehcache-xml-3-8-1-sources-jar/org/ehcache/xml/provider/CacheManagerPersistenceConfigurationParser.java
* /ehcache-xml-3-8-1-sources-jar/org/ehcache/xml/CacheResourceConfigurationParser.java
* /ehcache-xml-3-8-1-sources-jar/org/ehcache/xml/model/CacheDefinition.java
* /ehcache-xml-3-8-1-sources-jar/org/ehcache/xml/provider/OffHeapDiskStoreProviderConfigurationParser.java
* /ehcache-xml-3-8-1-sources-jar/org/ehcache/xml/model/CacheSpec.java

```

## 1.336 offheap-store 2.4.3

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```

Found in path(s):

```

* /offheap-store-2-4-3-sources-
jar/org/terracotta/offheapstore/disk/persistent/AbstractPersistentConcurrentOffHeapCache.java

```

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 */
```

Found in path(s):

```
* /offheap-store-2-4-3-sources-
jar/org/terracotta/offheapstore/concurrent/WriteLockedOffHeapHashMapFactory.java
* /offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/AbstractOffHeapClockCache.java
* /offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/concurrent/AbstractConcurrentOffHeapCache.java
*
/offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/disk/storage/FileBackedStorageEngine.java
* /offheap-store-2-4-3-sources-
jar/org/terracotta/offheapstore/eviction/EvictionListeningReadWriteLockedOffHeapClockCache.java
* /offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/concurrent/ConcurrentOffHeapClockCache.java
* /offheap-store-2-4-3-sources-
jar/org/terracotta/offheapstore/disk/persistent/PersistentReadWriteLockedOffHeapClockCacheFactory.java
* /offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/storage/SplitStorageEngine.java
* /offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/Segment.java
* /offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/storage/OffHeapBufferHalfStorageEngine.java
* /offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/disk/paging/PowerOfTwoFileAllocator.java
* /offheap-store-2-4-3-sources-
jar/org/terracotta/offheapstore/concurrent/ReadWriteLockedOffHeapHashMapFactory.java
*
/offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/storage/PointerSize.java
* /offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/storage/portability/SerializablePortability.java
* /offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/storage/allocator/LongBestFitAllocator.java
* /offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/storage/StorageEngine.java
* /offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/util/PhysicalMemory.java
* /offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/buffersource/TimingBufferSource.java
* /offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/disk/paging/MappedPageSource.java
* /offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/paging/PhantomReferenceLimitedPageSource.java
* /offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/storage/IntegerStorageEngine.java
* /offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/HashingMap.java
* /offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/util/AATreeSet.java
```

```

*
/offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/storage/LongStorageEngine.java
* /offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/disk/storage/PersistentSplitStorageEngine.java
* /offheap-store-2-4-3-sources-
jar/org/terracotta/offheapstore/concurrent/ConcurrentWriteLockedOffHeapClockCache.java
* /offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/storage/listener/AbstractListenableStorageEngine.java
* /offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/util/WeakIdentityHashMap.java
* /offheap-store-2-4-3-sources-
jar/org/terracotta/offheapstore/disk/persistent/PersistentReadWriteLockedOffHeapHashMapFactory.java
* /offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/paging/UpfrontAllocatingPageSource.java
* /offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/storage/HalfStorageEngine.java
* /offheap-store-2-4-3-sources-
jar/org/terracotta/offheapstore/concurrent/ConcurrentWriteLockedOffHeapHashMap.java
*
/offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/storage/allocator/PowerOfTwoAllocator.java
* /offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/util/Retryer.java
* /offheap-store-2-4-3-sources-
jar/org/terracotta/offheapstore/concurrent/ReadWriteLockedOffHeapClockCacheFactory.java
* /offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/storage/OffHeapBufferStorageEngine.java
* /offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/disk/storage/PersistentIntegerStorageEngine.java
* /offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/util/FindbugsSuppressWarnings.java
* /offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/concurrent/AbstractConcurrentOffHeapMap.java
* /offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/set/OffHeapHashSet.java
* /offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/storage/SerializableStorageEngine.java
* /offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/MetadataTuple.java
*
/offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/storage/PortabilityBasedHalfStorageEngine.java
* /offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/storage/StringStorageEngine.java
* /offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/disk/storage/AATreeFileAllocator.java
* /offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/OffHeapHashMap.java
* /offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/storage/PortabilityBasedStorageEngine.java
* /offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/paging/OffHeapStorageArea.java
* /offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/util/ByteBufferUtils.java
* /offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/concurrent/ConcurrentOffHeapHashMap.java
* /offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/AbstractLockedOffHeapHashMap.java
* /offheap-store-2-4-3-sources-
jar/org/terracotta/offheapstore/concurrent/WriteLockedOffHeapClockCacheFactory.java
*
/offheap-store-2-4-3-sources-
jar/org/terracotta/offheapstore/disk/persistent/PersistentConcurrentOffHeapClockCache.java
* /offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/storage/BooleanHalfStorageEngine.java
* /offheap-store-2-4-3-sources-
jar/org/terracotta/offheapstore/eviction/EvictionListeningWriteLockedOffHeapClockCache.java
* /offheap-store-2-4-3-sources-
jar/org/terracotta/offheapstore/disk/persistent/PersistentConcurrentOffHeapHashMap.java
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Found in path(s):

\* /offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/eviction/EvictionListener.java  
 \* /offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/util/DebuggingUtils.java  
 \* /offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/storage/allocator/Allocator.java  
 \* /offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/storage/BinaryStorageEngine.java  
 \*  
 /offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/ReadWriteLockedOffHeapHashMap.java  
 \* /offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/storage/portability/Portability.java  
 \* /offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/disk/persistent/PersistentPortability.java  
 \* /offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/pinning/PinnableSegment.java  
 \* /offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/exceptions/OversizeMappingException.java  
 \* /offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/WriteLockedOffHeapHashMap.java  
 \* /offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/util/Validation.java  
 \* /offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/pinning/PinnableCache.java  
 \* /offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/buffersource/HeapBufferSource.java  
 \* /offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/buffersource/OffHeapBufferSource.java  
 \*  
 /offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/paging/Page.java  
 \* /offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/disk/persistent/Persistent.java  
 \* /offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/disk/persistent/PersistentStorageEngine.java  
 \* /offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/paging/PageSource.java  
 \* /offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/storage/listener/RuntimeStorageEngineListener.java  
 \* /offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/storage/portability/ByteArrayPortability.java  
 \* /offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/storage/portability/BooleanPortability.java  
 \* /offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/Metadata.java  
 \* /offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/WriteLockedOffHeapClockCache.java  
 \* /offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/disk/storage/portability/PersistentSerializablePortability.java  
 \*  
 /offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/disk/persistent/AbstractPersistentOffHeapCache.java  
 \* /offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/storage/listener/RecoveryStorageEngineListener.java  
 \* /offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/disk/storage/Region.java  
 \* /offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/util/ByteBufferInputStream.java

```

* /offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/disk/persistent/PersistentHalfStorageEngine.java
* /offheap-store-2-4-3-sources-
jar/org/terracotta/offheapstore/disk/storage/portability/PersistentByteArrayPortability.java
* /offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/util/Factory.java
* /offheap-store-2-4-3-sources-
jar/org/terracotta/offheapstore/disk/persistent/PersistentReadWriteLockedOffHeapHashMap.java
* /offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/storage/listener/StorageEngineListener.java
*
/offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/disk/paging/MappedPage.java
* /offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/buffersource/BufferSource.java
* /offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/util/NoOpLock.java
* /offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/storage/portability/WriteContext.java
* /offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/storage/portability/WriteBackPortability.java
* /offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/storage/portability/StringPortability.java
* /offheap-store-2-4-3-sources-
jar/org/terracotta/offheapstore/disk/persistent/AbstractPersistentLockedOffHeapHashMap.java
* /offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/storage/listener/ListenableStorageEngine.java
* /offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/MapInternals.java
* /offheap-store-2-4-3-sources-
jar/org/terracotta/offheapstore/disk/persistent/PersistentReadWriteLockedOffHeapClockCache.java
*
/offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/paging/UnlimitedPageSource.java
* /offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/storage/allocator/IntegerBestFitAllocator.java
* /offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/util/MemoryUnit.java
* /offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/ReadWriteLockedOffHeapClockCache.java
* /offheap-store-2-4-3-sources-
jar/org/terracotta/offheapstore/disk/persistent/AbstractPersistentConcurrentOffHeapMap.java
* /offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/storage/allocator/Region.java
* /offheap-store-2-4-3-sources-jar/org/terracotta/offheapstore/concurrent/ConcurrentMapInternals.java
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Found in path(s):

```

* /offheap-store-2-4-3-sources-jar/META-INF/maven/org.terracotta/offheap-store/pom.xml

```

# 1.337 ehcache-impl 3.8.1

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```

Found in path(s):

```
* /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/internal/store/basic/NopStore.java
* /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/internal/resilience/RobustLoaderWriterResilienceStrategy.java
* /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/serialization/StringSerializer.java
* /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/internal/DefaultTimeSourceService.java
*
* /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/internal/resilience/AbstractResilienceStrategy.java
* /ehcache-impl-3-8-1-sources-
jar/org/ehcache/impl/config/loaderwriter/DefaultCacheLoaderWriterConfiguration.java
* /ehcache-impl-3-8-1-sources-
jar/org/ehcache/impl/internal/spi/serialization/DefaultSerializationProviderFactory.java
* /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/events/CacheEventDispatcherImpl.java
* /ehcache-impl-3-8-1-sources-
jar/org/ehcache/impl/config/resilience/DefaultResilienceStrategyProviderConfiguration.java
* /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/serialization/IntegerSerializer.java
* /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/internal/loaderwriter/writebehind/AbstractWriteBehind.java
* /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/internal/store/heap/Backend.java
* /ehcache-impl-3-8-1-sources-jar/org/ehcache/config/builders/WriteBehindConfigurationBuilder.java
* /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/internal/executor/OnDemandExecutionService.java
*
* /ehcache-impl-3-8-1-sources-jar/org/ehcache/config/builders/CacheManagerConfiguration.java
* /ehcache-impl-3-8-1-sources-jar/org/ehcache/config/builders/CacheEventListenerConfigurationBuilder.java
* /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/persistence/package-info.java
* /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/internal/sizeof/NoopSizeOfEngine.java
* /ehcache-impl-3-8-1-sources-
```

```

jar/org/ehcache/impl/config/loaderwriter/DefaultCacheLoaderWriterProviderConfiguration.java
* /ehcache-impl-3-8-1-sources-
jar/org/ehcache/impl/config/store/heap/DefaultSizeOfEngineProviderConfiguration.java
* /ehcache-impl-3-8-1-sources-
jar/org/ehcache/impl/internal/store/disk/EhcachePersistentConcurrentOffHeapClockCache.java
* /ehcache-impl-3-8-1-sources-
jar/org/ehcache/impl/internal/spi/resilience/DefaultResilienceStrategyProviderFactory.java
* /ehcache-impl-3-8-1-sources-
jar/org/ehcache/impl/internal/loaderwriter/writebehind/operations/BatchOperation.java
*
/ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/serialization/CompactJavaSerializer.java
* /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/config/persistence/CacheManagerPersistenceConfiguration.java
* /ehcache-impl-3-8-1-sources-
jar/org/ehcache/impl/config/serializer/DefaultSerializationProviderConfiguration.java
* /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/internal/resilience/RobustResilienceStrategy.java
* /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/serialization/TransientStateHolder.java
* /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/persistence/FileUtils.java
* /ehcache-impl-3-8-1-sources-
jar/org/ehcache/impl/internal/loaderwriter/writebehind/WriteBehindProviderFactory.java
* /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/internal/executor/OutOfBandScheduledExecutor.java
* /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/config/event/DefaultCacheEventListenerConfiguration.java
* /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/internal/classes/ClassInstanceProviderConfiguration.java
*
/ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/serialization/LongSerializer.java
* /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/internal/executor/DefaultExecutionServiceFactory.java
* /ehcache-impl-3-8-1-sources-
jar/org/ehcache/impl/internal/store/disk/factories/EhcachePersistentSegmentFactory.java
* /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/internal/store/heap/OnHeapStoreProviderFactory.java
* /ehcache-impl-3-8-1-sources-
jar/org/ehcache/impl/internal/store/loaderwriter/LocalWriteBehindLoaderWriterStore.java
* /ehcache-impl-3-8-1-sources-
jar/org/ehcache/impl/internal/loaderwriter/writebehind/operations/SingleOperation.java
* /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/internal/spi/resilience/DefaultResilienceStrategyProvider.java
* /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/internal/store/offheap/BinaryOffHeapValueHolder.java
* /ehcache-impl-3-8-1-sources-
jar/org/ehcache/impl/internal/spi/loaderwriter/DefaultCacheLoaderWriterProviderFactory.java
*
/ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/events/CacheEventAdapter.java
* /ehcache-impl-3-8-1-sources-jar/org/ehcache/config/builders/PooledExecutionServiceConfigurationBuilder.java
* /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/copy/IdentityCopier.java
* /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/config/store/disk/OffHeapDiskStoreConfiguration.java
* /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/internal/executor/ExecutorUtil.java
* /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/config/persistence/UserManagedPersistenceContext.java
* /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/internal/persistence/DefaultDiskResourceServiceFactory.java
* /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/internal/events/ThreadLocalStoreEventDispatcher.java
* /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/internal/TimeSourceConfiguration.java
* /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/config/event/DefaultCacheEventDispatcherConfiguration.java
*

```

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/ehcache-impl-3-8-1-sources-
jar/org/ehcache/impl/internal/loaderwriter/writebehind/NonBatchingLocalHeapWriteBehindQueue.java
* /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/config/copy/DefaultCopyProviderConfiguration.java
* /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/internal/store/offheap/OffHeapStore.java
* /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/internal/events/FudgingInvocationScopedEventSink.java
* /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/config/event/package-info.java
* /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/copy/SerializingCopier.java
* /ehcache-impl-3-8-1-sources-
jar/org/ehcache/impl/config/loaderwriter/writebehind/DefaultBatchingConfiguration.java
* /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/config/store/disk/OffHeapDiskStoreProviderConfiguration.java
* /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/config/event/DefaultEventSourceConfiguration.java
* /ehcache-impl-3-8-1-sources-jar/org/ehcache/config/builders/UserManagedCacheBuilder.java
*
/ehcache-impl-3-8-1-sources-
jar/org/ehcache/impl/internal/store/loaderwriter/LoaderWriterStoreProviderFactory.java
* /ehcache-impl-3-8-1-sources-jar/org/ehcache/config/builders/ResourcePoolsBuilder.java
* /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/internal/store/heap/holders/OnHeapValueHolder.java
* /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/internal/sizeof/DefaultSizeOfEngine.java
* /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/internal/store/heap/SimpleBackend.java
* /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/internal/store/tiering/TieredStoreProviderFactory.java
* /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/internal/store/BinaryValueHolder.java
* /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/internal/spi/copy/DefaultCopyProvider.java
* /ehcache-impl-3-8-1-sources-
jar/org/ehcache/impl/config/loaderwriter/writebehind/WriteBehindProviderConfiguration.java
* /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/internal/store/offheap/factories/EhcacheSegmentFactory.java
*
/ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/internal/events/CloseableStoreEventSink.java
* /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/serialization/PlainJavaSerializer.java
* /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/config/serializer/DefaultSerializerConfiguration.java
* /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/internal/store/heap/holders/SerializedOnHeapValueHolder.java
* /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/config/loaderwriter/package-info.java
* /ehcache-impl-3-8-1-sources-
jar/org/ehcache/impl/internal/spi/event/DefaultCacheEventListenerProviderFactory.java
* /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/internal/store/disk/OffHeapDiskStore.java
* /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/internal/spi/serialization/DefaultSerializationProvider.java
* /ehcache-impl-3-8-1-sources-
jar/org/ehcache/impl/internal/store/tiering/CompoundCachingTierProviderFactory.java
* /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/internal/store/offheap/EhcacheOffHeapBackingMap.java
*
/ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/internal/events/DisabledCacheEventNotificationService.java
* /ehcache-impl-3-8-1-sources-
jar/org/ehcache/impl/internal/loaderwriter/writebehind/BatchingLocalHeapWriteBehindQueue.java
* /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/internal/executor/PooledExecutionService.java
* /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/internal/store/offheap/OffHeapMapStatistics.java
* /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/internal/store/offheap/SwitchableEvictionAdvisor.java
* /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/internal/util/ThreadFactoryUtil.java
* /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/config/serializer/package-info.java
* /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/internal/store/tiering/TieredStore.java

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\* /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/internal/loaderwriter/writebehind/WriteBehind.java  
 \* /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/copy/package-info.java  
 \*  
 /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/internal/store/offheap/BasicOffHeapValueHolder.java  
 \* /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/store/DefaultStoreEventDispatcher.java  
 \* /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/internal/events/AbstractStoreEventDispatcher.java  
 \* /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/internal/classes/ClassInstanceProvider.java  
 \* /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/internal/store/loaderwriter/LoaderWriterStoreProvider.java  
 \* /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/serialization/TransientStateRepository.java  
 \* /ehcache-impl-3-8-1-sources-  
 jar/org/ehcache/impl/internal/loaderwriter/writebehind/operations/WriteOperation.java  
 \* /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/internal/events/StoreEvents.java  
 \* /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/persistence/DefaultLocalPersistenceService.java  
 \* /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/config/executor/package-info.java  
 \*  
 /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/internal/spi/event/DefaultCacheEventListenerProvider.java  
 \* /ehcache-impl-3-8-1-sources-  
 jar/org/ehcache/impl/internal/loaderwriter/writebehind/operations/KeyBasedOperation.java  
 \* /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/serialization/CharSerializer.java  
 \* /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/internal/executor/PartitionedUnorderedExecutor.java  
 \* /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/config/loaderwriter/writebehind/package-info.java  
 \* /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/config/ResourcePoolsImpl.java  
 \* /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/config/BaseCacheConfiguration.java  
 \* /ehcache-impl-3-8-1-sources-jar/org/ehcache/config/builders/CacheConfigurationBuilder.java  
 \* /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/internal/util/Pacer.java  
 \* /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/config/executor/PooledExecutionServiceConfiguration.java  
 \*  
 /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/internal/store/offheap/OffHeapValueHolder.java  
 \* /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/config/store/heap/DefaultSizeOfEngineConfiguration.java  
 \* /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/internal/events/CacheEventDispatcherFactoryImpl.java  
 \* /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/internal/concurrent/package-info.java  
 \* /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/internal/executor/PartitionedScheduledExecutor.java  
 \* /ehcache-impl-3-8-1-sources-  
 jar/org/ehcache/impl/internal/store/offheap/EhcacheConcurrentOffHeapClockCache.java  
 \* /ehcache-impl-3-8-1-sources-  
 jar/org/ehcache/impl/internal/persistence/DefaultLocalPersistenceServiceFactory.java  
 \* /ehcache-impl-3-8-1-sources-  
 jar/org/ehcache/impl/internal/events/CacheEventNotificationListenerServiceProviderFactory.java  
 \* /ehcache-impl-3-8-1-sources-  
 jar/org/ehcache/impl/internal/loaderwriter/writebehind/operations/DeleteOperation.java  
 \* /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/serialization/package-info.java  
 \*  
 /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/internal/store/offheap/OffHeapStoreUtils.java  
 \* /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/internal/events/StoreEventImpl.java  
 \* /ehcache-impl-3-8-1-sources-jar/org/ehcache/config/builders/UserManagedCacheConfiguration.java  
 \* /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/internal/store/offheap/MemorySizeParser.java  
 \* /ehcache-impl-3-8-1-sources-  
 jar/org/ehcache/impl/internal/loaderwriter/writebehind/operations/WriteAllOperation.java

- \* /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/internal/store/heap/holders/LookupOnlyOnHeapKey.java
- \* /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/internal/events/FireableStoreEventHandler.java
- \* /ehcache-impl-3-8-1-sources-
- jar/org/ehcache/impl/internal/loaderwriter/writebehind/operations/DeleteAllOperation.java
- \* /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/internal/store/disk/OffHeapDiskStoreProviderFactory.java
- \* /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/internal/store/loaderwriter/LocalLoaderWriterStore.java
- \*
- /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/internal/loaderwriter/writebehind/StripedWriteBehind.java
- \* /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/internal/classes/ClassInstanceConfiguration.java
- \* /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/serialization/FloatSerializer.java
- \* /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/internal/concurrent/EvictingConcurrentMap.java
- \* /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/persistence/FileBasedStateRepository.java
- \* /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/config/copy/package-info.java
- \* /ehcache-impl-3-8-1-sources-jar/org/ehcache/config/builders/package-info.java
- \* /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/internal/store/heap/holders/OnHeapKey.java
- \* /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/internal/store/heap/OnHeapStrategy.java
- \* /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/config/store/heap/package-info.java
- \*
- /ehcache-impl-3-8-1-sources-
- jar/org/ehcache/impl/internal/sizeof/listeners/exceptions/VisitorListenerException.java
- \* /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/internal/store/heap/holders/BaseOnHeapKey.java
- \* /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/config/resilience/DefaultResilienceStrategyConfiguration.java
- \* /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/internal/store/heap/holders/CopiedOnHeapKey.java
- \* /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/internal/store/heap/holders/CopiedOnHeapValueHolder.java
- \* /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/serialization/DoubleSerializer.java
- \* /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/internal/executor/PartitionedOrderedExecutor.java
- \* /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/config/AbstractResourcePool.java
- \* /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/config/store/disk/package-info.java
- \* /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/internal/store/tiering/CompoundCachingTier.java
- \*
- /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/internal/store/offheap/LazyOffHeapValueHolder.java
- \* /ehcache-impl-3-8-1-sources-
- jar/org/ehcache/impl/internal/store/offheap/portability/OffHeapValueHolderPortability.java
- \* /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/internal/sizeof/DefaultSizeOfEngineProvider.java
- \* /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/events/EventDispatchTask.java
- \* /ehcache-impl-3-8-1-sources-
- jar/org/ehcache/impl/internal/spi/loaderwriter/DefaultCacheLoaderWriterProvider.java
- \* /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/internal/store/offheap/OffHeapStoreProviderFactory.java
- \* /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/internal/spi/copy/DefaultCopyProviderFactory.java
- \* /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/internal/util/ServiceUtil.java
- \* /ehcache-impl-3-8-1-sources-jar/org/ehcache/config/builders/ExpiryPolicyBuilder.java
- \* /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/events/package-info.java
- \* /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/internal/sizeof/listeners/EhcacheVisitorListener.java
- \*
- /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/config/SizedResourcePoolImpl.java
- \* /ehcache-impl-3-8-1-sources-jar/org/ehcache/config/builders/ConfigurationBuilder.java
- \* /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/internal/events/InvocationScopedEventSink.java
- \* /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/internal/store/heap/OnHeapStore.java

- \* /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/internal/store/offheap/AbstractOffHeapStore.java
- \* /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/config/copy/DefaultCopierConfiguration.java
- \* /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/store/HashUtils.java
- \* /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/internal/store/heap/KeyCopyBackend.java
- \* /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/config/event/CacheEventDispatcherFactoryConfiguration.java
- \* /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/internal/store/offheap/HeuristicConfiguration.java
- \*
- /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/persistence/DefaultDiskResourceService.java
- \* /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/copy/ReadWriteCopier.java
- \* /ehcache-impl-3-8-1-sources-jar/org/ehcache/config/builders/CacheManagerBuilder.java
- \* /ehcache-impl-3-8-1-sources-
- jar/org/ehcache/impl/config/loaderwriter/writebehind/DefaultWriteBehindConfiguration.java
- \* /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/internal/store/disk/DiskWriteThreadPool.java
- \* /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/internal/TimeSourceServiceFactory.java
- \* /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/config/persistence/DefaultPersistenceConfiguration.java
- \* /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/internal/store/offheap/portability/SerializerPortability.java
- \* /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/internal/sizeof/DefaultSizeOfEngineProviderFactory.java
- \* /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/store/BaseStore.java
- \* /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/serialization/ByteArraySerializer.java
- \*
- /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/internal/store/loaderwriter/LoaderWriterValueHolder.java
- \* /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/config/persistence/package-info.java

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- \* /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/internal/classes/commonslang/ClassUtils.java
- \* /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/internal/classes/commonslang/reflect/MethodUtils.java
- \*
- /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/internal/classes/commonslang/ArrayUtils.java
- \* /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/internal/classes/commonslang/reflect/ConstructorUtils.java
- \* /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/internal/classes/commonslang/reflect/MemberUtils.java

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 */
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- \* /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/internal/concurrent/ConcurrentHashMap.java
- \* /ehcache-impl-3-8-1-sources-jar/org/ehcache/impl/internal/concurrent/ThreadLocalRandomUtil.java

## 1.338 webjars-locator-core 0.45

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## 1.339 byte-buddy 1.10.14

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## The Unicode Standard, Unicode Character Database, Version 10.0.0

### Unicode Character Database

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\*\*\*\*\*

----  
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Mesa 3-D  
graphics library

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```
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include/GL/glxext.h
include/GL/wglxext.h :
```

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```
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/flyway-commandline-7-3-1-sources-jar/org/flywaydb/commandline/Main.java  
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- Chris McDonough, 2011/02/16

- Wichert Akkerman, 2012/02/02

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This package contains a modified version of ca-bundle.crt:

ca-bundle.crt -- Bundle of CA Root Certificates

Certificate data from Mozilla as of: Thu Nov 3 19:04:19 2011#

This is a bundle of X.509 certificates of public Certificate Authorities  
(CA). These were automatically extracted from Mozilla's root certificates  
file (certdata.txt). This file can be found in the mozilla source tree:

<http://mxr.mozilla.org/mozilla/source/security/nss/lib/ckfw/builtins/certdata.txt?raw=1#>

It contains the certificates in PEM format and therefore  
can be directly used with curl / libcurl / php\_curl, or with  
an Apache+mod\_ssl webserver for SSL client authentication.  
Just configure this file as the SSLCACertificateFile.#

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@(#) \$RCSfile: certdata.txt,v \$

\$Revision: 1.80 \$ \$Date: 2011/11/03 15:11:58 \$

## A. HISTORY OF THE SOFTWARE

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Python was created in the early 1990s by Guido van Rossum at Stichting  
Mathematisch Centrum (CWI, see <http://www.cwi.nl>) in the Netherlands  
as a successor of a language called ABC. Guido remains Python's  
principal author, although it includes many contributions from others.

In 1995, Guido continued his work on Python at the Corporation for National Research Initiatives (CNRI, see <http://www.cnri.reston.va.us>) in Reston, Virginia where he released several versions of the software.

In May 2000, Guido and the Python core development team moved to BeOpen.com to form the BeOpen PythonLabs team. In October of the same year, the PythonLabs team moved to Digital Creations (now Zope Corporation, see <http://www.zope.com>). In 2001, the Python Software Foundation (PSF, see <http://www.python.org/psf/>) was formed, a non-profit organization created specifically to own Python-related Intellectual Property. Zope Corporation is a sponsoring member of the PSF.

All Python releases are Open Source (see <http://www.opensource.org> for the Open Source Definition). Historically, most, but not all, Python releases have also been GPL-compatible; the table below summarizes the various releases.

| Release        | Derived from | Year      | Owner      | GPL-compatible? (1) |
|----------------|--------------|-----------|------------|---------------------|
| 0.9.0 thru 1.2 |              | 1991-1995 | CWI        | yes                 |
| 1.3 thru 1.5.2 | 1.2          | 1995-1999 | CNRI       | yes                 |
| 1.6            | 1.5.2        | 2000      | CNRI       | no                  |
| 2.0            | 1.6          | 2000      | BeOpen.com | no                  |
| 1.6.1          | 1.6          | 2001      | CNRI       | yes (2)             |
| 2.1            | 2.0+1.6.1    | 2001      | PSF        | no                  |
| 2.0.1          | 2.0+1.6.1    | 2001      | PSF        | yes                 |
| 2.1.1          | 2.1+2.0.1    | 2001      | PSF        | yes                 |
| 2.2            | 2.1.1        | 2001      | PSF        | yes                 |
| 2.1.2          | 2.1.1        | 2002      | PSF        | yes                 |
| 2.1.3          |              |           |            |                     |
| 2.1.2          | 2002         | PSF       | yes        |                     |
| 2.2.1          | 2.2          | 2002      | PSF        | yes                 |
| 2.2.2          | 2.2.1        | 2002      | PSF        | yes                 |
| 2.2.3          | 2.2.2        | 2003      | PSF        | yes                 |
| 2.3            | 2.2.2        | 2002-2003 | PSF        | yes                 |
| 2.3.1          | 2.3          | 2002-2003 | PSF        | yes                 |
| 2.3.2          | 2.3.1        | 2002-2003 | PSF        | yes                 |
| 2.3.3          | 2.3.2        | 2002-2003 | PSF        | yes                 |
| 2.3.4          | 2.3.3        | 2004      | PSF        | yes                 |
| 2.3.5          | 2.3.4        | 2005      | PSF        | yes                 |
| 2.4            | 2.3          | 2004      | PSF        | yes                 |
| 2.4.1          | 2.4          | 2005      | PSF        | yes                 |
| 2.4.2          | 2.4.1        | 2005      | PSF        | yes                 |

|       |       |      |     |     |
|-------|-------|------|-----|-----|
| 2.4.3 | 2.4.2 | 2006 | PSF | yes |
| 2.4.4 | 2.4.3 | 2006 | PSF | yes |
| 2.5   | 2.4   | 2006 | PSF | yes |
| 2.5.1 | 2.5   | 2007 | PSF | yes |
| 2.5.2 | 2.5.1 | 2008 | PSF | yes |
| 2.5.3 | 2.5.2 | 2008 | PSF | yes |
| 2.6   | 2.5   | 2008 | PSF | yes |
| 2.6.1 | 2.6   | 2008 | PSF | yes |
| 2.6.2 | 2.6.1 | 2009 | PSF | yes |
| 2.6.3 | 2.6.2 | 2009 | PSF | yes |
| 2.6.4 | 2.6.3 | 2009 | PSF | yes |
| 2.6.5 | 2.6.4 | 2010 | PSF | yes |
| 2.7   | 2.6   | 2010 | PSF | yes |

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(1) GPL-compatible doesn't mean that we're distributing Python under the GPL. All Python licenses, unlike the GPL, let you distribute a modified version without making your changes open source. The GPL-compatible licenses make it possible to combine Python with other software that is released under the GPL; the others don't.

(2) According to Richard Stallman, 1.6.1 is not GPL-compatible, because its license has a choice of law clause. According to CNRI, however, Stallman's lawyer has told CNRI's lawyer that 1.6.1 is "not incompatible" with the GPL.

Thanks to the many outside volunteers who have worked under Guido's direction to make these releases possible.

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In 1995, Guido continued his work on Python at the Corporation for National Research Initiatives (CNRI, see <http://www.cnri.reston.va.us>) in Reston, Virginia where he released several versions of the software.

In May 2000, Guido and the Python core development team moved to BeOpen.com to form the BeOpen PythonLabs team. In October of the same year, the PythonLabs team moved to Digital Creations (now Zope Corporation, see <http://www.zope.com>). In 2001, the Python Software Foundation (PSF, see <http://www.python.org/psf/>) was formed, a non-profit organization created specifically to own Python-related Intellectual Property. Zope Corporation is a sponsoring member of the PSF.

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|---------|--------------|------|-------|---------------------|

|                |           |           |            |         |
|----------------|-----------|-----------|------------|---------|
| 0.9.0 thru 1.2 |           | 1991-1995 | CWI        | yes     |
| 1.3 thru 1.5.2 | 1.2       | 1995-1999 | CNRI       | yes     |
| 1.6            | 1.5.2     | 2000      | CNRI       | no      |
| 2.0            | 1.6       | 2000      | BeOpen.com | no      |
| 1.6.1          | 1.6       | 2001      | CNRI       | yes (2) |
| 2.1            | 2.0+1.6.1 | 2001      | PSF        | no      |
| 2.0.1          | 2.0+1.6.1 | 2001      | PSF        | yes     |
| 2.1.1          | 2.1+2.0.1 | 2001      | PSF        | yes     |
| 2.2            | 2.1.1     | 2001      | PSF        | yes     |
| 2.1.2          | 2.1.1     | 2002      | PSF        | yes     |
| 2.1.3          |           |           |            |         |
| 2.1.2          | 2002      | PSF       | yes        |         |
| 2.2.1          | 2.2       | 2002      | PSF        | yes     |
| 2.2.2          | 2.2.1     | 2002      | PSF        | yes     |
| 2.2.3          | 2.2.2     | 2003      | PSF        | yes     |
| 2.3            | 2.2.2     | 2002-2003 | PSF        | yes     |
| 2.3.1          | 2.3       | 2002-2003 | PSF        | yes     |
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| 2.3.4          | 2.3.3     | 2004      | PSF        | yes     |
| 2.3.5          | 2.3.4     | 2005      | PSF        | yes     |
| 2.4            | 2.3       | 2004      | PSF        | yes     |
| 2.4.1          | 2.4       | 2005      | PSF        | yes     |
| 2.4.2          | 2.4.1     | 2005      | PSF        | yes     |
| 2.4.3          | 2.4.2     | 2006      | PSF        | yes     |
| 2.4.4          | 2.4.3     | 2006      | PSF        | yes     |
| 2.5            | 2.4       | 2006      | PSF        | yes     |
| 2.5.1          | 2.5       | 2007      | PSF        | yes     |
| 2.5.2          | 2.5.1     | 2008      | PSF        | yes     |
| 2.5.3          | 2.5.2     | 2008      | PSF        | yes     |
| 2.6            | 2.5       | 2008      | PSF        | yes     |
| 2.6.1          | 2.6       | 2008      | PSF        | yes     |
| 2.6.2          | 2.6.1     | 2009      | PSF        | yes     |
| 2.6.3          | 2.6.2     | 2009      | PSF        | yes     |
| 2.6.4          | 2.6.3     | 2009      | PSF        | yes     |
| 2.6.5          | 2.6.4     | 2010      | PSF        | yes     |
| 3.0            | 2.6       | 2008      | PSF        | yes     |
| 3.0.1          | 3.0       | 2009      | PSF        | yes     |
| 3.1            | 3.0.1     | 2009      | PSF        | yes     |
| 3.1.1          | 3.1       | 2009      | PSF        | yes     |
| 3.1.2          | 3.1       | 2010      | PSF        | yes     |
| 3.2            | 3.1       | 2010      | PSF        | yes     |

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### History

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Before (and including) argparse 1.1, the argparse package was licensed under  
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After argparse 1.1, all project files from the argparse project were deleted  
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The project repository then had a clean start with some files taken from  
Python 2.7.1, so definitely all files are under Python License now.

=====

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=====

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| 1.3 thru 1.5.2 | 1.2          | 1995-1999 | CNRI       | yes                 |
| 1.6            | 1.5.2        | 2000      | CNRI       | no                  |
| 2.0            | 1.6          | 2000      | BeOpen.com | no                  |
| 1.6.1          | 1.6          | 2001      | CNRI       | yes (2)             |
| 2.1            | 2.0+1.6.1    | 2001      | PSF        | no                  |
| 2.0.1          | 2.0+1.6.1    | 2001      | PSF        | yes                 |
| 2.1.1          | 2.1+2.0.1    | 2001      | PSF        | yes                 |
| 2.1.2          | 2.1.1        | 2002      | PSF        | yes                 |
| 2.1.3          | 2.1.2        | 2002      | PSF        | yes                 |
| 2.2 and above  |              |           |            |                     |
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# 1.345 cryptsetup 2.3.6

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\* @version 3.0 (December 2000)

\*

\* Optimised ANSI C code for the Rijndael cipher (now AES)

\*

\* @author Vincent Rijmen <vincent.rijmen@esat.kuleuven.ac.be>

\* @author Antoon Bosselaers <antoon.bosselaers@esat.kuleuven.ac.be>

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as a successor of a language called ABC. Guido remains Python's principal author, although it includes many contributions from others.

In 1995, Guido continued his work on Python at the Corporation for National Research Initiatives (CNRI, see <http://www.cnri.reston.va.us>) in Reston, Virginia where he released several versions of the software.

In May 2000, Guido and the Python core development team moved to BeOpen.com to form the BeOpen PythonLabs team. In October of the same year, the PythonLabs team moved to Digital Creations, which became Zope Corporation. In 2001, the Python Software Foundation (PSF, see <https://www.python.org/psf/>) was formed, a non-profit organization created specifically to own Python-related Intellectual Property. Zope Corporation was a sponsoring member of the PSF.

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| 1.6            | 1.5.2        | 2000      | CNRI       | no                  |
| 2.0            | 1.6          | 2000      | BeOpen.com | no                  |
| 1.6.1          | 1.6          | 2001      | CNRI       | yes (2)             |
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# 1.355 base-files 10.3+deb10u12

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The

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The End

## 1.356 click 8.1.2

### 1.356.1 Available under license :

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Found in path(s):

\* /click-8-1-2-tar-gz/click-8.1.2/setup.cfg

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.. \_contrib:

```
=====
click-contrib
=====
```

As the userbase of Click grows, more and more major feature requests pop up in Click's bugtracker. As reasonable as it may be for those features to be bundled with Click instead of being a standalone project, many of those requested features are either highly experimental or have unproven practical use, while potentially being a burden to maintain.

This is why click-contrib\_ exists. The GitHub organization is a collection of possibly experimental third-party packages whose featureset does not belong into Click, but also a playground for major features that may be added to Click in the future. It is also meant to coordinate and concentrate effort on writing third-party extensions for Click, and to ease the effort of searching for such extensions. In that sense it could be described as a low-maintenance alternative to extension repositories of other frameworks.

Please

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.. \_click-contrib: <https://github.com/click-contrib/>

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- \* Being respectful of differing viewpoints and experiences
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Examples of unacceptable behavior by participants include:

- \* The use of sexualized language or imagery and unwelcome sexual attention or advances
- \* Trolling, insulting/derogatory comments, and personal or political attacks
- \* Public or private harassment
- \* Publishing others' private information, such as a physical or electronic address, without explicit permission
- \* Other conduct which could reasonably be considered inappropriate in a professional setting

## Our Responsibilities

Project maintainers are responsible for clarifying the standards of acceptable behavior and are expected to take appropriate and fair corrective action in response to any instances of unacceptable behavior.

Project maintainers have the right and responsibility to remove, edit, or

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## ## Scope

This Code of Conduct applies both within project spaces and in public spaces when an individual is representing the project or its community. Examples of representing a project or community include using an official project e-mail address, posting via an official social media account, or acting as an appointed representative at an online or offline event. Representation of a project may be further defined and clarified by project maintainers.

## ## Enforcement

Instances of abusive, harassing, or otherwise unacceptable behavior may be reported by contacting the project team at [report@palletsprojects.com](mailto:report@palletsprojects.com). All complaints will be reviewed and investigated and will result in a response that is deemed necessary and appropriate to the circumstances. The project team is obligated to maintain confidentiality with regard to the reporter of an incident. Further details of specific enforcement policies may be posted separately.

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```
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jar/org/springframework/context/annotation/aspectj/EnableSpringConfigured.java
* /spring-aspects-5-2-20-release-sources-jar/org/springframework/beans/factory/aspectj/ConfigurableObject.java
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* /spring-aspects-5-2-20-release-sources-
jar/org/springframework/transaction/aspectj/AnnotationTransactionAspect.aj
* /spring-aspects-5-2-20-release-sources-
jar/org/springframework/transaction/aspectj/JtaAnnotationTransactionAspect.aj
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* /spring-aspects-5-2-20-release-sources-
jar/org/springframework/beans/factory/aspectj/GenericInterfaceDrivenDependencyInjectionAspect.aj
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- \* /spring-aspects-5-2-20-release-sources-jar/org/springframework/cache/aspectj/JCacheCacheAspect.aj
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- jar/org/springframework/beans/factory/aspectj/AbstractDependencyInjectionAspect.aj
- \* /spring-aspects-5-2-20-release-sources-jar/org/springframework/cache/aspectj/AbstractCacheAspect.aj

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- jar/org/springframework/context/annotation/aspectj/SpringConfiguredConfiguration.java
- \* /spring-aspects-5-2-20-release-sources-jar/org/springframework/cache/aspectj/AspectJCacheConfiguration.java
- \* /spring-aspects-5-2-20-release-sources-jar/org/springframework/cache/aspectj/AspectJCacheConfiguration.java
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- /spring-aspects-5-2-20-release-sources-jar/org/springframework/cache/aspectj/AnyThrow.java

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- \* /spring-aspects-5-2-20-release-sources-jar/org/springframework/transaction/aspectj/AspectJtaTransactionManagementConfiguration.java
- \* /spring-aspects-5-2-20-release-sources-jar/org/springframework/beans/factory/aspectj/AbstractInterfaceDrivenDependencyInjectionAspect.aj
- \*
- \* /spring-aspects-5-2-20-release-sources-jar/org/springframework/scheduling/aspectj/AspectJAsyncConfiguration.java
- \* /spring-aspects-5-2-20-release-sources-jar/org/springframework/beans/factory/aspectj/AnnotationBeanConfigurerAspect.aj
- \* /spring-aspects-5-2-20-release-sources-jar/org/springframework/transaction/aspectj/AspectJTransactionManagementConfiguration.java

## 1.360 spring-jdbc 5.2.20.RELEASE

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 */

/**
 * Implement this interface when parameters need to be customized based
 * on the connection. We might need to do this to make use of proprietary
 * features, available only with a specific Connection type.
 *
 * @author Rod Johnson
 */
```

```

* @author Thomas Risberg
* @see CallableStatementCreatorFactory#newCallableStatementCreator(ParameterMapper)
* @see org.springframework.jdbc.object.StoredProcedure#execute(ParameterMapper)
*/
/**
 * Create a Map of input parameters, keyed by name.
 * @param con a JDBC connection. This is useful (and the purpose of this interface)
 * if we need to do something RDBMS-specific with a proprietary Connection
 * implementation class. This class conceals such proprietary details. However,
 * it is best to avoid using such proprietary RDBMS features if possible.
 * @return a Map of input parameters, keyed by name (never { @code null })
 * @throws SQLException if an SQLException is encountered setting
 * parameter values (that is, there's no need to catch SQLException)
 */

```

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\* /spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/core/ParameterMapper.java

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\* /spring-jdbc-5-2-20-release-sources-

jar/org/springframework/jdbc/datasource/embedded/EmbeddedDatabaseFactoryBean.java

\* /spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/support/xml/Jdbc4SqlXmlHandler.java

\*

/spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/core/simple/SimpleJdbcInsert.java

\* /spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/datasource/init/DataSourceInitializer.java

\* /spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/datasource/ConnectionProxy.java

\* /spring-jdbc-5-2-20-release-sources-

jar/org/springframework/jdbc/support/CustomSQLExceptionCodesTranslation.java

\* /spring-jdbc-5-2-20-release-sources-

jar/org/springframework/jdbc/core/metadata/PostgresCallMetaDataProvider.java



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* /spring-jdbc-5-2-20-release-sources-
jar/org/springframework/jdbc/config/InitializeDatabaseBeanDefinitionParser.java
* /spring-jdbc-5-2-20-release-sources-
jar/org/springframework/jdbc/core/metadata/SqlServerCallMetaDataProvider.java
* /spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/support/lob/DefaultLobHandler.java
* /spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/support/lob/PassThroughBlob.java
*
/spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/core/metadata/SybaseCallMetaDataProvider.java
* /spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/core/ParameterDisposer.java
* /spring-jdbc-5-2-20-release-sources-
jar/org/springframework/jdbc/config/EmbeddedDatabaseBeanDefinitionParser.java
* /spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/datasource/DelegatingDataSource.java
* /spring-jdbc-5-2-20-release-sources-
jar/org/springframework/jdbc/core/metadata/OracleCallMetaDataProvider.java
* /spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/support/lob/PassThroughClob.java
* /spring-jdbc-5-2-20-release-sources-
jar/org/springframework/jdbc/datasource/AbstractDriverBasedDataSource.java
* /spring-jdbc-5-2-20-release-sources-
jar/org/springframework/jdbc/datasource/lookup/BeanFactoryDataSourceLookup.java
* /spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/support/SQLExceptionSubclassTranslator.java
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jar/org/springframework/jdbc/datasource/lookup/SingleDataSourceLookup.java
* /spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/object/GenericStoredProcedure.java
* /spring-jdbc-5-2-20-release-sources-
jar/org/springframework/jdbc/datasource/lookup/DataSourceLookupFailureException.java
*

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/spring-jdbc-5-2-20-release-sources-
jar/org/springframework/jdbc/support/incrementer/AbstractSequenceMaxValueIncrementer.java
* /spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/support/SqlValue.java
* /spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/support/xml/XmlResultProvider.java
* /spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/support/xml/XmlBinaryStreamProvider.java
* /spring-jdbc-5-2-20-release-sources-
jar/org/springframework/jdbc/support/xml/SqlXmlFeatureNotImplementedException.java
* /spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/support/xml/XmlCharacterStreamProvider.java
* /spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/config/JdbcNamespaceHandler.java
* /spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/datasource/lookup/JndiDataSourceLookup.java
* /spring-jdbc-5-2-20-release-sources-
jar/org/springframework/jdbc/core/InterruptibleBatchPreparedStatementSetter.java
*
/spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/core/BatchPreparedStatementSetter.java
* /spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/support/MetaDataAccessException.java
* /spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/datasource/SmartDataSource.java
* /spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/SQLWarningException.java
* /spring-jdbc-5-2-20-release-sources-
jar/org/springframework/jdbc/datasource/embedded/SimpleDriverDataSourceFactory.java
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jar/org/springframework/jdbc/support/rowset/ResultSetWrappingSqlRowSet.java
* /spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/datasource/JdbcTransactionObjectSupport.java
* /spring-jdbc-5-2-20-release-sources-
jar/org/springframework/jdbc/datasource/LazyConnectionDataSourceProxy.java
*
/spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/support/KeyHolder.java
* /spring-jdbc-5-2-20-release-sources-
jar/org/springframework/jdbc/datasource/TransactionAwareDataSourceProxy.java
* /spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/core/namedparam/SqlParameterSource.java

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* /spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/object/RdbmsOperation.java
* /spring-jdbc-5-2-20-release-sources-
jar/org/springframework/jdbc/core/namedparam/BeanPropertySqlParameterSource.java
* /spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/core/simple/AbstractJdbcInsert.java
* /spring-jdbc-5-2-20-release-sources-
jar/org/springframework/jdbc/core/support/AbstractLobStreamingResultSetExtractor.java
* /spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/support/rowset/SqlRowSet.java
* /spring-jdbc-5-2-20-release-sources-
jar/org/springframework/jdbc/support/CustomSQLExceptionTranslatorRegistry.java
*
/spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/core/namedparam/MapSqlParameterSource.java
* /spring-jdbc-5-2-20-release-sources-
jar/org/springframework/jdbc/core/namedparam/AbstractSqlParameterSource.java
* /spring-jdbc-5-2-20-release-sources-
jar/org/springframework/jdbc/datasource/init/ResourceDatabasePopulator.java
* /spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/support/SQLStateSQLExceptionTranslator.java
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*/
/**
* Strategy interface for translating between { @link SQLException SQLExceptions }
* and Spring's data access strategy-agnostic { @link DataAccessException }
* hierarchy.
*
* <p>Implementations can be generic (for example, using
* { @link java.sql.SQLException#getSQLState() SQLState } codes for JDBC) or
* wholly
* proprietary (for example, using Oracle error codes) for greater precision.
*
* @author Rod Johnson
* @author Juergen Hoeller
* @see org.springframework.dao.DataAccessException
*/

```

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\* /spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/support/SQLExceptionTranslator.java

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Found in path(s):

\* /spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/core/SqlReturnType.java

\* /spring-jdbc-5-2-20-release-sources-

jar/org/springframework/jdbc/datasource/embedded/AbstractEmbeddedDatabaseConfigurer.java

\* /spring-jdbc-5-2-20-release-sources-

jar/org/springframework/jdbc/datasource/lookup/AbstractRoutingDataSource.java

\*

/spring-jdbc-5-2-20-release-sources-

jar/org/springframework/jdbc/support/SQLErrorCodeSQLExceptionTranslator.java

\* /spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/core/namedparam/ParsedSql.java

\* /spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/core/SqlProvider.java

\* /spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/datasource/SingleConnectionDataSource.java

\* /spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/datasource/SimpleDriverDataSource.java

\* /spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/datasource/embedded/DataSourceFactory.java

\* /spring-jdbc-5-2-20-release-sources-

jar/org/springframework/jdbc/core/metadata/CallMetaDataProviderFactory.java

\* /spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/core/PreparedStatementCreatorFactory.java

\* /spring-jdbc-5-2-20-release-sources-

jar/org/springframework/jdbc/core/namedparam/SqlParameterSourceUtils.java

\*

/spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/support/SQLErrorCodesFactory.java

\* /spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/datasource/init/DatabasePopulatorUtils.java

\* /spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/core/SingleColumnRowMapper.java

\* /spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/support/JdbcUtils.java

\* /spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/core/JdbcTemplate.java

\* /spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/core/metadata/CallMetaDataContext.java

\* /spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/support/DatabaseMetaDataCallback.java

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* /spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/datasource/DriverManagerDataSource.java
* /spring-jdbc-5-2-20-release-sources-
jar/org/springframework/jdbc/core/namedparam/NamedParameterJdbcTemplate.java
* /spring-jdbc-5-2-20-release-sources-
jar/org/springframework/jdbc/datasource/DataSourceTransactionManager.java
*
/spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/core/simple/AbstractJdbcCall.java
* /spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/core/StatementCreatorUtils.java
* /spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/core/metadata/CallParameterMetaData.java
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* /spring-jdbc-5-2-20-release-sources-
jar/org/springframework/jdbc/support/incrementer/DB2MainframeSequenceMaxValueIncrementer.java
* /spring-jdbc-5-2-20-release-sources-
jar/org/springframework/jdbc/support/incrementer/DB2SequenceMaxValueIncrementer.java
* /spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/core/DisposableSqlTypeValue.java
*
/spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/support/xml/SqlXmlValue.java
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- \* /spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/core/namedparam/NamedParameterJdbcOperations.java
- \* /spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/core/metadata/GenericTableMetaDataProvider.java
- \* /spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/core/metadata/TableMetaDataContext.java
- \*
- \*/spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/core/metadata/TableMetaDataProviderFactory.java
- \* /spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/core/JdbcOperations.java
- \* /spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/core/metadata/GenericCallMetaDataProvider.java
- \* /spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/datasource/init/ScriptUtils.java
- \* /spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/core/BeanPropertyRowMapper.java
- \* /spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/core/namedparam/NamedParameterUtils.java

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- \* The classes in this package make JDBC easier to use and
- \* reduce the likelihood of common errors. In particular, they:
- \* <ul>
- \* <li>Simplify error handling, avoiding the need for try/catch/finally
- \* blocks in application code.
- \* <li>Present exceptions to application code in a generic hierarchy of
- \* unchecked exceptions, enabling applications to catch data access
- \* exceptions without being dependent on JDBC, and to ignore fatal
- \* exceptions there is no value in catching.
- \* <li>Allow the implementation of error handling to be modified
- \* to target different RDBMSes without introducing proprietary
- \* dependencies into application code.
- \* </ul>
- \*
- \* <p>This package and related packages are discussed in Chapter 9 of
- \* <a href="https://www.amazon.com/exec/obidos/tg/detail/-/0764543857/">Expert One-On-One J2EE Design and
- \* Development</a>
- \* by Rod Johnson (Wrox, 2002).
- \*/

Found in path(s):

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- \* /spring-jdbc-5-2-20-release-sources-
- jar/org/springframework/jdbc/support/incrementer/Db2MainframeMaxValueIncrementer.java
- \* /spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/support/GeneratedKeyHolder.java
- \* /spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/core/support/AbstractSqlTypeValue.java
- \*
- /spring-jdbc-5-2-20-release-sources-
- jar/org/springframework/jdbc/datasource/embedded/DerbyEmbeddedDatabaseConfigurer.java
- \* /spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/core/SqlParameterValue.java
- \* /spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/core/metadata/TableParameterMetaData.java
- \* /spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/core/support/JdbcBeanDefinitionReader.java
- \* /spring-jdbc-5-2-20-release-sources-
- jar/org/springframework/jdbc/support/AbstractFallbackSQLExceptionTranslator.java
- \* /spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/datasource/DataSourceUtils.java
- \* /spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/core/BatchUpdateUtils.java
- \* /spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/core/SqlRowSetResultSetExtractor.java
- \* /spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/core/ConnectionCallback.java
- \* /spring-jdbc-5-2-20-release-sources-
- jar/org/springframework/jdbc/support/CustomSQLExceptionTranslatorRegistrar.java
- \*
- /spring-jdbc-5-2-20-release-sources-
- jar/org/springframework/jdbc/support/incrementer/HsqlSequenceMaxValueIncrementer.java
- \* /spring-jdbc-5-2-20-release-sources-
- jar/org/springframework/jdbc/core/namedparam/NamedParameterBatchUpdateUtils.java
- \* /spring-jdbc-5-2-20-release-sources-
- jar/org/springframework/jdbc/support/incrementer/OracleSequenceMaxValueIncrementer.java
- \* /spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/core/ColumnMapRowMapper.java
- \* /spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/core/simple/SimpleJdbcCall.java
- \* /spring-jdbc-5-2-20-release-sources-
- jar/org/springframework/jdbc/support/incrementer/SybaseAnywhereMaxValueIncrementer.java
- \* /spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/config/SortedResourcesFactoryBean.java
- \* /spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/core/SqlOutParameter.java
- \*

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/spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/UncategorizedSQLException.java
* /spring-jdbc-5-2-20-release-sources-
jar/org/springframework/jdbc/core/ParameterizedPreparedStatementSetter.java
* /spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/object/StoredProcedure.java
* /spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/core/SqlReturnUpdateCount.java
* /spring-jdbc-5-2-20-release-sources-
jar/org/springframework/jdbc/datasource/embedded/EmbeddedDatabaseConfigurerFactory.java
* /spring-jdbc-5-2-20-release-sources-
jar/org/springframework/jdbc/core/namedparam/NamedParameterJdbcDaoSupport.java
* /spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/core/simple/SimpleJdbcCallOperations.java
* /spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/LobRetrievalFailureException.java
* /spring-jdbc-5-2-20-release-sources-
jar/org/springframework/jdbc/core/support/AbstractInterruptibleBatchPreparedStatementSetter.java
* /spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/core/ResultSetSupportingSqlParameter.java
*
/spring-jdbc-5-2-20-release-sources-
jar/org/springframework/jdbc/datasource/lookup/IsolationLevelDataSourceRouter.java
* /spring-jdbc-5-2-20-release-sources-
jar/org/springframework/jdbc/datasource/embedded/EmbeddedDatabaseBuilder.java
* /spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/object/SqlUpdate.java
* /spring-jdbc-5-2-20-release-sources-
jar/org/springframework/jdbc/core/metadata/DerbyTableMetaDataProvider.java
* /spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/core/StatementCallback.java
* /spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/core/simple/SimpleJdbcInsertOperations.java
* /spring-jdbc-5-2-20-release-sources-
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* /spring-jdbc-5-2-20-release-sources-
jar/org/springframework/jdbc/support/incrementer/SybaseMax ValueIncrementer.java
* /spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/object/SqlOperation.java
*
/spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/core/SqlInOutParameter.java
* /spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/core/CallableStatementCallback.java
* /spring-jdbc-5-2-20-release-sources-
jar/org/springframework/jdbc/JdbcUpdateAffectedIncorrectNumberOfRowsException.java
* /spring-jdbc-5-2-20-release-sources-
jar/org/springframework/jdbc/support/rowset/ResultSetWrappingSqlRowSetMetaData.java
* /spring-jdbc-5-2-20-release-sources-
jar/org/springframework/jdbc/support/incrementer/MySQLMax ValueIncrementer.java
* /spring-jdbc-5-2-20-release-sources-
jar/org/springframework/jdbc/datasource/embedded/OutputStreamFactory.java
* /spring-jdbc-5-2-20-release-sources-
jar/org/springframework/jdbc/support/incrementer/Db2LuwMax ValueIncrementer.java
* /spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/config/DatabasePopulatorConfigUtils.java
* /spring-jdbc-5-2-20-release-sources-
jar/org/springframework/jdbc/support/incrementer/DerbyMax ValueIncrementer.java
*
/spring-jdbc-5-2-20-release-sources-
jar/org/springframework/jdbc/support/incrementer/PostgresSequenceMax ValueIncrementer.java

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* /spring-jdbc-5-2-20-release-sources-
jar/org/springframework/jdbc/support/incrementer/AbstractIdentityColumnMaxValueIncrementer.java
* /spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/support/xml/SqlXmlHandler.java
* /spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/core/RowMapper.java
* /spring-jdbc-5-2-20-release-sources-
jar/org/springframework/jdbc/datasource/embedded/EmbeddedDatabaseFactory.java
* /spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/datasource/ConnectionHolder.java
* /spring-jdbc-5-2-20-release-sources-
jar/org/springframework/jdbc/datasource/embedded/EmbeddedDatabaseType.java
* /spring-jdbc-5-2-20-release-sources-
jar/org/springframework/jdbc/core/namedparam/EmptySqlParameterSource.java
* /spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/core/metadata/HanaCallMetaDataProvider.java
*
/spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/datasource/ConnectionHandle.java
* /spring-jdbc-5-2-20-release-sources-
jar/org/springframework/jdbc/datasource/IsolationLevelDataSourceAdapter.java
* /spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/core/PreparedStatementCallback.java
* /spring-jdbc-5-2-20-release-sources-
jar/org/springframework/jdbc/datasource/embedded/HsqlEmbeddedDatabaseConfigurer.java
* /spring-jdbc-5-2-20-release-sources-
jar/org/springframework/jdbc/core/metadata/DerbyCallMetaDataProvider.java
* /spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/object/BatchSqlUpdate.java
* /spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/object/SqlCall.java
* /spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/support/JdbcAccessor.java
* /spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/core/CallableStatementCreatorFactory.java
*
/spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/core/RowMapperResultSetExtractor.java
* /spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/core/SqlParameter.java
* /spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/core/metadata/TableMetaDataProvider.java
* /spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/IncorrectResultSetColumnCountException.java
* /spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/datasource/AbstractDataSource.java
* /spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/core/ResultSetExtractor.java
* /spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/core/metadata/CallMetaDataProvider.java
* /spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/object/GenericSqlQuery.java
* /spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/core/ArgumentPreparedStatementSetter.java
* /spring-jdbc-5-2-20-release-sources-
jar/org/springframework/jdbc/core/ArgumentTypePreparedStatementSetter.java
*
/spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/support/DatabaseStartupValidator.java
* /spring-jdbc-5-2-20-release-sources-
jar/org/springframework/jdbc/support/incrementer/H2SequenceMaxValueIncrementer.java
* /spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/object/MappingSqlQueryWithParameters.java
* /spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/core/PreparedStatementCreator.java
* /spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/datasource/WebSphereDataSourceAdapter.java
* /spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/object/UpdatableSqlQuery.java
* /spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/datasource/SimpleConnectionHandle.java
* /spring-jdbc-5-2-20-release-sources-
jar/org/springframework/jdbc/datasource/embedded/EmbeddedDatabaseConfigurer.java

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* /spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/core/CallableStatementCreator.java
*
/spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/core/RowCountCallbackHandler.java
* /spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/BadSqlGrammarException.java
* /spring-jdbc-5-2-20-release-sources-
jar/org/springframework/jdbc/core/metadata/PostgresTableMetaDataProvider.java
* /spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/support/lob/TemporaryLobCreator.java
* /spring-jdbc-5-2-20-release-sources-
jar/org/springframework/jdbc/support/incrementer/HanaSequenceMaxValueIncrementer.java
* /spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/CannotGetJdbcConnectionException.java
* /spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/object/MappingSqlQuery.java
* /spring-jdbc-5-2-20-release-sources-
jar/org/springframework/jdbc/support/incrementer/AbstractColumnMaxValueIncrementer.java
* /spring-jdbc-5-2-20-release-sources-
jar/org/springframework/jdbc/core/metadata/HsqlTableMetaDataProvider.java
*
/spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/core/metadata/Db2CallMetaDataProvider.java
* /spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/core/support/JdbcDaoSupport.java
* /spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/core/SqlTypeValue.java
* /spring-jdbc-5-2-20-release-sources-
jar/org/springframework/jdbc/support/incrementer/AbstractDataFieldMaxValueIncrementer.java
* /spring-jdbc-5-2-20-release-sources-
jar/org/springframework/jdbc/datasource/UserCredentialsDataSourceAdapter.java
* /spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/object/SqlQuery.java
* /spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/InvalidResultSetAccessException.java
* /spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/datasource/lookup/MapDataSourceLookup.java
* /spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/support/SQLExceptionCodes.java
* /spring-jdbc-5-2-20-release-sources-
jar/org/springframework/jdbc/support/incrementer/PostgreSQLSequenceMaxValueIncrementer.java
*
/spring-jdbc-5-2-20-release-sources-
jar/org/springframework/jdbc/core/metadata/OracleTableMetaDataProvider.java
* /spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/core/SqlReturnResultSet.java
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\* /spring-jdbc-5-2-20-release-sources-

jar/org/springframework/jdbc/datasource/init/CannotReadScriptException.java

\* /spring-jdbc-5-2-20-release-sources-

jar/org/springframework/jdbc/support/incrementer/HsqlMaxValueIncrementer.java

\* /spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/datasource/init/ScriptException.java

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/spring-jdbc-5-2-20-release-sources-

jar/org/springframework/jdbc/datasource/init/UncategorizedScriptException.java

\* /spring-jdbc-5-2-20-release-sources-

jar/org/springframework/jdbc/datasource/embedded/ConnectionProperties.java

\* /spring-jdbc-5-2-20-release-sources-

jar/org/springframework/jdbc/support/incrementer/SqlServerMaxValueIncrementer.java

\* /spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/support/rowset/SqlRowSetMetaData.java

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- \* /spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/datasource/init/CompositeDatabasePopulator.java
- \* /spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/core/RowCallbackHandler.java
- \* /spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/support/lob/LobHandler.java
- \*
  - /spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/datasource/init/DatabasePopulator.java
  - /spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/datasource/lookup/DataSourceLookup.java
  - /spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/core/PreparedStatementSetter.java

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- \*/
- /\*\*
  - \* Close this LobCreator session and free its temporarily created BLOBs and CLOBs.
  - \* Will not need to do anything if using PreparedStatement's standard methods,
  - \* but might be necessary to free database resources if using proprietary means.
  - \* <p><b>NOTE</b></p>: Needs to be invoked after the involved

PreparedStatement have

- \* been executed or the affected O/R mapping sessions have been flushed.
- \* Otherwise, the database resources for the temporary BLOBs might stay allocated.

Found in path(s):

- \* /spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/support/lob/LobCreator.java

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Found in path(s):

```
*/spring-jdbc-5-2-20-release-sources-
jar/org/springframework/jdbc/core/namedparam/MapSqlParameterSourceExtensions.kt
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Found in path(s):

```
*/spring-jdbc-5-2-20-release-sources-
jar/org/springframework/jdbc/datasource/init/ScriptStatementFailedException.java
*/spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/datasource/embedded/EmbeddedDatabase.java
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Found in path(s):

\* /spring-jdbc-5-2-20-release-sources-  
jar/org/springframework/jdbc/core/support/AbstractLobCreatingPreparedStatementCallback.java  
\* /spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/support/lob/AbstractLobHandler.java  
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Found in path(s):

\* /spring-jdbc-5-2-20-release-sources-jar/org/springframework/jdbc/core/JdbcOperationsExtensions.kt

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Found in path(s):

```

* /spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/handler/DispatcherServletWebRequest.java
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```

Found in path(s):

```

* /spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/resource/WebJarsResourceResolver.java
* /spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/resource/ResourceUrlProviderExposingInterceptor.java
* /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/function/RouterFunction.java
*
* /spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/resource/CssLinkResourceTransformer.java
* /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/DispatcherServlet.java
* /spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/resource/CachingResourceResolver.java
* /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/function/RouterFunctionDsl.kt
* /spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/mvc/method/annotation/DeferredResultMethodReturnValueHandler.java
* /spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/function/support/HandlerFunctionAdapter.java

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\* /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/support/RequestContext.java  
 \* /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/config/MvcNamespaceUtils.java  
 \* /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/view/script/ScriptTemplateView.java  
 \*  
 /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/mvc/WebContentInterceptor.java  
 \* /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/mvc/ServletWrappingController.java  
 \* /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/function/HandlerFunction.java  
 \* /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/mvc/method/annotation/PathVariableMethodArgumentResolver.java  
 \* /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/function/DefaultRenderingResponseBuilder.java  
 \* /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/mvc/method/annotation/ViewMethodReturnValueHandler.java  
 \* /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/mvc/method/annotation/ExceptionHandlerExceptionResolver.java  
 \* /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/resource/ResourceUrlEncodingFilter.java  
 \*  
 /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/mvc/method/annotation/ResponseEntityExceptionHandler.java  
 \* /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/view/UrlBasedViewResolver.java  
 \* /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/config/annotation/WebMvcConfigurer.java  
 \* /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/function/HandlerFilterFunction.java  
 \* /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/view/script/ScriptTemplateConfigurer.java  
 \* /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/mvc/method/annotation/SessionAttributeMethodArgumentResolver.java  
 \* /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/i18n/LocaleChangeInterceptor.java  
 \* /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/function/EntityResponse.java  
 \* /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/handler/SimpleUrlHandlerMapping.java  
 \*  
 /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/mvc/method/RequestMappingInfoHandlerMethodMappingNamingStrategy.java  
 \* /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/mvc/method/annotation/ServletInvocableHandlerMethod.java  
 \* /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/function/ServerRequestExtensions.kt  
 \* /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/handler/AbstractUrlHandlerMapping.java  
 \* /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/view/DefaultRequestToViewNameTranslator.java  
 \* /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/resource/CachingResourceTransformer.java



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* /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/resource/PathResourceResolver.java
* /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/function/ServerResponse.java
*
/spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/function/ResourceHandlerFunction.java
* /spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/config/annotation/InterceptorRegistration.java
* /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/HandlerInterceptor.java
* /spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/config/annotation/DefaultServletHandlerConfigurer.java
* /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/function/ToStringVisitor.java
* /spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/function/ServerResponseExtensions.kt
* /spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/config/annotation/AsyncSupportConfigurer.java
* /spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/mvc/condition/AbstractRequestCondition.java
* /spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/config/annotation/DelegatingWebMvcConfiguration.java
*
/spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/handler/BeanNameUrlHandlerMapping.java
* /spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/handler/HandlerExceptionResolverComposite.java
* /spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/mvc/method/annotation/ViewNameMethodReturnValueHandler.java
* /spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/view/AbstractCachingViewResolver.java
* /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/function/RenderingResponse.java
* /spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/resource/VersionResourceResolver.java
* /spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/resource/EncodedResourceResolver.java
* /spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/view/script/ScriptTemplateConfig.java
*
/spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/mvc/method/annotation/StreamingResponseBodyReturnValueHandler.java
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Found in path(s):

- \* /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/tags/form/OptionsTag.java
- \* /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/view/xml/MarshallingView.java
- \* /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/tags/EscapeBodyTag.java
- \*
- /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/tags/form/RadioButtonTag.java
- \* /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/view/AbstractView.java
- \* /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/tags/EvalTag.java
- \* /spring-webmvc-5-2-20-release-sources-
- jar/org/springframework/web/servlet/tags/form/SelectedValueComparator.java
- \* /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/view/XmlViewResolver.java
- \* /spring-webmvc-5-2-20-release-sources-
- jar/org/springframework/web/servlet/resource/GzipResourceResolver.java
- \* /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/tags/ThemeTag.java
- \* /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/tags/form/CheckboxTag.java
- \* /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/handler/MappedInterceptor.java
- \* /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/tags/form/SelectTag.java
- \*
- /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/View.java
- \* /spring-webmvc-5-2-20-release-sources-
- jar/org/springframework/web/servlet/view/document/AbstractPdfView.java
- \* /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/tags/HtmlEscapeTag.java
- \* /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/tags/BindTag.java
- \* /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/view/script/RenderingContext.java
- \* /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/mvc/AbstractController.java
- \* /spring-webmvc-5-2-20-release-sources-
- jar/org/springframework/web/servlet/mvc/method/annotation/ServletRequestMethodArgumentResolver.java
- \* /spring-webmvc-5-2-20-release-sources-
- jar/org/springframework/web/servlet/tags/form/AbstractHtmlInputElementTag.java
- \* /spring-webmvc-5-2-20-release-sources-
- jar/org/springframework/web/servlet/tags/form/AbstractSingleCheckedElementTag.java
- \*
- /spring-webmvc-5-2-20-release-sources-
- jar/org/springframework/web/servlet/mvc/method/annotation/ServletResponseMethodArgumentResolver.java
- \* /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/tags/form/InputTag.java
- \* /spring-webmvc-5-2-20-release-sources-
- jar/org/springframework/web/servlet/config/annotation/InterceptorRegistry.java
- \* /spring-webmvc-5-2-20-release-sources-
- jar/org/springframework/web/servlet/resource/DefaultServletHttpRequestHandler.java
- \* /spring-webmvc-5-2-20-release-sources-

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jar/org/springframework/web/servlet/config/TilesConfigurerBeanDefinitionParser.java
* /spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/view/freemarker/FreeMarkerConfigurer.java
* /spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/resource/ResourceResolverChain.java
* /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/ViewResolver.java
* /spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/resource/ResourceTransformerSupport.java
*
/spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/support/WebContentGenerator.java
* /spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/config/annotation/ViewResolverRegistry.java
* /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/tags/form/OptionTag.java
* /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/resource/TransformedResource.java
* /spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/config/ScriptTemplateConfigurerBeanDefinitionParser.java
* /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/ModelAndView.java
* /spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/config/ViewResolversBeanDefinitionParser.java
* /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/view/BeanNameViewResolver.java
* /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/tags/NestedPathTag.java
*
/spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/tags/form/CheckboxesTag.java
* /spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/mvc/method/annotation/RequestBodyAdviceChain.java
* /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/HandlerAdapter.java
* /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/HandlerExceptionResolver.java
* /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/theme/CookieThemeResolver.java
* /spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/view/groovy/GroovyMarkupConfigurer.java
* /spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/tags/form/AbstractHtmlElementTag.java
* /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/tags/form/TagWriter.java
* /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/tags/form/ValueFormatter.java
*
/spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/view/ResourceBundleViewResolver.java
* /spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/mvc/method/AbstractHandlerMethodAdapter.java
* /spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/mvc/condition/NameValueExpression.java
* /spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/resource/ContentVersionStrategy.java
* /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/support/RequestContextUtils.java
* /spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/view/ContentNegotiatingViewResolver.java
* /spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/mvc/condition/CompositeRequestCondition.java

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* /spring-webmvc-5-2-20-release-sources-
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* /spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/mvc/method/annotation/RequestPartMethodArgumentResolver.java
*
/spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/view/json/MappingJackson2JsonView.java
* /spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/mvc/method/annotation/ResponseBodyAdvice.java
* /spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/resource/DefaultResourceResolverChain.java
* /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/tags/RequestContextAwareTag.java
* /spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/view/xml/MappingJackson2XmlView.java
* /spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/mvc/method/annotation/AbstractMessageConverterMethodArgumentResolver.
java
* /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/tags/form/TextareaTag.java
* /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/resource/FixedVersionStrategy.java
*
/spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/tags/form/AbstractHtmlElementBodyTag.java
* /spring-webmvc-5-2-20-release-sources-
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* /spring-webmvc-5-2-20-release-sources-
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jar/org/springframework/web/servlet/mvc/method/annotation/MatrixVariableMapMethodArgumentResolver.java
* /spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/handler/SimpleMappingExceptionResolver.java
* /spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/view/feed/AbstractAtomFeedView.java
* /spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/config/GroovyMarkupConfigurerBeanDefinitionParser.java
* /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/tags/form/AbstractFormTag.java
* /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/support/BindStatus.java
* /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/tags/BindErrorsTag.java
* /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/view/feed/AbstractFeedView.java
* /spring-webmvc-5-2-20-release-sources-

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jar/org/springframework/web/servlet/view/document/AbstractPdfStamperView.java
*
/spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/HandlerMapping.java
* /spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/view/freemarker/FreeMarkerView.java
* /spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/view/tiles3/SimpleSpringPreparerFactory.java
* /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/tags/EditorAwareTag.java
* /spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/tags/form/AbstractCheckedElementTag.java
* /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/tags/TransformTag.java
* /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/tags/form/FormTag.java
* /spring-webmvc-5-2-20-release-sources-
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* /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/tags/form/LabelTag.java
*
/spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/ModelAndViewDefiningException.java
* /spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/resource/ResourceTransformerChain.java
* /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/tags/form/ButtonTag.java
* /spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/tags/form/AbstractMultiCheckedElementTag.java
* /spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/support/AbstractDispatcherServletInitializer.java
* /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/HttpServletBean.java
* /spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/handler/HandlerMethodMappingNamingStrategy.java
* /spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/mvc/method/annotation/MatrixVariableMethodArgumentResolver.java
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Found in path(s):

```
* /spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/mvc/annotation/ModelAndViewResolver.java
* /spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/view/document/AbstractXlsView.java
* /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/resource/VersionPathStrategy.java
*
/spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/view/groovy/GroovyMarkupViewResolver.java
* /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/tags/ArgumentAware.java
* /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/tags/HtmlEscapingAwareTag.java
* /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/resource/VersionStrategy.java
* /spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/view/document/AbstractXlsxStreamingView.java
* /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/NoHandlerFoundException.java
* /spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/view/groovy/GroovyMarkupConfig.java
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```

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```
* /spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/view/freemarker/FreeMarkerViewResolver.java
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```

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*/
/**
* XSLT-driven View that allows for response context to be rendered as the
* result of an XSLT transformation.
*
* <p>The XSLT Source object is supplied as a parameter in the model and then
* { @link #locateSource detected} during response rendering. Users can either specify
* a specific entry in the
* model via the { @link #setSourceKey sourceKey} property or
* have Spring locate the Source object. This class also provides basic conversion
* of objects into Source implementations. See { @link #getSourceTypes() here}
* for more details.
*
* <p>All model parameters are passed to the XSLT Transformer as parameters.
* In addition the user can configure { @link #setOutputProperties output properties}
* to be passed to the Transformer.
*
* @author Rob Harrop
* @author Juergen Hoeller
* @since 2.0
*/

```

Found in path(s):

```

* /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/view/xslt/XsltView.java
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\* /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/theme/AbstractThemeResolver.java

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Found in path(s):

\* /spring-webmvc-5-2-20-release-sources-

jar/org/springframework/web/servlet/mvc/method/annotation/ResponseBodyEmitter.java

\* /spring-webmvc-5-2-20-release-sources-

jar/org/springframework/web/servlet/resource/AppCacheManifestTransformer.java

\* /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/function/RouterFunctions.java

\*

/spring-webmvc-5-2-20-release-sources-

jar/org/springframework/web/servlet/config/AnnotationDrivenBeanDefinitionParser.java

\* /spring-webmvc-5-2-20-release-sources-

jar/org/springframework/web/servlet/config/annotation/ResourceHandlerRegistry.java

\* /spring-webmvc-5-2-20-release-sources-

jar/org/springframework/web/servlet/config/annotation/ViewControllerRegistry.java

\* /spring-webmvc-5-2-20-release-sources-

jar/org/springframework/web/servlet/config/annotation/CorsRegistration.java

\* /spring-webmvc-5-2-20-release-sources-

jar/org/springframework/web/servlet/mvc/method/annotation/SseEmitter.java

\* /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/function/DefaultServerRequest.java

\* /spring-webmvc-5-2-20-release-sources-

jar/org/springframework/web/servlet/config/ResourcesBeanDefinitionParser.java

\* /spring-webmvc-5-2-20-release-sources-

jar/org/springframework/web/servlet/mvc/method/annotation/AbstractMessageConverterMethodProcessor.java

\*

/spring-webmvc-5-2-20-release-sources-

jar/org/springframework/web/servlet/function/DefaultServerRequestBuilder.java

\* /spring-webmvc-5-2-20-release-sources-

jar/org/springframework/web/servlet/mvc/method/annotation/ResponseBodyEmitterReturnValueHandler.java

\* /spring-webmvc-5-2-20-release-sources-



```

jar/org/springframework/web/servlet/function/RouterFunctionBuilder.java
* /spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/mvc/annotation/ResponseStatusExceptionHandler.java
* /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/tags/MessageTag.java
* /spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/mvc/method/annotation/RequestMappingHandlerAdapter.java
* /spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/handler/AbstractHandlerMapping.java
* /spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/view/AbstractTemplateViewResolver.java
* /spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/mvc/condition/RequestMethodRequestCondition.java
*
/spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/mvc/condition/AbstractMediaTypeExpression.java
* /spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/mvc/UrlFilenameViewController.java
* /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/HandlerExecutionChain.java
* /spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/mvc/condition/PatternsRequestCondition.java
* /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/function/RequestPredicates.java
* /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/function/ServerRequest.java
* /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/tags/form/ErrorsTag.java
* /spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/resource/ResourceHttpRequestHandler.java
*
/spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/support/ServletUriComponentsBuilder.java
* /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/config/annotation/CorsRegistry.java
* /spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/mvc/method/RequestMappingInfo.java
* /spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/config/annotation/PathMatchConfigurer.java
* /spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/mvc/method/annotation/HttpEntityMethodProcessor.java
* /spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/mvc/condition/ConsumesRequestCondition.java
* /spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/mvc/method/annotation/ServletCookieValueMethodArgumentResolver.java
* /spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/mvc/condition/ProducesRequestCondition.java
* /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/i18n/CookieLocaleResolver.java
*
/spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/config/annotation/ContentNegotiationConfigurer.java
* /spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/mvc/condition/HeadersRequestCondition.java
* /spring-webmvc-5-2-20-release-sources-

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jar/org/springframework/web/servlet/mvc/condition/ParamsRequestCondition.java
* /spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/config/annotation/WebMvcConfigurationSupport.java
* /spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/function/DefaultEntityResponseBuilder.java
* /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/tags/UrlTag.java
* /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/view/RedirectView.java
* /spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/support/AbstractFlashMapManager.java
* /spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/function/DefaultServerResponseBuilder.java
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* /spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/i18n/AcceptHeaderLocaleResolver.java
* /spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/function/PathResourceLookupFunction.java
* /spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/mvc/method/annotation/ExtendedServletRequestDataBinder.java
*
/spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/handler/AbstractHandlerExceptionResolver.java
* /spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/function/support/RouterFunctionMapping.java
* /spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/mvc/method/annotation/RequestBodyAdviceAdapter.java
* /spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/mvc/support/DefaultHandlerExceptionResolver.java
* /spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/handler/HandlerMappingIntrospector.java
* /spring-webmvc-5-2-20-release-sources-

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jar/org/springframework/web/servlet/handler/MatchableHandlerMapping.java
* /spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/mvc/method/annotation/RequestMappingHandlerMapping.java
* /spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/mvc/method/annotation/MvcUriComponentsBuilder.java
*
/spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/config/FreeMarkerConfigurerBeanDefinitionParser.java
* /spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/handler/AbstractHandlerMethodMapping.java
* /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/function/RequestPredicate.java
* /spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/mvc/method/annotation/ReactiveTypeHandler.java
* /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/resource/ResourceUrlProvider.java
* /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/FrameworkServlet.java
* /spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/mvc/method/annotation/RequestBodyAdvice.java
* /spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/mvc/method/RequestMappingInfoHandlerMapping.java
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* /spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/mvc/method/annotation/AbstractMappingJacksonResponseBodyAdvice.java
* /spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/config/annotation/UrlBasedViewResolverRegistration.java
* /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/FlashMapManager.java
*
/spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/support/SessionFlashMapManager.java
* /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/tags/form/PasswordInputTag.java

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```
* /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/view/xslt/XsltViewResolver.java
* /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/view/tiles3/TilesViewResolver.java
* /spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/mvc/method/annotation/PathVariableMapMethodArgumentResolver.java
*
/spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/mvc/ServletForwardingController.java
* /spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/view/InternalResourceViewResolver.java
* /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/LocaleContextResolver.java
* /spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/mvc/support/RedirectAttributesModelMap.java
* /spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/view/script/ScriptTemplateViewResolver.java
* /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/FlashMap.java
* /spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/config/annotation/ViewControllerRegistration.java
* /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/view/tiles3/TilesView.java
* /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/ThemeResolver.java
*
/spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/i18n/SessionLocaleResolver.java
* /spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/mvc/method/annotation/RequestAttributeMethodArgumentResolver.java
* /spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/RequestToViewNameTranslator.java
* /spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/config/annotation/EnableWebMvc.java
* /spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/mvc/method/annotation/CallableMethodReturnValueHandler.java
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* /spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/mvc/method/annotation/ServletWebArgumentResolverAdapter.java
* /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/resource/HttpResource.java
* /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/tags/Param.java
* /spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/config/annotation/RedirectViewControllerRegistration.java
*
/spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/mvc/method/annotation/UriComponentsBuilderMethodArgumentResolver.jav
a
* /spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/config/ViewControllerBeanDefinitionParser.java
* /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/view/InternalResourceView.java
* /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/theme/FixedThemeResolver.java
* /spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/handler/HandlerInterceptorAdapter.java
* /spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/view/document/AbstractXlsView.java
* /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/resource/ResourceResolver.java
* /spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/i18n/AbstractLocaleContextResolver.java
*
/spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/view/freemarker/FreeMarkerConfig.java
* /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/support/JstlUtils.java
* /spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/handler/UserRoleAuthorizationInterceptor.java
* /spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/handler/WebRequestHandlerInterceptorAdapter.java
* /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/theme/SessionThemeResolver.java
* /spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/config/annotation/ResourceChainRegistration.java
* /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/view/JstlView.java
* /spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/mvc/method/annotation/ModelAndViewResolverMethodReturnValueHandler.j
ava
* /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/i18n/FixedLocaleResolver.java
*
/spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/LocaleResolver.java
* /spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/mvc/ParameterizableViewController.java
* /spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/mvc/method/annotation/AsyncTaskMethodReturnValueHandler.java
* /spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/view/groovy/GroovyMarkupView.java
* /spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/support/JspAwareRequestContext.java
* /spring-webmvc-5-2-20-release-sources-

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```

jar/org/springframework/web/servlet/config/annotation/ResourceHandlerRegistration.java
* /spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/mvc/method/annotation/ServletModelAttributeMethodProcessor.java
* /spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/mvc/method/annotation/HttpHeadersReturnValueHandler.java
*
/spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/AsyncHandlerInterceptor.java
* /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/view/tiles3/TilesConfigurer.java
* /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/view/AbstractUrlBasedView.java
* /spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/mvc/method/annotation/ModelAndViewMethodReturnValueHandler.java
* /spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/resource/AbstractResourceResolver.java
* /spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/mvc/method/annotation/ServletRequestDataBinderFactory.java
* /spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/view/feed/AbstractRssFeedView.java
* /spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/config/CorsBeanDefinitionParser.java
*
/spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/mvc/method/annotation/JsonViewRequestBodyAdvice.java
* /spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/handler/AbstractHandlerMethodExceptionResolver.java
* /spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/handler/SimpleServletPostProcessor.java
* /spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/mvc/condition/RequestConditionHolder.java
* /spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/mvc/method/annotation/JsonViewResponseBodyAdvice.java
* /spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/mvc/method/annotation/RedirectAttributesMethodArgumentResolver.java
* /spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/view/tiles3/SpringWildcardServletTilesApplicationContext.java
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\* /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/handler/RequestMatchResult.java  
\* /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/config/MvcNamespaceHandler.java  
\* /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/config/DefaultServletHandlerBeanDefinitionParser.java  
\*  
\* /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/mvc/Controller.java  
\* /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/view/AbstractTemplateView.java  
\* /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/mvc/method/annotation/StreamingResponseBody.java  
\* /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/view/tiles3/SpringLocaleResolver.java  
\* /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/mvc/condition/RequestCondition.java  
\* /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/config/annotation/WebMvcConfigurerAdapter.java  
\* /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/config/annotation/WebMvcConfigurerComposite.java  
\* /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/resource/ResourceTransformer.java  
\* /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/view/ViewResolverComposite.java  
\*  
\* /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/config/InterceptorsBeanDefinitionParser.java  
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* /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/SmartView.java
* /spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/view/tiles3/SpringBeanPreparerFactory.java
*
/spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/handler/AbstractDetectingUrlHandlerMapping.java
* /spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/mvc/SimpleControllerHandlerAdapter.java
* /spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/view/tiles3/AbstractSpringPreparerFactory.java
* /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/mvc/LastModified.java
* /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/tags/ParamAware.java
* /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/tags/form/RadioButtonsTag.java
* /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/mvc/support/RedirectAttributes.java
* /spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/handler/ConversionServiceExposingInterceptor.java
* /spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/handler/SimpleServletHandlerAdapter.java
*
/spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/tags/form/OptionWriter.java
* /spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/mvc/condition/MediaTypeExpression.java
* /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/tags/form/TagIdGenerator.java
* /spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/mvc/AbstractUrlViewController.java
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* /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/tags/form/HiddenInputTag.java
* /spring-webmvc-5-2-20-release-sources-jar/org/springframework/web/servlet/i18n/AbstractLocaleResolver.java
* /spring-webmvc-5-2-20-release-sources-
jar/org/springframework/web/servlet/theme/ThemeChangeInterceptor.java

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 * A contract for inspecting and potentially modifying request data values such
 * as URL query parameters or form field values before they are rendered by a
 * view or before a redirect.
 *
 * <p>Implementations may use this contract for example as part of a solution
 * to provide data integrity, confidentiality,
 * protection against cross-site
 * request forgery (CSRF), and others or for other tasks such as automatically
 * adding a hidden field to all forms and URLs.
 *
 * <p>View technologies that support this contract can obtain an instance to
 * delegate to via { @link RequestContext#getRequestDataValueProcessor() }.
 *
 * @author Rossen Stoyanchev
 * @since 3.1
 */
```

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```
* /spring-webmvc-5.2.20-release-sources-
jar/org/springframework/web/servlet/support/RequestDataValueProcessor.java
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* /spring-expression-5-2-20-release-sources-
jar/org/springframework/expression/spel/support/ReflectivePropertyAccessor.java
* /spring-expression-5-2-20-release-sources-jar/org/springframework/expression/spel/standard/SpelCompiler.java
*
/spring-expression-5-2-20-release-sources-jar/org/springframework/expression/spel/ast/MethodReference.java
* /spring-expression-5-2-20-release-sources-jar/org/springframework/expression/spel/standard/SpelExpression.java
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* /spring-expression-5-2-20-release-sources-jar/org/springframework/expression/spel/SpelMessage.java
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- \* /spring-expression-5-2-20-release-sources-jar/org/springframework/expression/spel/ast/OpDec.java
- \* /spring-expression-5-2-20-release-sources-jar/org/springframework/expression/spel/standard/Tokenizer.java
- \*
- /spring-expression-5-2-20-release-sources-jar/org/springframework/expression/spel/ast/ValueRef.java
- \* /spring-expression-5-2-20-release-sources-jar/org/springframework/expression/spel/ast/OperatorBetween.java
- \* /spring-expression-5-2-20-release-sources-jar/org/springframework/expression/spel/ast/FunctionReference.java
- \* /spring-expression-5-2-20-release-sources-jar/org/springframework/expression/spel/ast/LongLiteral.java
- \* /spring-expression-5-2-20-release-sources-jar/org/springframework/expression/spel/ast/QualifiedIdentifier.java
- \* /spring-expression-5-2-20-release-sources-jar/org/springframework/expression/spel/ast/OpAnd.java
- \* /spring-expression-5-2-20-release-sources-
- jar/org/springframework/expression/spel/support/StandardTypeComparator.java
- \* /spring-expression-5-2-20-release-sources-jar/org/springframework/expression/spel/ast/Assign.java
- \* /spring-expression-5-2-20-release-sources-jar/org/springframework/expression/spel/ast/Elvis.java
- \* /spring-expression-5-2-20-release-sources-jar/org/springframework/expression/spel/ast/Indexer.java
- \*
- /spring-expression-5-2-20-release-sources-jar/org/springframework/expression/spel/ast/OperatorNot.java
- \* /spring-expression-5-2-20-release-sources-jar/org/springframework/expression/spel/ast/OpLE.java
- \* /spring-expression-5-2-20-release-sources-jar/org/springframework/expression/spel/ast/RealLiteral.java
- \* /spring-expression-5-2-20-release-sources-jar/org/springframework/expression/spel/ast/CompoundExpression.java
- \* /spring-expression-5-2-20-release-sources-jar/org/springframework/expression/spel/ast/OpInc.java
- \* /spring-expression-5-2-20-release-sources-jar/org/springframework/expression/spel/ast/SpelNodeImpl.java
- \* /spring-expression-5-2-20-release-sources-jar/org/springframework/expression/spel/ast/Projection.java
- \* /spring-expression-5-2-20-release-sources-jar/org/springframework/expression/spel/ast/Identifier.java
- \* /spring-expression-5-2-20-release-sources-jar/org/springframework/expression/PropertyAccessor.java
- \*
- /spring-expression-5-2-20-release-sources-jar/org/springframework/expression/spel/ast/Ternary.java
- \* /spring-expression-5-2-20-release-sources-jar/org/springframework/expression/spel/ast/TypeReference.java
- \* /spring-expression-5-2-20-release-sources-jar/org/springframework/expression/spel/ast/OpPlus.java
- \* /spring-expression-5-2-20-release-sources-jar/org/springframework/expression/spel/ast/OperatorMatches.java
- \* /spring-expression-5-2-20-release-sources-jar/org/springframework/expression/spel/ast/InlineList.java
- \* /spring-expression-5-2-20-release-sources-jar/org/springframework/expression/spel/ast/InlineMap.java
- \* /spring-expression-5-2-20-release-sources-jar/org/springframework/expression/spel/ast/NullLiteral.java
- \* /spring-expression-5-2-20-release-sources-jar/org/springframework/expression/spel/ast/OpOr.java
- \* /spring-expression-5-2-20-release-sources-jar/org/springframework/expression/spel/ast/OpMultiply.java

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* /spring-expression-5-2-20-release-sources-jar/org/springframework/expression/spel/ast/Operator.java
*
/spring-expression-5-2-20-release-sources-jar/org/springframework/expression/spel/ast/OpLT.java
* /spring-expression-5-2-20-release-sources-jar/org/springframework/expression/spel/ast/VariableReference.java
* /spring-expression-5-2-20-release-sources-jar/org/springframework/expression/spel/ast/TypeCode.java
* /spring-expression-5-2-20-release-sources-jar/org/springframework/expression/spel/ast/OpEQ.java
* /spring-expression-5-2-20-release-sources-jar/org/springframework/expression/spel/ast/BooleanLiteral.java
* /spring-expression-5-2-20-release-sources-
jar/org/springframework/expression/spel/ast/PropertyOrFieldReference.java
* /spring-expression-5-2-20-release-sources-jar/org/springframework/expression/spel/ast/OpGT.java
* /spring-expression-5-2-20-release-sources-jar/org/springframework/expression/spel/ast/Literal.java
* /spring-expression-5-2-20-release-sources-jar/org/springframework/expression/spel/ast/OperatorPower.java
* /spring-expression-5-2-20-release-sources-jar/org/springframework/expression/spel/ast/FloatLiteral.java
*
/spring-expression-5-2-20-release-sources-jar/org/springframework/expression/spel/ast/OpGE.java
* /spring-expression-5-2-20-release-sources-jar/org/springframework/expression/spel/ast/OperatorInstanceOf.java
* /spring-expression-5-2-20-release-sources-jar/org/springframework/expression/spel/ast/StringLiteral.java
* /spring-expression-5-2-20-release-sources-
jar/org/springframework/expression/spel/standard/InternalSpelExpressionParser.java
* /spring-expression-5-2-20-release-sources-jar/org/springframework/expression/spel/ast/OpDivide.java
* /spring-expression-5-2-20-release-sources-jar/org/springframework/expression/spel/ast/Selection.java
* /spring-expression-5-2-20-release-sources-jar/org/springframework/expression/spel/ast/OpNE.java
* /spring-expression-5-2-20-release-sources-
jar/org/springframework/expression/spel/support/ReflectiveConstructorResolver.java
* /spring-expression-5-2-20-release-sources-jar/org/springframework/expression/spel/ast/OpMinus.java
*
/spring-expression-5-2-20-release-sources-jar/org/springframework/expression/spel/ast/IntLiteral.java
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* /spring-expression-5-2-20-release-sources-
jar/org/springframework/expression/common/CompositeStringExpression.java
* /spring-expression-5-2-20-release-sources-jar/org/springframework/expression/ExpressionException.java
*
/spring-expression-5-2-20-release-sources-jar/org/springframework/expression/spel/SpelEvaluationException.java
* /spring-expression-5-2-20-release-sources-
jar/org/springframework/expression/spel/support/StandardEvaluationContext.java
* /spring-expression-5-2-20-release-sources-
jar/org/springframework/expression/common/TemplateAwareExpressionParser.java
* /spring-expression-5-2-20-release-sources-jar/org/springframework/expression/Operation.java
* /spring-expression-5-2-20-release-sources-
jar/org/springframework/expression/spel/support/SimpleEvaluationContext.java
* /spring-expression-5-2-20-release-sources-
jar/org/springframework/expression/spel/support/ReflectiveMethodResolver.java
* /spring-expression-5-2-20-release-sources-jar/org/springframework/expression/spel/ExpressionState.java
* /spring-expression-5-2-20-release-sources-jar/org/springframework/expression/TypedValue.java
* /spring-expression-5-2-20-release-sources-
jar/org/springframework/expression/spel/support/DataBindingPropertyAccessor.java
*
/spring-expression-5-2-20-release-sources-jar/org/springframework/expression/common/LiteralExpression.java
* /spring-expression-5-2-20-release-sources-jar/org/springframework/expression/spel/support/ReflectionHelper.java
* /spring-expression-5-2-20-release-sources-jar/org/springframework/expression/spel/SpelNode.java
* /spring-expression-5-2-20-release-sources-
jar/org/springframework/expression/spel/support/StandardTypeConverter.java
* /spring-expression-5-2-20-release-sources-
jar/org/springframework/expression/spel/support/StandardOperatorOverloader.java
* /spring-expression-5-2-20-release-sources-
jar/org/springframework/expression/spel/support/BooleanTypedValue.java
* /spring-expression-5-2-20-release-sources-jar/org/springframework/expression/spel/CodeFlow.java
* /spring-expression-5-2-20-release-sources-
jar/org/springframework/expression/spel/support/ReflectiveMethodExecutor.java
* /spring-expression-5-2-20-release-sources-jar/org/springframework/expression/spel/ast/FormatHelper.java
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\* /spring-expression-5-2-20-release-sources-jar/org/springframework/expression/spel/SpelParseException.java  
\*

/spring-expression-5-2-20-release-sources-jar/org/springframework/expression/ParserContext.java

\* /spring-expression-5-2-20-release-sources-

jar/org/springframework/expression/spel/support/StandardTypeLocator.java

\* /spring-expression-5-2-20-release-sources-jar/org/springframework/expression/AccessException.java

\* /spring-expression-5-2-20-release-sources-jar/org/springframework/expression/TypeConverter.java

\* /spring-expression-5-2-20-release-sources-jar/org/springframework/expression/common/ExpressionUtils.java

\* /spring-expression-5-2-20-release-sources-jar/org/springframework/expression/spel/standard/Token.java

\* /spring-expression-5-2-20-release-sources-jar/org/springframework/expression/ParseException.java

\* /spring-expression-5-2-20-release-sources-jar/org/springframework/expression/OperatorOverloader.java

\* /spring-expression-5-2-20-release-sources-jar/org/springframework/expression/spel/SpelParserConfiguration.java

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jar/org/springframework/expression/spel/support/ReflectiveConstructorExecutor.java

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* /spring-expression-5-2-20-release-sources-jar/org/springframework/expression/ConstructorResolver.java
*
* /spring-expression-5-2-20-release-sources-jar/org/springframework/expression/TypeLocator.java
* /spring-expression-5-2-20-release-sources-jar/org/springframework/expression/spel/standard/TokenKind.java
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* /spring-expression-5-2-20-release-sources-
jar/org/springframework/expression/spel/standard/SpelExpressionParser.java
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\* /spring-expression-5-2-20-release-sources-jar/org/springframework/expression/common/TemplateParserContext.java  
\* /spring-expression-5-2-20-release-sources-jar/org/springframework/expression/ExpressionInvocationTargetException.java  
\*  
/spring-expression-5-2-20-release-sources-jar/org/springframework/expression/MethodExecutor.java  
\* /spring-expression-5-2-20-release-sources-jar/org/springframework/expression/MethodResolver.java

# 1.363 spring-web 5.2.20.RELEASE

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\* /spring-web-5-2-20-release-sources-jar/org/springframework/web/jsf/FacesContextUtils.java  
\*  
/spring-web-5-2-20-release-sources-jar/org/springframework/web/context/ConfigurableWebApplicationContext.java  
\* /spring-web-5-2-20-release-sources-jar/org/springframework/http/client/AbstractClientHttpRequest.java

\* /spring-web-5-2-20-release-sources-  
jar/org/springframework/web/context/support/ServletConfigPropertySource.java  
\* /spring-web-5-2-20-release-sources-jar/org/springframework/http/client/ClientHttpRequest.java  
\* /spring-web-5-2-20-release-sources-jar/org/springframework/http/server/ServerHttpAsyncRequestControl.java  
\* /spring-web-5-2-20-release-sources-  
jar/org/springframework/web/context/support/ServletContextPropertySource.java  
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Found in path(s):

\* /spring-web-5-2-20-release-sources-  
jar/org/springframework/web/server/adapter/ForwardedHeaderTransformer.java  
\* /spring-web-5-2-20-release-sources-jar/org/springframework/web/bind/annotation/RestControllerAdvice.java

\* /spring-web-5-2-20-release-sources-jar/org/springframework/web/util/ContentCachingResponseWrapper.java  
 \*  
 /spring-web-5-2-20-release-sources-jar/org/springframework/web/client/HttpServerErrorException.java  
 \* /spring-web-5-2-20-release-sources-jar/org/springframework/http/client/MultipartBodyBuilder.java  
 \* /spring-web-5-2-20-release-sources-jar/org/springframework/web/accept/FixedContentNegotiationStrategy.java  
 \* /spring-web-5-2-20-release-sources-jar/org/springframework/http/codec/xml/Jaxb2XmlEncoder.java  
 \* /spring-web-5-2-20-release-sources-jar/org/springframework/http/codec/cbor/Jackson2CborDecoder.java  
 \* /spring-web-5-2-20-release-sources-  
 jar/org/springframework/http/server/reactive/AbstractListenerWriteFlushProcessor.java  
 \* /spring-web-5-2-20-release-sources-  
 jar/org/springframework/web/client/MessageBodyClientHttpResponseWrapper.java  
 \* /spring-web-5-2-20-release-sources-jar/org/springframework/web/filter/AbstractRequestLoggingFilter.java  
 \* /spring-web-5-2-20-release-sources-  
 jar/org/springframework/web/multipart/support/MultipartResolutionDelegate.java  
 \*  
 /spring-web-5-2-20-release-sources-jar/org/springframework/web/server/handler/DefaultWebFilterChain.java  
 \* /spring-web-5-2-20-release-sources-  
 jar/org/springframework/http/server/reactive/AbstractListenerReadPublisher.java  
 \* /spring-web-5-2-20-release-sources-jar/org/springframework/web/server/adapters/DefaultServerWebExchange.java  
 \* /spring-web-5-2-20-release-sources-jar/org/springframework/http/client/SimpleClientHttpResponse.java  
 \* /spring-web-5-2-20-release-sources-jar/org/springframework/web/filter/CorsFilter.java  
 \* /spring-web-5-2-20-release-sources-jar/org/springframework/web/client/UnknownHttpStatusCodeException.java  
 \* /spring-web-5-2-20-release-sources-jar/org/springframework/web/context/request/async/DeferredResult.java  
 \* /spring-web-5-2-20-release-sources-jar/org/springframework/http/codec/protobuf/ProtobufEncoder.java  
 \* /spring-web-5-2-20-release-sources-jar/org/springframework/http/codec/cbor/Jackson2CborEncoder.java  
 \* /spring-web-5-2-20-release-sources-jar/org/springframework/web/client/HttpStatusCodeException.java  
 \*  
 /spring-web-5-2-20-release-sources-jar/org/springframework/web/util/HtmlCharacterEntityDecoder.java  
 \* /spring-web-5-2-20-release-sources-jar/org/springframework/web/server/handler/WebHandlerDecorator.java  
 \* /spring-web-5-2-20-release-sources-  
 jar/org/springframework/web/multipart/commons/CommonsMultipartFile.java  
 \* /spring-web-5-2-20-release-sources-  
 jar/org/springframework/http/converter/protobuf/ProtobufHttpMessageConverter.java  
 \* /spring-web-5-2-20-release-sources-jar/org/springframework/http/CacheControl.java  
 \* /spring-web-5-2-20-release-sources-jar/org/springframework/web/context/ContextCleanupListener.java  
 \* /spring-web-5-2-20-release-sources-jar/org/springframework/http/codec/xml/XmlEventDecoder.java  
 \* /spring-web-5-2-20-release-sources-jar/org/springframework/web/server/session/InMemoryWebSessionStore.java  
 \* /spring-web-5-2-20-release-sources-jar/org/springframework/web/context/request/ServletRequestAttributes.java  
 \* /spring-web-5-2-20-release-sources-jar/org/springframework/web/client/RestOperations.java  
 \*  
 /spring-web-5-2-20-release-sources-  
 jar/org/springframework/http/converter/xml/MappingJackson2XmlHttpMessageConverter.java  
 \* /spring-web-5-2-20-release-sources-jar/org/springframework/web/context/support/RequestHandledEvent.java  
 \* /spring-web-5-2-20-release-sources-  
 jar/org/springframework/http/converter/xml/AbstractJaxb2HttpMessageConverter.java  
 \* /spring-web-5-2-20-release-sources-jar/org/springframework/web/cors/reactive/CorsWebFilter.java  
 \* /spring-web-5-2-20-release-sources-jar/org/springframework/http/client/ClientHttpRequestInitializer.java  
 \* /spring-web-5-2-20-release-sources-

jar/org/springframework/http/client/support/BasicAuthenticationInterceptor.java  
 \* /spring-web-5-2-20-release-sources-jar/org/springframework/http/codec/ServerCodecConfigurer.java  
 \* /spring-web-5-2-20-release-sources-jar/org/springframework/http/codec/json/Jackson2SmileEncoder.java  
 \* /spring-web-5-2-20-release-sources-jar/org/springframework/web/cors/UrlBasedCorsConfigurationSource.java  
 \*  
 /spring-web-5-2-20-release-sources-  
 jar/org/springframework/http/converter/feed/AbstractWireFeedHttpMessageConverter.java  
 \* /spring-web-5-2-20-release-sources-jar/org/springframework/web/util/pattern/InternalPathPatternParser.java  
 \* /spring-web-5-2-20-release-sources-  
 jar/org/springframework/web/context/support/AnnotationConfigWebApplicationContext.java  
 \* /spring-web-5-2-20-release-sources-  
 jar/org/springframework/http/converter/xml/Jaxb2RootElementHttpMessageConverter.java  
 \* /spring-web-5-2-20-release-sources-  
 jar/org/springframework/http/converter/cbor/MappingJackson2CborHttpMessageConverter.java  
 \* /spring-web-5-2-20-release-sources-jar/org/springframework/http/codec/DecoderHttpMessageReader.java  
 \* /spring-web-5-2-20-release-sources-jar/org/springframework/http/client/OkHttp3ClientHttpRequestFactory.java  
 \* /spring-web-5-2-20-release-sources-jar/org/springframework/web/filter/OncePerRequestFilter.java  
 \* /spring-web-5-2-20-release-sources-jar/org/springframework/web/client/RestClientResponseException.java  
 \*  
 /spring-web-5-2-20-release-sources-jar/org/springframework/http/converter/ByteArrayHttpMessageConverter.java  
 \* /spring-web-5-2-20-release-sources-jar/org/springframework/web/context/support/ServletContextScope.java  
 \* /spring-web-5-2-20-release-sources-  
 jar/org/springframework/web/filter/reactive/ServerWebExchangeContextFilter.java  
 \* /spring-web-5-2-20-release-sources-jar/org/springframework/http/codec/ResourceHttpMessageWriter.java  
 \* /spring-web-5-2-20-release-sources-jar/org/springframework/http/server/reactive/ChannelSendOperator.java  
 \* /spring-web-5-2-20-release-sources-jar/org/springframework/http/codec/ResourceHttpMessageReader.java  
 \* /spring-web-5-2-20-release-sources-  
 jar/org/springframework/web/method/annotation/RequestParamMethodArgumentResolver.java  
 \* /spring-web-5-2-20-release-sources-jar/org/springframework/http/client/InterceptingClientHttpRequest.java  
 \* /spring-web-5-2-20-release-sources-jar/org/springframework/http/codec/protobuf/ProtobufDecoder.java  
 \*  
 /spring-web-5-2-20-release-sources-  
 jar/org/springframework/web/context/support/GenericWebApplicationContext.java  
 \* /spring-web-5-2-20-release-sources-jar/org/springframework/web/bind/annotation/ControllerAdvice.java  
 \* /spring-web-5-2-20-release-sources-jar/org/springframework/web/util/UriUtils.java  
 \* /spring-web-5-2-20-release-sources-  
 jar/org/springframework/web/method/support/AsyncHandlerMethodReturnValueHandler.java  
 \* /spring-web-5-2-20-release-sources-jar/org/springframework/http/codec/HttpMessageWriter.java  
 \* /spring-web-5-2-20-release-sources-jar/org/springframework/web/util/pattern/PathPatternRouteMatcher.java  
 \* /spring-web-5-2-20-release-sources-jar/org/springframework/http/HttpStatus.java  
 \* /spring-web-5-2-20-release-sources-jar/org/springframework/http/HttpRange.java  
 \* /spring-web-5-2-20-release-sources-jar/org/springframework/web/client/HttpClientErrorException.java  
 \* /spring-web-5-2-20-release-sources-jar/org/springframework/http/codec/support/ClientDefaultCodecsImpl.java  
 \*  
 /spring-web-5-2-20-release-sources-jar/org/springframework/http/codec/xml/JaxbContextContainer.java  
 \* /spring-web-5-2-20-release-sources-jar/org/springframework/web/filter/reactive/ForwardedHeaderFilter.java  
 \* /spring-web-5-2-20-release-sources-jar/org/springframework/web/util/HtmlUtils.java  
 \* /spring-web-5-2-20-release-sources-jar/org/springframework/http/server/reactive/AbstractServerHttpRequest.java

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* /spring-web-5-2-20-release-sources-
jar/org/springframework/http/converter/xml/SourceHttpMessageConverter.java
* /spring-web-5-2-20-release-sources-jar/org/springframework/http/codec/ClientCodecConfigurer.java
* /spring-web-5-2-20-release-sources-jar/org/springframework/http/codec/support/ServerDefaultCodecsImpl.java
* /spring-web-5-2-20-release-sources-jar/org/springframework/web/method/annotation/ModelFactory.java
* /spring-web-5-2-20-release-sources-jar/org/springframework/http/codec/FormHttpMessageReader.java
* /spring-web-5-2-20-release-sources-jar/org/springframework/http/server/ServerHttpRequest.java
*
/spring-web-5-2-20-release-sources-
jar/org/springframework/http/codec/support/DefaultServerCodecConfigurer.java
* /spring-web-5-2-20-release-sources-jar/org/springframework/web/client/RestOperationsExtensions.kt
* /spring-web-5-2-20-release-sources-
jar/org/springframework/web/method/annotation/AbstractWebArgumentResolverAdapter.java
* /spring-web-5-2-20-release-sources-
jar/org/springframework/http/codec/support/DefaultClientCodecConfigurer.java
* /spring-web-5-2-20-release-sources-
jar/org/springframework/http/converter/BufferedImageHttpMessageConverter.java
* /spring-web-5-2-20-release-sources-jar/org/springframework/web/server/ServerWebExchangeDecorator.java
* /spring-web-5-2-20-release-sources-jar/org/springframework/http/client/reactive/ClientHttpResponse.java
* /spring-web-5-2-20-release-sources-jar/org/springframework/http/codec/FormHttpMessageWriter.java
* /spring-web-5-2-20-release-sources-jar/org/springframework/web/accept/MediaTypeFileExtensionResolver.java
*
/spring-web-5-2-20-release-sources-jar/org/springframework/http/client/support/HttpAccessor.java
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- \* /spring-web-5-2-20-release-sources-jar/org/springframework/http/HttpMessage.java
- \* /spring-web-5-2-20-release-sources-jar/org/springframework/web/server/WebFilterChain.java
- \* /spring-web-5-2-20-release-sources-jar/org/springframework/web/bind/annotation/SessionAttributes.java
- \* /spring-web-5-2-20-release-sources-jar/org/springframework/web/util/HttpSessionMutexListener.java
- \*
- /spring-web-5-2-20-release-sources-jar/org/springframework/web/multipart/MultipartResolver.java
- \* /spring-web-5-2-20-release-sources-jar/org/springframework/web/filter/CommonsRequestLoggingFilter.java
- \* /spring-web-5-2-20-release-sources-jar/org/springframework/web/filter/RequestContextFilter.java
- \* /spring-web-5-2-20-release-sources-jar/org/springframework/web/context/request/RequestContextListener.java
- \* /spring-web-5-2-20-release-sources-jar/org/springframework/web/bind/annotation/RequestMethod.java
- \* /spring-web-5-2-20-release-sources-
- jar/org/springframework/web/bind/support/SpringWebConstraintValidatorFactory.java
- \* /spring-web-5-2-20-release-sources-jar/org/springframework/web/server/WebFilter.java
- \* /spring-web-5-2-20-release-sources-
- jar/org/springframework/http/converter/HttpMessageNotWritableException.java
- \* /spring-web-5-2-20-release-sources-
- jar/org/springframework/http/converter/HttpMessageConversionException.java
- \*
- /spring-web-5-2-20-release-sources-
- jar/org/springframework/http/client/AbstractClientHttpRequestFactoryWrapper.java
- \* /spring-web-5-2-20-release-sources-
- jar/org/springframework/web/context/request/DestructionCallbackBindingListener.java

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```

* /spring-web-5-2-20-release-sources-jar/org/springframework/http/client/ClientHttpResponse.java
* /spring-web-5-2-20-release-sources-jar/org/springframework/web/util/HierarchicalUriComponents.java
* /spring-web-5-2-20-release-sources-
jar/org/springframework/web/accept/ContentNegotiationManagerFactoryBean.java
*
/spring-web-5-2-20-release-sources-jar/org/springframework/http/server/reactive/ServletServerHttpResponse.java
* /spring-web-5-2-20-release-sources-jar/org/springframework/web/cors/reactive/DefaultCorsProcessor.java
* /spring-web-5-2-20-release-sources-jar/org/springframework/http/HttpHeaders.java
* /spring-web-5-2-20-release-sources-jar/org/springframework/web/cors/DefaultCorsProcessor.java
* /spring-web-5-2-20-release-sources-jar/org/springframework/http/ReadOnlyHttpHeaders.java
* /spring-web-5-2-20-release-sources-jar/org/springframework/web/server/adapter/WebHttpHandlerBuilder.java
* /spring-web-5-2-20-release-sources-jar/org/springframework/http/server/reactive/ServerHttpRequest.java
* /spring-web-5-2-20-release-sources-jar/org/springframework/http/client/reactive/ReactorClientHttpConnector.java
* /spring-web-5-2-20-release-sources-jar/org/springframework/http/client/reactive/ReactorResourceFactory.java
* /spring-web-5-2-20-release-sources-jar/org/springframework/web/method/annotation/MapMethodProcessor.java
*
/spring-web-5-2-20-release-sources-jar/org/springframework/http/server/reactive/ServerHttpResponse.java
* /spring-web-5-2-20-release-sources-
jar/org/springframework/web/cors/reactive/UrlBasedCorsConfigurationSource.java
* /spring-web-5-2-20-release-sources-jar/org/springframework/web/context/request/WebRequest.java
* /spring-web-5-2-20-release-sources-jar/org/springframework/http/client/reactive/JettyClientHttpResponse.java
* /spring-web-5-2-20-release-sources-jar/org/springframework/http/ResponseCookie.java
* /spring-web-5-2-20-release-sources-jar/org/springframework/http/codec/xml/Jaxb2XmlDecoder.java
* /spring-web-5-2-20-release-sources-jar/org/springframework/web/cors/CorsUtils.java
* /spring-web-5-2-20-release-sources-
jar/org/springframework/web/method/annotation/AbstractNamedValueMethodArgumentResolver.java
* /spring-web-5-2-20-release-sources-jar/org/springframework/http/codec/json/AbstractJackson2Decoder.java
* /spring-web-5-2-20-release-sources-jar/org/springframework/http/codec/ServerSentEventHttpMessageWriter.java
*
/spring-web-5-2-20-release-sources-jar/org/springframework/http/converter/json/JsonbHttpMessageConverter.java
* /spring-web-5-2-20-release-sources-jar/org/springframework/web/accept/ContentNegotiationManager.java
* /spring-web-5-2-20-release-sources-jar/org/springframework/web/server/NotAcceptableStatusException.java
* /spring-web-5-2-20-release-sources-jar/org/springframework/web/client/RestClientException.java
* /spring-web-5-2-20-release-sources-jar/org/springframework/http/converter/HttpMessageConverter.java
* /spring-web-5-2-20-release-sources-
jar/org/springframework/http/server/reactive/UndertowServerHttpResponse.java
* /spring-web-5-2-20-release-sources-jar/org/springframework/http/server/reactive/TomcatHttpHandlerAdapter.java
* /spring-web-5-2-20-release-sources-
jar/org/springframework/http/server/reactive/ServerHttpRequestDecorator.java
* /spring-web-5-2-20-release-sources-jar/org/springframework/http/MediaType.java
*

```

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/spring-web-5-2-20-release-sources-jar/org/springframework/web/cors/reactive/CorsUtils.java
* /spring-web-5-2-20-release-sources-jar/org/springframework/http/codec/CodecConfigurer.java
* /spring-web-5-2-20-release-sources-jar/org/springframework/http/server/reactive/ReactorServerHttpResponse.java
* /spring-web-5-2-20-release-sources-jar/org/springframework/http/client/reactive/JettyClientHttpConnector.java
* /spring-web-5-2-20-release-sources-jar/org/springframework/web/util/ServletContextPropertyUtils.java
* /spring-web-5-2-20-release-sources-jar/org/springframework/http/converter/json/GsonHttpMessageConverter.java
* /spring-web-5-2-20-release-sources-jar/org/springframework/web/bind/annotation/RequestMapping.java
* /spring-web-5-2-20-release-sources-
jar/org/springframework/http/converter/json/AbstractJsonHttpMessageConverter.java
* /spring-web-5-2-20-release-sources-jar/org/springframework/web/bind/annotation/CrossOrigin.java
* /spring-web-5-2-20-release-sources-jar/org/springframework/http/client/reactive/ReactorClientHttpResponse.java
*
/spring-web-5-2-20-release-sources-jar/org/springframework/http/codec/json/AbstractJackson2Encoder.java
* /spring-web-5-2-20-release-sources-
jar/org/springframework/http/converter/protobuf/ProtobufJsonFormatHttpMessageConverter.java
* /spring-web-5-2-20-release-sources-
jar/org/springframework/http/codec/multipart/MultipartHttpMessageReader.java
* /spring-web-5-2-20-release-sources-jar/org/springframework/web/method/annotation/ModelMethodProcessor.java
* /spring-web-5-2-20-release-sources-
jar/org/springframework/http/client/HttpComponentsClientHttpRequestFactory.java
* /spring-web-5-2-20-release-sources-
jar/org/springframework/web/method/support/HandlerMethodArgumentResolverComposite.java
* /spring-web-5-2-20-release-sources-jar/org/springframework/web/util/UriTemplate.java
* /spring-web-5-2-20-release-sources-jar/org/springframework/http/ContentDisposition.java
* /spring-web-5-2-20-release-sources-
jar/org/springframework/web/multipart/support/MissingServletRequestPartException.java
*
/spring-web-5-2-20-release-sources-jar/org/springframework/web/method/support/InvocableHandlerMethod.java
* /spring-web-5-2-20-release-sources-jar/org/springframework/web/util/UriBuilderFactory.java
* /spring-web-5-2-20-release-sources-jar/org/springframework/web/bind/support/WebExchangeBindException.java
* /spring-web-5-2-20-release-sources-
jar/org/springframework/http/server/reactive/UndertowServerHttpRequest.java
* /spring-web-5-2-20-release-sources-jar/org/springframework/http/codec/ServerSentEventHttpMessageReader.java
* /spring-web-5-2-20-release-sources-jar/org/springframework/http/client/reactive/JettyClientHttpRequest.java
* /spring-web-5-2-20-release-sources-jar/org/springframework/http/codec/json/Jackson2JsonDecoder.java
* /spring-web-5-2-20-release-sources-jar/org/springframework/http/converter/AbstractHttpMessageConverter.java
* /spring-web-5-2-20-release-sources-jar/org/springframework/web/client/UnknownContentTypeException.java
*
/spring-web-5-2-20-release-sources-jar/org/springframework/web/client/HttpMessageConverterExtractor.java
* /spring-web-5-2-20-release-sources-
jar/org/springframework/http/server/reactive/DefaultServerHttpRequestBuilder.java
* /spring-web-5-2-20-release-sources-jar/org/springframework/web/context/request/async/WebAsyncManager.java
* /spring-web-5-2-20-release-sources-
jar/org/springframework/remoting/httpinvoker/AbstractHttpInvokerRequestExecutor.java
* /spring-web-5-2-20-release-sources-jar/org/springframework/http/client/support/InterceptingHttpAccessor.java
* /spring-web-5-2-20-release-sources-
jar/org/springframework/web/context/support/ServletContextResourcePatternResolver.java
* /spring-web-5-2-20-release-sources-jar/org/springframework/http/codec/json/Jackson2CodecSupport.java

```



\* /spring-web-5-2-20-release-sources-jar/org/springframework/web/util/DefaultUriBuilderFactory.java  
 \* /spring-web-5-2-20-release-sources-jar/org/springframework/http/client/reactive/ReactorClientHttpRequest.java  
 \*  
 /spring-web-5-2-20-release-sources-jar/org/springframework/web/util/UriBuilder.java  
 \* /spring-web-5-2-20-release-sources-jar/org/springframework/web/util/pattern/PathPatternParser.java  
 \* /spring-web-5-2-20-release-sources-jar/org/springframework/http/RequestEntity.java  
 \* /spring-web-5-2-20-release-sources-jar/org/springframework/http/server/reactive/HttpHeadResponseDecorator.java  
 \* /spring-web-5-2-20-release-sources-jar/org/springframework/http/server/reactive/ReactorServerHttpRequest.java  
 \* /spring-web-5-2-20-release-sources-jar/org/springframework/web/server/MediaTypeNotSupportedException.java  
 \* /spring-web-5-2-20-release-sources-jar/org/springframework/web/util/WebUtils.java  
 \* /spring-web-5-2-20-release-sources-jar/org/springframework/http/converter/FormHttpMessageConverter.java  
 \* /spring-web-5-2-20-release-sources-jar/org/springframework/web/client/RestTemplate.java  
 \* /spring-web-5-2-20-release-sources-jar/org/springframework/http/server/reactive/ServletServerHttpRequest.java  
 \*  
 /spring-web-5-2-20-release-sources-jar/org/springframework/http/codec/multipart/MultipartHttpMessageWriter.java  
 \* /spring-web-5-2-20-release-sources-jar/org/springframework/http/codec/support/BaseCodecConfigurer.java  
 \* /spring-web-5-2-20-release-sources-jar/org/springframework/web/server/i18n/AcceptHeaderLocaleContextResolver.java  
 \* /spring-web-5-2-20-release-sources-jar/org/springframework/http/converter/json/AbstractJackson2HttpMessageConverter.java  
 \* /spring-web-5-2-20-release-sources-jar/org/springframework/web/method/HandlerMethod.java  
 \* /spring-web-5-2-20-release-sources-jar/org/springframework/web/accept/ServletPathExtensionContentNegotiationStrategy.java  
 \* /spring-web-5-2-20-release-sources-jar/org/springframework/web/server/MethodNotAllowedException.java  
 \* /spring-web-5-2-20-release-sources-jar/org/springframework/http/codec/support/BaseDefaultCodecs.java  
 \* /spring-web-5-2-20-release-sources-jar/org/springframework/http/converter/json/Jackson2ObjectMapperBuilder.java  
 \*  
 /spring-web-5-2-20-release-sources-jar/org/springframework/http/server/reactive/AbstractListenerWriteProcessor.java  
 \* /spring-web-5-2-20-release-sources-jar/org/springframework/web/server/session/DefaultWebSessionManager.java  
 \* /spring-web-5-2-20-release-sources-jar/org/springframework/web/filter/ShallowEtagHeaderFilter.java  
 \* /spring-web-5-2-20-release-sources-jar/org/springframework/web/multipart/support/RequestPartServletServerHttpRequest.java  
 \* /spring-web-5-2-20-release-sources-jar/org/springframework/http/server/reactive/AbstractServerHttpResponse.java  
 \* /spring-web-5-2-20-release-sources-jar/org/springframework/http/converter/StringHttpMessageConverter.java  
 \* /spring-web-5-2-20-release-sources-jar/org/springframework/web/method/ControllerAdviceBean.java  
 \* /spring-web-5-2-20-release-sources-jar/org/springframework/web/accept/MappingMediaTypeFileExtensionResolver.java  
 \* /spring-web-5-2-20-release-sources-jar/org/springframework/http/codec/json/Jackson2Tokenizer.java  
 \*  
 /spring-web-5-2-20-release-sources-jar/org/springframework/http/converter/ResourceHttpMessageConverter.java  
 \* /spring-web-5-2-20-release-sources-jar/org/springframework/web/server/handler/ExceptionHandlerWebHandler.java

\* /spring-web-5-2-20-release-sources-jar/org/springframework/http/codec/EncoderHttpMessageWriter.java  
\* /spring-web-5-2-20-release-sources-jar/org/springframework/http/server/reactive/WriteResultPublisher.java  
\* /spring-web-5-2-20-release-sources-jar/org/springframework/web/accept/PathExtensionContentNegotiationStrategy.java  
\* /spring-web-5-2-20-release-sources-jar/org/springframework/web/context/support/WebApplicationContextUtils.java  
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\*/  
/\*\*  
\* Return the web session for the current request. Always guaranteed to  
\* return an instance either matching to the session id requested by the  
\* client, or with a new session id either because the client did not  
\* specify one or because the underlying session had expired. Use of this  
\* method  
does not automatically create a session. See { @link WebSession }  
\* for more details.  
\*/

Found in path(s):

\* /spring-web-5-2-20-release-sources-jar/org/springframework/web/server/ServerWebExchange.java  
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Found in path(s):

\* /spring-web-5-2-20-release-sources-jar/org/springframework/web/bind/annotation/Mapping.java

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```
This file maps Internet media types to unique file extension(s).
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The table below contains both registered and (common) unregistered types.
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here to guide configurations toward known types and to make it easier to
identify "new" types. File extensions are also commonly used to indicate
content languages and encodings, so choose them carefully.
#
Internet media types should be registered as described in RFC 4288.
The registry is at <https://www.iana.org/assignments/media-types/>.
#
This file was retrieved from
https://svn.apache.org/viewvc/httpd/httpd/trunk/docs/conf/mime.types?revision=1752884&view=co
#
MIME type (lowercased) Extensions
=====
#
application/1d-interleaved-parityfec
application/3gpdash-qoe-report+xml
application/3gpp-ims+xml
application/a2l
application/activemessage
application/alto-costmap+json
application/alto-costmapfilter+json
application/alto-directory+json
application/alto-endpointcost+json
application/alto-endpointcostparams+json
application/alto-endpointprop+json
application/alto-endpointpropparams+json
application/alto-error+json
application/alto-networkmap+json
application/alto-networkmapfilter+json
application/aml
application/andrew-inset ez
application/applefile
application/applixware aw
application/atf
```

# application/atfx  
application/atom+xml atom  
application/atomcat+xml atomcat  
# application/atomdeleted+xml  
# application/atomicmail  
application/atomsvc+xml atomsvc  
# application/atxml  
# application/auth-policy+xml  
# application/bacnet-xdd+zip  
# application/batch-smtp  
# application/beep+xml  
# application/calendar+json  
# application/calendar+xml  
#  
application/call-completion  
# application/cals-1840  
# application/cbor  
# application/ccmp+xml  
application/ccxml+xml ccxml  
# application/cdfx+xml  
application/cdmi-capability cdmia  
application/cdmi-container cdmic  
application/cdmi-domain cdmid  
application/cdmi-object cdmio  
application/cdmi-queue cdmiq  
# application/cdni  
# application/cea  
# application/cea-2018+xml  
# application/cellml+xml  
# application/cfw  
# application/cms  
# application/cnrp+xml  
# application/coap-group+json  
# application/commonground  
# application/conference-info+xml  
# application/cpl+xml  
# application/csrattrs  
# application/csta+xml  
# application/cstadata+xml  
# application/csvm+json  
application/cu-seeme cu  
# application/cybercash  
# application/dash+xml  
# application/dashdelta  
application/davmount+xml davmount  
# application/dca-rft  
# application/dcd  
# application/dec-dx

# application/dialog-info+xml  
# application/dicom  
# application/dii  
# application/dit  
# application/dns  
application/docbook+xml dbk  
#  
application/dskpp+xml  
application/dssc+der dssc  
application/dssc+xml xdssc  
# application/dvcs  
application/ecmascript ecma  
# application/edi-consent  
# application/edi-x12  
# application/edifact  
# application/efi  
# application/emergencycalldata.comment+xml  
# application/emergencycalldata.deviceinfo+xml  
# application/emergencycalldata.providerinfo+xml  
# application/emergencycalldata.serviceinfo+xml  
# application/emergencycalldata.subscriberinfo+xml  
application/emma+xml emma  
# application/emotionml+xml  
# application/encaprtsp  
# application/epp+xml  
application/epub+zip epub  
# application/eshop  
# application/example  
application/exi exi  
# application/fastinfoset  
# application/fastsoap  
# application/fdt+xml  
# application/fits  
# application/font-sfnt  
application/font-tdpfr pfr  
application/font-woff woff  
# application/framework-attributes+xml  
# application/geo+json  
application/gml+xml gml  
application/gpx+xml gpx  
application/gxf gxf  
# application/gzip  
#  
application/h224  
# application/held+xml  
# application/http  
application/hyperstudio stk  
# application/ibe-key-request+xml

```

application/ibe-pkg-reply+xml
application/ibe-pp-data
application/iges
application/im-iscomposing+xml
application/index
application/index.cmd
application/index.obj
application/index.response
application/index.vnd
application/inkml+xml ink inkml
application/iotp
application/ipfix ipfix
application/ipp
application/isup
application/its+xml
application/java-archive jar
application/java-serialized-object ser
application/java-vm class
application/javascript js
application/jose
application/jose+json
application/jrd+json
application/json json
application/json-patch+json
application/json-seq
application/jsonml+json jsonml
application/jwk+json
application/jwk-set+json
application/jwt
application/kpml-request+xml
application/kpml-response+xml
application/ld+json
application/lgr+xml
application/link-format
#
application/load-control+xml
application/lost+xml lostxml
application/lostsync+xml
application/lxf
application/mac-binhex40 hqx
application/mac-compactpro cpt
application/macwriteii
application/mads+xml mads
application/marc mrc
application/marcxml+xml mrcx
application/mathematica ma nb mb
application/mathml+xml mathml
application/mathml-content+xml

```

```

application/mathml-presentation+xml
application/mbms-associated-procedure-description+xml
application/mbms-deregister+xml
application/mbms-envelope+xml
application/mbms-msk+xml
application/mbms-msk-response+xml
application/mbms-protection-description+xml
application/mbms-reception-report+xml
application/mbms-register+xml
application/mbms-register-response+xml
application/mbms-schedule+xml
application/mbms-user-service-description+xml
application/mbox mbox
application/media-policy-dataset+xml
application/media_control+xml
application/mediaservercontrol+xml mscml
application/merge-patch+json
application/metalink+xml metalink
application/metalink4+xml meta4
application/mets+xml mets
#
application/mf4
application/mikey
application/mods+xml mods
application/moss-keys
application/moss-signature
application/mosskey-data
application/mosskey-request
application/mp21 m21 mp21
application/mp4 mp4s
application/mpeg4-generic
application/mpeg4-iod
application/mpeg4-iod-xmt
application/mrb-consumer+xml
application/mrb-publish+xml
application/msc-ivr+xml
application/msc-mixer+xml
application/msword doc dot
application/mxf mxf
application/nasdata
application/news-checkgroups
application/news-groupinfo
application/news-transmission
application/nlsml+xml
application/nss
application/ocsp-request
application/ocsp-response
application/octet-stream bin dms lrf mar so dist distz pkg bpk dump elc deploy

```

application/oda oda  
# application/odx  
application/oebps-package+xml opf  
application/ogg ogx  
application/omdoc+xml omdoc  
application/onenote onetoc  
onetoc2 onetmp onepkg  
application/oxps oxps  
# application/p2p-overlay+xml  
# application/parityfec  
application/patch-ops-error+xml xer  
application/pdf pdf  
# application/pdx  
application/pgp-encrypted pgp  
# application/pgp-keys  
application/pgp-signature asc sig  
application/pics-rules prf  
# application/pidf+xml  
# application/pidf-diff+xml  
application/pkcs10 p10  
# application/pkcs12  
application/pkcs7-mime p7m p7c  
application/pkcs7-signature p7s  
application/pkcs8 p8  
application/pkix-attr-cert ac  
application/pkix-cert cer  
application/pkix-crl crl  
application/pkix-pkipath pkipath  
application/pkixcmp pki  
application/pls+xml pls  
# application/poc-settings+xml  
application/postscript ai eps ps  
# application/ppsp-tracker+json  
# application/problem+json  
# application/problem+xml  
# application/provenance+xml  
# application/prs.alvestrand.titrax-sheet  
application/prs.cww cww  
# application/prs.hpub+zip  
#  
application/prs.nprend  
# application/prs.plucker  
# application/prs.rdf-xml-crypt  
# application/prs.xsf+xml  
application/pskc+xml pskcxml  
# application/qsig  
# application/raptorfec  
# application/rdap+json



application/rdf+xml rdf  
application/reginfo+xml rif  
application/relax-ng-compact-syntax rnc  
# application/remote-printing  
# application/reputon+json  
application/resource-lists+xml rl  
application/resource-lists-diff+xml rld  
# application/rfc+xml  
# application/riscos  
# application/rlmi+xml  
application/rls-services+xml rs  
application/rpki-ghostbusters gbr  
application/rpki-manifest mft  
application/rpki-roa roa  
# application/rpki-updown  
application/rsd+xml rsd  
application/rss+xml rss  
application/rtf rtf  
# application/rtploopback  
# application/rtx  
# application/samlassertion+xml  
# application/samlmetadata+xml  
application/sbml+xml sbml  
# application/scaip+xml  
# application/scim+json  
application/scvp-cv-request scq  
application/scvp-cv-response scs  
application/scvp-vp-request spq  
application/scvp-vp-response spp  
application/sdp sdp  
#  
application/sep+xml  
# application/sep-exi  
# application/session-info  
# application/set-payment  
application/set-payment-initiation setpay  
# application/set-registration  
application/set-registration-initiation setreg  
# application/sgml  
# application/sgml-open-catalog  
application/shf+xml shf  
# application/sieve  
# application/simple-filter+xml  
# application/simple-message-summary  
# application/simplesymbolcontainer  
# application/slate  
# application/smil  
application/smil+xml smi smil

# application/smpite336m  
# application/soap+fastinfoset  
# application/soap+xml  
application/sparql-query rq  
application/sparql-results+xml srx  
# application/spirits-event+xml  
# application/sql  
application/srgs gram  
application/srgs+xml grxml  
application/sru+xml sru  
application/ssdl+xml ssdl  
application/ssml+xml ssml  
# application/tamp-apex-update  
# application/tamp-apex-update-confirm  
# application/tamp-community-update  
#  
application/tamp-community-update-confirm  
# application/tamp-error  
# application/tamp-sequence-adjust  
# application/tamp-sequence-adjust-confirm  
# application/tamp-status-query  
# application/tamp-status-response  
# application/tamp-update  
# application/tamp-update-confirm  
application/tei+xml tei teicorpus  
application/thraud+xml tfi  
# application/timestamp-query  
# application/timestamp-reply  
application/timestamped-data tsd  
# application/ttml+xml  
# application/tve-trigger  
# application/ulpfec  
# application/urc-grpsheet+xml  
# application/urc-ressheet+xml  
# application/urc-targetdesc+xml  
# application/urc-uisocketdesc+xml  
# application/vcard+json  
# application/vcard+xml  
# application/vemmi  
# application/vividence.scriptfile  
# application/vnd.3gpp-prose+xml  
# application/vnd.3gpp-prose-pc3ch+xml  
# application/vnd.3gpp.access-transfer-events+xml  
# application/vnd.3gpp.bsf+xml  
# application/vnd.3gpp.mid-call+xml  
application/vnd.3gpp.pic-bw-large plb  
application/vnd.3gpp.pic-bw-small psb  
application/vnd.3gpp.pic-bw-var pvb

```

#
application/vnd.3gpp.sms
application/vnd.3gpp.sms+xml
application/vnd.3gpp.srvcc-ext+xml
application/vnd.3gpp.srvcc-info+xml
application/vnd.3gpp.state-and-event-info+xml
application/vnd.3gpp.ussd+xml
application/vnd.3gpp2.bcmcsinfo+xml
application/vnd.3gpp2.sms
application/vnd.3gpp2.tcap tcap
application/vnd.3lightssoftware.imagescal
application/vnd.3m.post-it-notes pwn
application/vnd.accpac.simply.aso aso
application/vnd.accpac.simply.imp imp
application/vnd.acucobol acu
application/vnd.acucorp atc acutc
application/vnd.adobe.air-application-installer-package+zip air
application/vnd.adobe.flash.movie
application/vnd.adobe.formscentral.fcdt fcdt
application/vnd.adobe.fxp fxp fxpl
application/vnd.adobe.partial-upload
application/vnd.adobe.xdp+xml xdp
application/vnd.adobe.xfdf xfdf
application/vnd.aether.imp
application/vnd.ah-barcode
application/vnd.ahead.space ahead
application/vnd.airzip.filesecure.azf azf
application/vnd.airzip.filesecure.azs azs
application/vnd.amazon.ebook azw
#
application/vnd.amazon.mobi8-ebook
application/vnd.americandynamics.acc acc
application/vnd.amiga.ami ami
application/vnd.amundsen.maze+xml
application/vnd.android.package-archive apk
application/vnd.anki
application/vnd.anser-web-certificate-issue-initiation cii
application/vnd.anser-web-funds-transfer-initiation fti
application/vnd.antix.game-component atx
application/vnd.apache.thrift.binary
application/vnd.apache.thrift.compact
application/vnd.apache.thrift.json
application/vnd.api+json
application/vnd.apple.installer+xml mpkg
application/vnd.apple.mpegurl m3u8
application/vnd.arastra.swi
application/vnd.aristanetworks.swi swi
application/vnd.artsquare

```

```

application/vnd.astraea-software.iota iota
application/vnd.audiograph aep
application/vnd.autopackage
application/vnd.avistar+xml
application/vnd.balsamiq.bmml+xml
application/vnd.balsamiq.bmpr
#
application/vnd.bekitzur-stech+json
application/vnd.biopax.rdf+xml
application/vnd.blueice.multipass mpm
application/vnd.bluetooth.ep.oob
application/vnd.bluetooth.le.oob
application/vnd.bmi bmi
application/vnd.businessobjects rep
application/vnd.cab-jscript
application/vnd.canon-cpdl
application/vnd.canon-lips
application/vnd.cendio.thinlinc.clientconf
application/vnd.century-systems.tcp_stream
application/vnd.chemdraw+xml cdxml
application/vnd.chess-pgn
application/vnd.chipnuts.karaoke-mmd mmd
application/vnd.cinderella cdy
application/vnd.cirpack.isdn-ext
application/vnd.citationstyles.style+xml
application/vnd.claymore cla
application/vnd.cloanto.rp9 rp9
application/vnd.clonk.c4group c4g c4d c4f c4p c4u
application/vnd.cluetrust.cartomobile-config c11amc
application/vnd.cluetrust.cartomobile-config-pkg c11amz
application/vnd.coffeescript
application/vnd.collection+json
application/vnd.collection.doc+json
application/vnd.collection.next+json
#
application/vnd.comicbook+zip
application/vnd.commerce-battelle
application/vnd.commonspace csp
application/vnd.contact.cmsg cdbcmg
application/vnd.coreos.ignition+json
application/vnd.cosmocaller cmc
application/vnd.crick.clicker clkx
application/vnd.crick.clicker.keyboard clkk
application/vnd.crick.clicker.palette clkp
application/vnd.crick.clicker.template clkt
application/vnd.crick.clicker.wordbank clkw
application/vnd.criticaltools.wbs+xml wbs
application/vnd.ctc-posml pml

```

# application/vnd.ctct.ws+xml  
# application/vnd.cups-pdf  
# application/vnd.cups-postscript  
application/vnd.cups-ppd ppd  
# application/vnd.cups-raster  
# application/vnd.cups-raw  
# application/vnd.curl  
application/vnd.curl.car car  
application/vnd.curl.pcurl pcurl  
# application/vnd.cyan.dean.root+xml  
# application/vnd.cybank  
application/vnd.dart dart  
application/vnd.data-vision.rdz rdz  
# application/vnd.debian.binary-package  
application/vnd.dece.data uvf uvvf  
uvd uvvd  
application/vnd.dece.ttml+xml uvt uvvt  
application/vnd.dece.unspecified uvx uvvx  
application/vnd.dece.zip uvz uvvz  
application/vnd.denovo.fcselayout-link fe\_launch  
# application/vnd.desmume.movie  
# application/vnd.dir-bi.plate-dl-nosuffix  
# application/vnd.dm.delegation+xml  
application/vnd.dna dna  
# application/vnd.document+json  
application/vnd.dolby.mlp mlp  
# application/vnd.dolby.mobile.1  
# application/vnd.dolby.mobile.2  
# application/vnd.doremir.scorecloud-binary-document  
application/vnd.dpgraph dpg  
application/vnd.dreamfactory dfac  
# application/vnd.drive+json  
application/vnd.ds-keypoint kpxx  
# application/vnd.dtg.local  
# application/vnd.dtg.local.flash  
# application/vnd.dtg.local.html  
application/vnd.dvb.ait ait  
# application/vnd.dvb.dvbj  
# application/vnd.dvb.esgcontainer  
# application/vnd.dvb.ipdcdftnotifaccess  
# application/vnd.dvb.ipdcesgaccess  
# application/vnd.dvb.ipdcesgaccess2  
# application/vnd.dvb.ipdcesgpdd  
# application/vnd.dvb.ipdcroaming  
#  
application/vnd.dvb.iptv.alfec-base  
# application/vnd.dvb.iptv.alfec-enhancement  
# application/vnd.dvb.notif-aggregate-root+xml

```
application/vnd.dvb.notif-container+xml
application/vnd.dvb.notif-generic+xml
application/vnd.dvb.notif-ia-msglist+xml
application/vnd.dvb.notif-ia-registration-request+xml
application/vnd.dvb.notif-ia-registration-response+xml
application/vnd.dvb.notif-init+xml
application/vnd.dvb.pfr
application/vnd.dvb.service svc
application/vnd.dxr
application/vnd.dynageo geo
application/vnd.dzr
application/vnd.easykaraoke.cdgdownload
application/vnd.ecdis-update
application/vnd.ecowin.chart mag
application/vnd.ecowin.filerequest
application/vnd.ecowin.fileupdate
application/vnd.ecowin.series
application/vnd.ecowin.seriesrequest
application/vnd.ecowin.seriesupdate
application/vnd.emclient.accessrequest+xml
application/vnd.enliven nml
application/vnd.enphase.envoy
application/vnd.eprints.data+xml
application/vnd.epson.esf esf
application/vnd.epson.msf msf
application/vnd.epson.quickanime qam
application/vnd.epson.salt slt
application/vnd.epson.ssf ssf
#
application/vnd.ericsson.quickcall
application/vnd.eszigno3+xml es3 et3
application/vnd.etsi.aoc+xml
application/vnd.etsi.asic-e+zip
application/vnd.etsi.asic-s+zip
application/vnd.etsi.cug+xml
application/vnd.etsi.iptvcommand+xml
application/vnd.etsi.iptvdiscovery+xml
application/vnd.etsi.iptvprofile+xml
application/vnd.etsi.iptvsad-bc+xml
application/vnd.etsi.iptvsad-cod+xml
application/vnd.etsi.iptvsad-npvr+xml
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application/vnd.etsi.overload-control-policy-dataset+xml
application/vnd.etsi.pstn+xml
```

# application/vnd.etsi.sci+xml  
# application/vnd.etsi.simserv+xml  
# application/vnd.etsi.timestamp-token  
# application/vnd.etsi.tsl+xml  
# application/vnd.etsi.tsl.der  
#  
application/vnd.eudora.data  
application/vnd.ezpix-album ez2  
application/vnd.ezpix-package ez3  
# application/vnd.f-secure.mobile  
# application/vnd.fastcopy-disk-image  
application/vnd.fdf fdf  
application/vnd.fdsn.mseed mseed  
application/vnd.fdsn.seed seed dataless  
# application/vnd.ffmpeg  
# application/vnd.filmit.zfc  
# application/vnd.fints  
# application/vnd.firemonkeys.cloudcell  
application/vnd.flographit gph  
application/vnd.fluxtime.clip ftc  
# application/vnd.font-fontforge-sfd  
application/vnd.frame-maker fm frame maker book  
application/vnd.frogans.fnc fnc  
application/vnd.frogans.ltf ltf  
application/vnd.fsc.weblaunch fsc  
application/vnd.fujitsu.oasys oas  
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application/vnd.fujitsu.oasys3 oa3  
application/vnd.fujitsu.oasysgp fg5  
application/vnd.fujitsu.oasysprs bh2  
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# application/vnd.fujixerox.art4  
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# application/vnd.fut-misnet  
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# application/vnd.geocube+xml  
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application/vnd.geonext gxt  
application/vnd.geoplan g2w

application/vnd.geospace g3w  
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# application/vnd.globalplatform.card-content-mgt-response  
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# application/vnd.gridmp  
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application/vnd.groove-identity-message gim  
application/vnd.groove-injector grv  
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# application/vnd.hcl-bireports  
# application/vnd.hdt  
# application/vnd.heroku+json  
application/vnd.hhe.lesson-player les  
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application/vnd.hp-hpid hpid  
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# application/vnd.hyperdrive+json  
# application/vnd.hzn-3d-crossword  
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# application/vnd.ibm.electronic-media  
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application/vnd.ibm.modcap afp listafp list3820  
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application/vnd.ibm.secure-container sc  
application/vnd.iccprofile icc  
icm  
# application/vnd.ieee.1905  
application/vnd.igloader igl



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 # application/vnd.jsk.isdn-ngn

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ktr  
application/vnd.kde.karbon karbon  
application/vnd.kde.kchart chrt  
application/vnd.kde.kformula kfo  
application/vnd.kde.kivio flw  
application/vnd.kde.kontour kon  
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application/vnd.koan skp skd skt skm  
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application/vnd.lotus-freelance pre  
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application/vnd.lotus-screencam scm  
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# application/vnd.micro+json  
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# application/vnd.miele+json  
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# application/vnd.minisoft-hp3000-save

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application/vnd.ms-htmlhelp chm
application/vnd.ms-ims ims
application/vnd.ms-lrm lrm
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application/vnd.ms-opentype
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application/vnd.ms-windows.printerpairing
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application/vnd.ms-wmdrm.lic-resp
#
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application/vnd.ms-works wps wks wcm wdb
application/vnd.ms-wpl wpl
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application/vnd.mseq mseq
application/vnd.msign
application/vnd.multiad.creator
application/vnd.multiad.creator.cif
application/vnd.music-niff
application/vnd.musician mus
application/vnd.muvee.style msty
application/vnd.mynfc taglet
application/vnd.ncd.control
application/vnd.ncd.reference
application/vnd.nervana
application/vnd.netfpx
application/vnd.neurolanguage.nlu nlu
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application/vnd.nokia.landmark+xml
application/vnd.nokia.landmarkcollection+xml

```

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application/vnd.nokia.pcd+xml
application/vnd.nokia.radio-preset rpst
application/vnd.nokia.radio-presets rpss
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application/vnd.ntt-local.content-share
application/vnd.ntt-local.file-transfer
application/vnd.ntt-local.ogw_remote-access
application/vnd.ntt-local.sip-ta_remote
application/vnd.ntt-local.sip-ta_tcp_stream
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application/vnd.oasis.opendocument.image odi
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#
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```

application/vnd.olpc-sugar xo  
# application/vnd.oma-scws-config  
# application/vnd.oma-scws-http-request  
# application/vnd.oma-scws-http-response  
# application/vnd.oma.bcast.associated-procedure-parameter+xml  
# application/vnd.oma.bcast.drm-trigger+xml  
# application/vnd.oma.bcast.imd+xml  
# application/vnd.oma.bcast.ltkm  
# application/vnd.oma.bcast.notification+xml  
# application/vnd.oma.bcast.provisioningtrigger  
# application/vnd.oma.bcast.sgboot  
# application/vnd.oma.bcast.sgdd+xml  
# application/vnd.oma.bcast.sgdu  
# application/vnd.oma.bcast.simple-symbol-container  
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# application/vnd.oma.bcast.sprov+xml  
# application/vnd.oma.bcast.stkm  
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# application/vnd.oma.cab-pcc+xml  
# application/vnd.oma.cab-subs-invite+xml  
# application/vnd.oma.cab-user-prefs+xml  
# application/vnd.oma.dcd  
# application/vnd.oma.dcdc  
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# application/vnd.oma.drm.risd+xml  
# application/vnd.oma.group-usage-list+xml  
# application/vnd.oma.lwm2m+json  
# application/vnd.oma.lwm2m+tlv  
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# application/vnd.oma.poc.final-report+xml  
# application/vnd.oma.poc.groups+xml  
# application/vnd.oma.poc.invocation-descriptor+xml  
# application/vnd.oma.poc.optimized-progress-report+xml  
# application/vnd.oma.push  
# application/vnd.oma.scidm.messages+xml  
# application/vnd.oma.xcap-directory+xml  
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```

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```

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application/vnd.osgi.bundle
application/vnd.osgi.dp dp
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application/vnd.pagerduty+json
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application/vnd.panoply
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application/vnd.pawaaf file paw
application/vnd.pcos

```



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# application/vnd.powerbuilder75-s  
# application/vnd.preminet  
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application/vnd.proteus.magazine mgz  
application/vnd.publishare-delta-tree qps  
application/vnd.pvi.ptid1 ptid  
# application/vnd.pwg-multiplexed  
# application/vnd.pwg-xml-print+xml  
# application/vnd.qualcomm.brew-app-res  
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# application/vnd.radisys.msml-dialog-fax-sendrecv+xml  
# application/vnd.radisys.msml-dialog-group+xml  
# application/vnd.radisys.msml-dialog-speech+xml  
# application/vnd.radisys.msml-dialog-transform+xml  
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# application/vnd.rapid  
# application/vnd.rar  
application/vnd.realvnc.bed bed  
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application/vnd.recordare.musicxml+xml musicxml  
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application/vnd.renlearn.rlprint  
application/vnd.rig.cryptonote cryptonote  
application/vnd.rim.cod cod  
application/vnd.rn-realmedia rm  
application/vnd.rn-realmedia-vbr rmvb  
application/vnd.route66.link66+xml link66  
# application/vnd.rs-274x  
# application/vnd.ruckus.download  
# application/vnd.s3sms  
application/vnd.sailingtracker.track st  
# application/vnd.sbm.cid  
# application/vnd.sbm.mid2  
# application/vnd.scribus  
# application/vnd.sealed.3df  
# application/vnd.sealed.csf  
# application/vnd.sealed.doc  
# application/vnd.sealed.eml  
# application/vnd.sealed.mht  
# application/vnd.sealed.net  
# application/vnd.sealed.ppt  
# application/vnd.sealed.tiff  
# application/vnd.sealed.xls  
# application/vnd.sealedmedia.softseal.html  
# application/vnd.sealedmedia.softseal.pdf  
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application/vnd.semd semd  
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application/vnd.shana.informed.formtemplate itp  
application/vnd.shana.informed.interchange iif  
application/vnd.shana.informed.package ipk  
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twds  
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application/vnd.smaf mmf  
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application/vnd.smart.teacher teacher  
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# application/vnd.sss-dtf  
# application/vnd.sss-ntf  
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application/vnd.stepmania.stepchart sm  
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# application/vnd.syncml.dmtnds+wbxml  
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application/vnd.trueapp tra  
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# application/vnd.wv.csp+xml  
# application/vnd.wv.ssp+xml  
# application/vnd.xacml+json

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# application/watcherinfo+xml  
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# application/whoispp-response  
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application/winhelp hlp  
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application/x-abiword abw  
application/x-ace-compressed ace  
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application/x-apple-diskimage dmg  
application/x-authorware-bin aab x32 u32 vox  
application/x-authorware-map aam  
application/x-authorware-seg aas  
application/x-bcpio bcpio  
application/x-bittorrent torrent  
application/x-blorb blb blorb  
application/x-bzip bz

application/x-bzip2 bz2 boz  
application/x-cbr cbr cba cbt cbz cb7  
application/x-cdlink vcd  
application/x-cfs-compressed cfs  
application/x-chat chat  
application/x-chess-pgn pgn  
# application/x-compress  
application/x-conference nsc  
application/x-cpio cpio  
application/x-csh csh  
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application/x-dgc-compressed dgc  
application/x-director dir dcr dxr cst cct cxt w3d fgd swa  
application/x-doom wad  
application/x-dtbncx+xml ncx  
application/x-dtbook+xml dtb  
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application/x-eva eva  
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application/x-font-pcf pcf  
application/x-font-snf snf  
# application/x-font-speedo  
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application/x-futuresplash spl  
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application/x-ms-wmd wmd  
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application/x-msbinder obd  
application/x-mscardfile crd  
application/x-msclip clp  
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application/x-msterial trm  
application/x-mswrite wri  
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application/x-nzb nzb  
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application/x-pkcs7-certreqresp p7r  
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application/x-shar shar  
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application/x-sql sql  
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application/x-stuffitx sitx  
application/x-subrip srt  
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application/x-sv4crc sv4crc  
application/x-t3vm-image t3  
application/x-tads gam  
application/x-tar tar  
application/x-tcl tcl  
application/x-tex tex  
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application/x-texinfo texinfo  
texi  
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application/x-wais-source src  
# application/x-www-form-urlencoded  
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application/x-xliff+xml xlf  
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application/x-xz xz  
application/x-zmachine z1 z2 z3 z4 z5 z6 z7 z8  
# application/x400-bp  
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# application/xcap-att+xml  
# application/xcap-caps+xml  
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# application/xcap-el+xml  
# application/xcap-error+xml  
# application/xcap-ns+xml  
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application/xv+xml mxml xhvm xvm xvm  
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application/yin+xml yin  
application/zip zip  
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# audio/1d-interleaved-parityfec  
# audio/32kadpcm  
# audio/3gpp  
# audio/3gpp2  
# audio/ac3  
audio/adpcm adp  
# audio/amr  
# audio/amr-wb  
# audio/amr-wb+  
# audio/aptx  
# audio/asc



# audio/atrac-advanced-lossless  
# audio/atrac-x  
# audio/atrac3  
audio/basic au snd  
# audio/bv16  
# audio/bv32  
# audio/clearmode  
# audio/cn  
# audio/dat12  
# audio/dls  
# audio/dsr-es201108  
# audio/dsr-es202050  
# audio/dsr-es202211  
# audio/dsr-es202212  
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# audio/dvi4  
# audio/eac3  
# audio/encaprtsp  
# audio/evrc  
# audio/evrc-qcp  
# audio/evrc0  
# audio/evrc1  
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# audio/evrcb1  
# audio/evrcnw  
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# audio/evrcnw1  
# audio/evrcwb  
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# audio/evrcwb1  
# audio/evs  
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# audio/g722  
# audio/g7221  
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# audio/g726-24  
# audio/g726-32  
# audio/g726-40  
# audio/g728  
# audio/g729  
# audio/g7291  
# audio/g729d

# audio/g729e  
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# audio/gsm-hr-08  
# audio/ilbc  
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# audio/isac  
# audio/l16  
# audio/l20  
# audio/l24  
# audio/l8  
# audio/lpc  
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# audio/mobile-xmf  
audio/mp4    m4a mp4a  
# audio/mp4a-latm  
# audio/mpa  
# audio/mpa-robust  
audio/mpeg    mpga mp2 mp2a mp3 m2a m3a  
# audio/mpeg4-generic  
# audio/musepack  
audio/ogg    oga ogg spx  
# audio/opus  
# audio/parityfec  
# audio/pcma  
# audio/pcma-wb  
# audio/pcmu  
# audio/pcmu-wb  
# audio/prs.sid  
# audio/qcelp  
# audio/raptorfec  
# audio/red  
# audio/rtp-enc-aescm128  
# audio/rtp-midi  
# audio/rtploopback  
# audio/rtx  
audio/s3m    s3m  
audio/silk    sil  
#  
audio/smv  
# audio/smv-qcp  
# audio/smv0  
# audio/sp-midi  
# audio/speex  
# audio/t140c  
# audio/t38  
# audio/telephone-event  
# audio/tone

```

audio/uemclip
audio/ulpfec
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audio/vnd.3gpp.iufp
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audio/vorbis-config
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audio/x-aac aac
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```

audio/x-caf caf  
audio/x-flac flac  
audio/x-matroska mka  
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audio/x-ms-wax wax  
audio/x-ms-wma wma  
audio/x-pn-realaudio ram ra  
audio/x-pn-realaudio-plugin rmp  
# audio/x-tta  
audio/x-wav wav  
audio/xm xm  
chemical/x-cdx cdx  
chemical/x-cif cif  
chemical/x-cmdf cmdf  
chemical/x-cml cml  
chemical/x-csml csml  
# chemical/x-pdb  
chemical/x-xyz xyz  
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image/cgm cgm  
# image/dicom-rle  
# image/emf  
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# image/fits  
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image/gif gif  
image/ief ief  
# image/jls  
# image/jp2  
image/jpeg jpeg jpg jpe  
# image/jpm  
# image/jpx  
image/ktx ktx  
# image/naplps  
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#  
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# image/pwg-raster  
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image/x-3ds 3ds  
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fhc fh4 fh5 fh7  
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image/x-mrsid-image sid  
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image/x-portable-pixmap ppm  
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image/x-tga tga  
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image/x-xpixmap xpm  
image/x-xwindowdump xwd  
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# message/delivery-status

# message/disposition-notification  
# message/example  
# message/external-body  
# message/feedback-report  
# message/global  
# message/global-delivery-status  
# message/global-disposition-notification  
# message/global-headers  
# message/http  
# message/imdn+xml  
# message/news  
# message/partial  
message/rfc822 eml mime  
# message/s-http  
# message/sip  
# message/sipfrag  
# message/tracking-status  
# message/vnd.si.simp  
# message/vnd.wfa.wsc  
# model/example  
# model/gltf+json  
model/iges igs iges  
model/mesh msh mesh silo  
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# model/vnd.gs-gdl  
# model/vnd.gs.gdl  
model/vnd.gtw gtw  
# model/vnd.moml+xml  
model/vnd.mts mts  
# model/vnd.opengex  
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# model/vnd.parasolid.transmit.text  
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model/vrml wrl vrml  
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# model/x3d+fastinfoset  
model/x3d+vrml x3dv x3dvz  
model/x3d+xml x3d x3dz  
# model/x3d-vrml  
# multipart/alternative  
# multipart/appledouble  
# multipart/byteranges

```

multipart/digest
multipart/encrypted
multipart/example
multipart/form-data
multipart/header-set
multipart/mixed
multipart/parallel
multipart/related
multipart/report
multipart/signed
multipart/voice-message
multipart/x-mixed-replace
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text/cache-manifest appcache
text/calendar ics ifb
text/css css
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text/encaprtpt
text/enriched
text/example
text/fwdred
text/grammar-ref-list
text/html html htm
text/javascript
text/jcr-cnd
text/markdown
text/mizar
text/n3 n3
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text/prs.prop.logic
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text/rfc822-headers
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text/rtp-enc-aescm128
text/rtploopback
text/rtx

```

text/sgml   sgml sgm  
# text/t140  
text/tab-separated-values   tsv  
text/troff    t tr roff man me ms  
text/turtle   ttl  
# text/ulpfec  
text/uri-list   uri uris urls  
text/vcard    vcard  
# text/vnd.a  
# text/vnd.abc  
text/vnd.curl   curl  
text/vnd.curl.dcurl   dcurl  
text/vnd.curl.mcurl   mcurl  
text/vnd.curl.scurl   scurl  
# text/vnd.debian.copyright  
# text/vnd.dmclientscript  
text/vnd.dvb.subtitle   sub  
# text/vnd.esmertec.theme-descriptor  
text/vnd.fly   fly  
text/vnd.fmi.flexstor   flx  
text/vnd.graphviz   gv  
text/vnd.in3d.3dml   3dml  
text/vnd.in3d.spot   spot  
#  
  text/vnd.iptc.newsml  
# text/vnd.iptc.nitf  
# text/vnd.latex-z  
# text/vnd.motorola.reflex  
# text/vnd.ms-mediapackage  
# text/vnd.net2phone.commcenter.command  
# text/vnd.radisys.msml-basic-layout  
# text/vnd.si.uricatalogue  
text/vnd.sun.j2me.app-descriptor   jad  
# text/vnd.trolltech.linguist  
# text/vnd.wap.si  
# text/vnd.wap.sl  
text/vnd.wap.wml   wml  
text/vnd.wap.wmlscript   wmls  
text/x-asm    s asm  
text/x-c    c cc cxx cpp h hh dic  
text/x-fortran   f for f77 f90  
text/x-java-source   java  
text/x-nfo    nfo  
text/x-opml   opml  
text/x-pascal   p pas  
text/x-setext   etx  
text/x-sfv    sfv  
text/x-uuencode   uu



text/x-vcalendar vcs  
text/x-vcard vcf  
# text/xml  
# text/xml-external-parsed-entity  
# video/1d-interleaved-parityfec  
video/3gpp 3gp  
# video/3gpp-tt  
video/3gpp2 3g2  
# video/bmpeg  
# video/bt656  
# video/celb  
# video/dv  
# video/encaprtsp  
#  
video/example  
video/h261 h261  
video/h263 h263  
# video/h263-1998  
# video/h263-2000  
video/h264 h264  
# video/h264-rcdo  
# video/h264-svc  
# video/h265  
# video/iso.segment  
video/jpeg jpgv  
# video/jpeg2000  
video/jpm jpm jpgm  
video/mj2 mj2 mjp2  
# video/mp1s  
# video/mp2p  
# video/mp2t  
video/mp4 mp4 mp4v mpg4  
# video/mp4v-es  
video/mpeg mpeg mpg mpe m1v m2v  
# video/mpeg4-generic  
# video/mpv  
# video/nv  
video/ogg ogv  
# video/parityfec  
# video/pointer  
video/quicktime qt mov  
# video/raptorfec  
# video/raw  
# video/rtp-enc-aescm128  
# video/rtploopback  
# video/rtx  
# video/smp292m  
# video/ulpfec

# video/vc1  
# video/vnd.cctv  
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video/vnd.dece.mobile uvm uvvm  
# video/vnd.dece.mp4  
video/vnd.dece.pd uvp uvvp  
video/vnd.dece.sd uvs uvvs  
video/vnd.dece.video uvv uvvv  
# video/vnd.directv.mpeg  
# video/vnd.directv.mpeg-tts  
# video/vnd.dlna.mpeg-tts  
video/vnd.dvb.file dvb  
video/vnd.fvt fvt  
# video/vnd.hns.video  
# video/vnd.iptvforum.1dparityfec-1010  
#  
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# video/vnd.iptvforum.2dparityfec-1010  
# video/vnd.iptvforum.2dparityfec-2005  
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# video/vnd.motorola.video  
# video/vnd.motorola.videop  
video/vnd.mpegurl mxu m4u  
video/vnd.ms-playready.media.pyv pyv  
# video/vnd.nokia.interleaved-multimedia  
# video/vnd.nokia.videovoip  
# video/vnd.objectvideo  
# video/vnd.radgamettools.bink  
# video/vnd.radgamettools.smacker  
# video/vnd.sealed.mpeg1  
# video/vnd.sealed.mpeg4  
# video/vnd.sealed.swf  
# video/vnd.sealedmedia.softseal.mov  
video/vnd.uvu.mp4 uvu uvvu  
video/vnd.vivo viv  
# video/vp8  
video/webm webm  
video/x-f4v f4v  
video/x-fli fli  
video/x-flv flv  
video/x-m4v m4v  
video/x-matroska mkv mk3d mks  
video/x-mng mng  
video/x-ms-asf asf asx  
video/x-ms-vob vob  
video/x-ms-wm wm  
video/x-ms-wmv wmv

video/x-ms-wmx wmx  
video/x-ms-wvx wvx  
video/x-msvideo avi  
video/x-sgi-movie movie  
video/x-smv smv  
x-conference/x-cooltalk ice

#### Found

in path(s):

\* /spring-web-5-2-20-release-sources-jar/org/springframework/http/mime.types

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Found in path(s):

\* /spring-web-5-2-20-release-sources-jar/org/springframework/remoting/jaxws/JaxWsSoapFaultException.java

\* /spring-web-5-2-20-release-sources-

jar/org/springframework/remoting/httpinvoker/HttpInvokerClientConfiguration.java

\* /spring-web-5-2-20-release-sources-jar/org/springframework/web/HttpMediaTypeNotAcceptableException.java

\*

/spring-web-5-2-20-release-sources-jar/org/springframework/web/bind/annotation/ValueConstants.java

\* /spring-web-5-2-20-release-sources-jar/org/springframework/web/bind/ServletRequestBindingException.java

\* /spring-web-5-2-20-release-sources-jar/org/springframework/web/context/ConfigurableWebEnvironment.java

\* /spring-web-5-2-20-release-sources-jar/org/springframework/web/util/IntrospectorCleanupListener.java

\* /spring-web-5-2-20-release-sources-

jar/org/springframework/web/context/support/SpringBeanAutowiringSupport.java

\* /spring-web-5-2-20-release-sources-jar/org/springframework/web/bind/annotation/InitBinder.java

\* /spring-web-5-2-20-release-sources-jar/org/springframework/web/jsf/DecoratingNavigationHandler.java

\* /spring-web-5-2-20-release-sources-jar/org/springframework/web/jsf/DelegatingPhaseListenerMulticaster.java

\* /spring-web-5-2-20-release-sources-jar/org/springframework/http/client/AbstractClientHttpResponse.java

\* /spring-web-5-2-20-release-sources-jar/org/springframework/http/MediaTypeEditor.java

\*

/spring-web-5-2-20-release-sources-

jar/org/springframework/web/bind/MissingServletRequestParameterException.java

\* /spring-web-5-2-20-release-sources-jar/org/springframework/web/bind/support/SimpleSessionStatus.java

\* /spring-web-5-2-20-release-sources-jar/org/springframework/web/client/ResourceAccessExceptionHandler.java

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\*/

Found in path(s):

\* /spring-web-5-2-20-release-sources-jar/org/springframework/web/util/pattern/LiteralPathElement.java

\* /spring-web-5-2-20-release-sources-jar/org/springframework/http/ResponseEntity.java

\* /spring-web-5-2-20-release-sources-jar/org/springframework/web/util/pattern/CaptureTheRestPathElement.java

\*

/spring-web-5-2-20-release-sources-jar/org/springframework/web/bind/annotation/CookieValue.java

\* /spring-web-5-2-20-release-sources-jar/org/springframework/web/util/pattern/WildcardPathElement.java

\* /spring-web-5-2-20-release-sources-jar/org/springframework/http/MediaTypeFactory.java

\* /spring-web-5-2-20-release-sources-jar/org/springframework/web/util/pattern/SeparatorPathElement.java

\* /spring-web-5-2-20-release-sources-

jar/org/springframework/web/util/pattern/SingleCharWildcardPathElement.java

\* /spring-web-5-2-20-release-sources-jar/org/springframework/http/server/DefaultPathContainer.java

\* /spring-web-5-2-20-release-sources-jar/org/springframework/web/util/UriPathHelper.java

\* /spring-web-5-2-20-release-sources-jar/org/springframework/web/util/pattern/PathPattern.java

\* /spring-web-5-2-20-release-sources-jar/org/springframework/web/util/UriComponents.java

\* /spring-web-5-2-20-release-sources-jar/org/springframework/web/util/pattern/WildcardTheRestPathElement.java

\*

/spring-web-5-2-20-release-sources-

jar/org/springframework/web/server/handler/ResponseStatusExceptionHandler.java

\* /spring-web-5-2-20-release-sources-jar/org/springframework/web/method/HandlerTypePredicate.java

\* /spring-web-5-2-20-release-sources-jar/org/springframework/web/client/DefaultResponseErrorHandler.java

\* /spring-web-5-2-20-release-sources-jar/org/springframework/web/util/pattern/RegexPathElement.java

\* /spring-web-5-2-20-release-sources-jar/org/springframework/web/bind/support/WebRequestDataBinder.java

\* /spring-web-5-2-20-release-sources-

jar/org/springframework/web/method/annotation/ModelAttributeMethodProcessor.java

\* /spring-web-5-2-20-release-sources-jar/org/springframework/http/server/reactive/JettyHeadersAdapter.java

\* /spring-web-5-2-20-release-sources-jar/org/springframework/web/util/pattern/CaptureVariablePathElement.java

\* /spring-web-5-2-20-release-sources-

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jar/org/springframework/http/codec/multipart/SynchronossPartHttpMessageReader.java
* /spring-web-5-2-20-release-sources-jar/org/springframework/http/server/PathContainer.java
*
/spring-web-5-2-20-release-sources-jar/org/springframework/web/cors/CorsConfiguration.java
* /spring-web-5-2-20-release-sources-jar/org/springframework/web/server/adapters/HandlerAdapter.java
* /spring-web-5-2-20-release-sources-jar/org/springframework/web/server/ResponseStatusException.java
* /spring-web-5-2-20-release-sources-jar/org/springframework/web/util/UriComponentsBuilder.java
* /spring-web-5-2-20-release-sources-
jar/org/springframework/web/method/support/CompositeUriComponentsContributor.java
* /spring-web-5-2-20-release-sources-jar/org/springframework/web/util/pattern/PatternParseException.java
* /spring-web-5-2-20-release-sources-jar/org/springframework/web/bind/support/WebExchangeDataBinder.java
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Found in path(s):

```

* /spring-web-5-2-20-release-sources-jar/org/springframework/web/context/ServletContextAware.java
* /spring-web-5-2-20-release-sources-
jar/org/springframework/http/server/reactive/UndertowHandlerAdapter.java
* /spring-web-5-2-20-release-sources-jar/org/springframework/http/server/reactive/UndertowHeadersAdapter.java
*
/spring-web-5-2-20-release-sources-jar/org/springframework/http/HttpOutputMessage.java
* /spring-web-5-2-20-release-sources-
jar/org/springframework/http/converter/xml/Jaxb2CollectionHttpMessageConverter.java
* /spring-web-5-2-20-release-sources-jar/org/springframework/http/server/reactive/ReactorHandlerAdapter.java
* /spring-web-5-2-20-release-sources-
jar/org/springframework/web/HttpRequestMethodNotSupportedException.java
* /spring-web-5-2-20-release-sources-
jar/org/springframework/http/client/HttpComponentsAsyncClientHttpRequestFactory.java
* /spring-web-5-2-20-release-sources-
jar/org/springframework/web/method/annotation/RequestParamMapMethodArgumentResolver.java
* /spring-web-5-2-20-release-sources-jar/org/springframework/web/util/OpaqueUriComponents.java
* /spring-web-5-2-20-release-sources-jar/org/springframework/web/client/support/RestGatewaySupport.java
* /spring-web-5-2-20-release-sources-jar/org/springframework/http/codec/CodecConfigurerFactory.java

```

\*  
 /spring-web-5-2-20-release-sources-jar/org/springframework/http/HttpRequest.java  
 \* /spring-web-5-2-20-release-sources-jar/org/springframework/remoting/caucho/HessianServiceExporter.java  
 \* /spring-web-5-2-20-release-sources-jar/org/springframework/web/bind/support/ConfigurableWebBindingInitializer.java  
 \* /spring-web-5-2-20-release-sources-jar/org/springframework/web/WebApplicationInitializer.java  
 \* /spring-web-5-2-20-release-sources-jar/org/springframework/http/server/reactive/AbstractListenerServerHttpResponse.java  
 \* /spring-web-5-2-20-release-sources-jar/org/springframework/web/server/session/HeaderWebSessionIdResolver.java  
 \* /spring-web-5-2-20-release-sources-jar/org/springframework/web/client/AsyncRestTemplate.java  
 \* /spring-web-5-2-20-release-sources-jar/org/springframework/web/context/support/StandardServletEnvironment.java  
 \* /spring-web-5-2-20-release-sources-jar/org/springframework/remoting/jaxws/SimpleJaxWsServiceExporter.java  
 \* /spring-web-5-2-20-release-sources-jar/org/springframework/web/context/request/async/WebAsyncUtils.java  
 \*  
 /spring-web-5-2-20-release-sources-jar/org/springframework/web/bind/MissingMatrixVariableException.java  
 \* /spring-web-5-2-20-release-sources-jar/org/springframework/http/server/reactive/DefaultSslInfo.java  
 \* /spring-web-5-2-20-release-sources-jar/org/springframework/http/client/reactive/JettyResourceFactory.java  
 \* /spring-web-5-2-20-release-sources-jar/org/springframework/web/method/support/HandlerMethodReturnValueHandlerComposite.java  
 \* /spring-web-5-2-20-release-sources-jar/org/springframework/web/filter/FormContentFilter.java  
 \* /spring-web-5-2-20-release-sources-jar/org/springframework/web/util/CookieGenerator.java  
 \* /spring-web-5-2-20-release-sources-jar/org/springframework/web/bind/annotation/RequestPart.java  
 \* /spring-web-5-2-20-release-sources-jar/org/springframework/http/client/support/AsyncHttpAccessor.java  
 \* /spring-web-5-2-20-release-sources-jar/org/springframework/http/client/reactive/ClientHttpRequest.java  
 \*  
 /spring-web-5-2-20-release-sources-jar/org/springframework/web/multipart/support/MultipartFilter.java  
 \* /spring-web-5-2-20-release-sources-jar/org/springframework/web/method/annotation/InitBinderDataBinderFactory.java  
 \* /spring-web-5-2-20-release-sources-jar/org/springframework/web/method/annotation/RequestHeaderMethodArgumentResolver.java  
 \* /spring-web-5-2-20-release-sources-jar/org/springframework/web/util/ContentCachingRequestWrapper.java  
 \* /spring-web-5-2-20-release-sources-jar/org/springframework/http/codec/ServerSentEvent.java  
 \* /spring-web-5-2-20-release-sources-jar/org/springframework/http/converter/GenericHttpMessageConverter.java  
 \* /spring-web-5-2-20-release-sources-jar/org/springframework/web/util/UriTemplateHandler.java  
 \* /spring-web-5-2-20-release-sources-jar/org/springframework/http/server/reactive/SslInfo.java  
 \* /spring-web-5-2-20-release-sources-jar/org/springframework/http/HttpEntity.java  
 \* /spring-web-5-2-20-release-sources-jar/org/springframework/http/client/SimpleBufferingClientHttpRequest.java  
 \*  
 /spring-web-5-2-20-release-sources-jar/org/springframework/http/codec/protobuf/ProtobufCodecSupport.java  
 \* /spring-web-5-2-20-release-sources-jar/org/springframework/web/SpringServletContainerInitializer.java  
 \* /spring-web-5-2-20-release-sources-jar/org/springframework/web/bind/annotation/RequestBody.java  
 \* /spring-web-5-2-20-release-sources-jar/org/springframework/http/client/InterceptingAsyncClientHttpRequestFactory.java  
 \* /spring-web-5-2-20-release-sources-jar/org/springframework/http/HttpInputMessage.java  
 \* /spring-web-5-2-20-release-sources-jar/org/springframework/web/method/support/ModelAndViewContainer.java  
 \* /spring-web-5-2-20-release-sources-

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jar/org/springframework/web/context/request/async/DeferredResultInterceptorChain.java
* /spring-web-5-2-20-release-sources-
jar/org/springframework/web/multipart/support/DefaultMultipartHttpServletRequest.java
* /spring-web-5-2-20-release-sources-jar/org/springframework/web/context/ServletConfigAware.java
*
/spring-web-5-2-20-release-sources-
jar/org/springframework/web/context/support/XmlWebApplicationContext.java
* /spring-web-5-2-20-release-sources-jar/org/springframework/remoting/jaxws/LocalJaxWsServiceFactory.java
* /spring-web-5-2-20-release-sources-
jar/org/springframework/remoting/httpinvoker/HttpComponentsHttpInvokerRequestExecutor.java
* /spring-web-5-2-20-release-sources-
jar/org/springframework/web/context/support/AbstractRefreshableWebApplicationContext.java
* /spring-web-5-2-20-release-sources-jar/org/springframework/http/converter/json/MappingJacksonValue.java
* /spring-web-5-2-20-release-sources-jar/org/springframework/http/client/HttpComponentsClientHttpRequest.java
* /spring-web-5-2-20-release-sources-
jar/org/springframework/http/converter/json/Jackson2ObjectMapperFactoryBean.java
* /spring-web-5-2-20-release-sources-jar/org/springframework/http/server/reactive/ServletHttpHandlerAdapter.java
* /spring-web-5-2-20-release-sources-
jar/org/springframework/web/bind/UnsatisfiedServletRequestParameterException.java
*
/spring-web-5-2-20-release-sources-jar/org/springframework/http/ZeroCopyHttpOutputMessage.java
* /spring-web-5-2-20-release-sources-
jar/org/springframework/web/bind/ServletRequestParameterPropertyValues.java
* /spring-web-5-2-20-release-sources-
jar/org/springframework/http/server/reactive/ServerHttpResponseDecorator.java
* /spring-web-5-2-20-release-sources-jar/org/springframework/web/util/TagUtils.java
* /spring-web-5-2-20-release-sources-
jar/org/springframework/web/accept/ParameterContentNegotiationStrategy.java
* /spring-web-5-2-20-release-sources-
jar/org/springframework/web/method/annotation/AbstractCookieValueMethodArgumentResolver.java
* /spring-web-5-2-20-release-sources-
jar/org/springframework/http/converter/AbstractGenericHttpMessageConverter.java
* /spring-web-5-2-20-release-sources-jar/org/springframework/web/server/DefaultServerWebExchangeBuilder.java
* /spring-web-5-2-20-release-sources-jar/org/springframework/web/client/RequestCallback.java
*
/spring-web-5-2-20-release-sources-jar/org/springframework/web/HttpSessionRequiredException.java
* /spring-web-5-2-20-release-sources-
jar/org/springframework/remoting/caucho/SimpleHessianServiceExporter.java
* /spring-web-5-2-20-release-sources-jar/org/springframework/http/codec/json/Jackson2SmileDecoder.java
* /spring-web-5-2-20-release-sources-jar/org/springframework/web/context/request/async/WebAsyncTask.java
* /spring-web-5-2-20-release-sources-jar/org/springframework/web/client/ResponseErrorHandler.java
* /spring-web-5-2-20-release-sources-jar/org/springframework/http/client/Netty4ClientHttpRequestFactory.java
* /spring-web-5-2-20-release-sources-jar/org/springframework/web/client/ExtractingResponseErrorHandler.java
* /spring-web-5-2-20-release-sources-jar/org/springframework/web/filter/RelativeRedirectFilter.java
* /spring-web-5-2-20-release-sources-jar/org/springframework/http/HttpLogging.java
* /spring-web-5-2-20-release-sources-
jar/org/springframework/web/jsf/el/WebApplicationContextFacesELResolver.java
*

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/spring-web-5-2-20-release-sources-
jar/org/springframework/web/server/session/CookieWebSessionIdResolver.java
* /spring-web-5-2-20-release-sources-jar/org/springframework/web/bind/annotation/RequestParam.java
* /spring-web-5-2-20-release-sources-
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* /spring-web-5-2-20-release-sources-
jar/org/springframework/http/converter/support/AllEncompassingFormHttpMessageConverter.java
* /spring-web-5-2-20-release-sources-jar/org/springframework/web/bind/MissingRequestHeaderException.java
* /spring-web-5-2-20-release-sources-
jar/org/springframework/web/multipart/commons/CommonsFileUploadSupport.java
* /spring-web-5-2-20-release-sources-jar/org/springframework/web/bind/annotation/MatrixVariable.java
* /spring-web-5-2-20-release-sources-jar/org/springframework/web/accept/ContentNegotiationStrategy.java
* /spring-web-5-2-20-release-sources-jar/org/springframework/web/filter/GenericFilterBean.java
*
/spring-web-5-2-20-release-sources-jar/org/springframework/http/client/reactive/ClientHttpConnector.java
* /spring-web-5-2-20-release-sources-jar/org/springframework/web/bind/annotation/PathVariable.java
* /spring-web-5-2-20-release-sources-jar/org/springframework/http/client/Netty4ClientHttpRequest.java
* /spring-web-5-2-20-release-sources-jar/org/springframework/web/filter/HiddenHttpMethodFilter.java
* /spring-web-5-2-20-release-sources-jar/org/springframework/http/client/reactive/ClientHttpRequestDecorator.java
* /spring-web-5-2-20-release-sources-
jar/org/springframework/http/converter/HttpMessageNotReadableException.java
* /spring-web-5-2-20-release-sources-jar/org/springframework/web/filter/RelativeRedirectResponseWrapper.java
* /spring-web-5-2-20-release-sources-jar/org/springframework/web/util/pattern/PathElement.java
* /spring-web-5-2-20-release-sources-
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* /spring-web-5-2-20-release-sources-
jar/org/springframework/http/client/SimpleStreamingAsyncClientHttpRequest.java
*
/spring-web-5-2-20-release-sources-
jar/org/springframework/remoting/httpinvoker/SimpleHttpInvokerRequestExecutor.java
* /spring-web-5-2-20-release-sources-jar/org/springframework/web/util/NestedServletException.java
* /spring-web-5-2-20-release-sources-jar/org/springframework/web/context/ContextLoaderListener.java
* /spring-web-5-2-20-release-sources-
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* /spring-web-5-2-20-release-sources-jar/org/springframework/http/HttpMethod.java
* /spring-web-5-2-20-release-sources-jar/org/springframework/web/filter/reactive/HiddenHttpMethodFilter.java
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* /spring-web-5-2-20-release-sources-
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* /spring-web-5-2-20-release-sources-
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* /spring-web-5-2-20-release-sources-jar/org/springframework/remoting/jaxws/AbstractJaxWsServiceExporter.java
* /spring-web-5-2-20-release-sources-
jar/org/springframework/http/codec/protobuf/ProtobufHttpMessageWriter.java
* /spring-web-5-2-20-release-sources-jar/org/springframework/http/client/InterceptingAsyncClientHttpRequest.java

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 \* /spring-web-5-2-20-release-sources-jar/org/springframework/web/context/request/FacesRequestAttributes.java  
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\* /spring-web-5-2-20-release-sources-jar/org/springframework/web/HttpMediaTypeException.java  
\* /spring-web-5-2-20-release-sources-jar/org/springframework/http/server/ServerHttpResponse.java  
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Found in path(s):

\* /spring-web-5-2-20-release-sources-jar/org/springframework/web/bind/support/SessionStatus.java



# 1.364 spring-aop 5.2.20.RELEASE

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Found in path(s):

```
* /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/scope/DefaultScopedObject.java
* /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/aspectj/AspectJAopUtils.java
* /spring-aop-5-2-20-release-sources-
jar/org/springframework/aop/target/dynamic/BeanFactoryRefreshableTargetSource.java
*
/spring-aop-5-2-20-release-sources-jar/org/springframework/aop/AopInvocationException.java
* /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/config/PointcutComponentDefinition.java
* /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/target/PoolingConfig.java
* /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/interceptor/ConcurrencyThrottleInterceptor.java
* /spring-aop-5-2-20-release-sources-
jar/org/springframework/aop/framework/adapter/MethodBeforeAdviceAdapter.java
* /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/framework/AopProxyFactory.java
* /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/target/SimpleBeanTargetSource.java
* /spring-aop-5-2-20-release-sources-
jar/org/springframework/aop/framework/adapter/UnknownAdviceTypeException.java
* /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/support/DynamicMethodMatcherPointcut.java
* /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/target/ThreadLocalTargetSourceStats.java
*
/spring-aop-5-2-20-release-sources-jar/org/springframework/aop/target/LazyInitTargetSource.java
* /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/scope/ScopedObject.java
* /spring-aop-5-2-20-release-sources-
jar/org/springframework/aop/config/ScopedProxyBeanDefinitionDecorator.java
* /spring-aop-5-2-20-release-sources-
jar/org/springframework/aop/framework/adapter/AfterReturningAdviceAdapter.java
* /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/framework/adapter/AdvisorAdapter.java
```

- \* /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/target/dynamic/Refreshable.java
- \* /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/IntroductionInfo.java
- \* /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/framework/AopConfigException.java
- \* /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/interceptor/DebugInterceptor.java
- \* /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/PointcutAdvisor.java
- \*
- /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/support/JdkRegexpMethodPointcut.java
- \* /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/Pointcut.java
- \* /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/framework/adapter/ThrowsAdviceAdapter.java
- \* /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/AfterReturningAdvice.java
- \* /spring-aop-5-2-20-release-sources-
- jar/org/springframework/aop/framework/adapter/AdvisorAdapterRegistrationManager.java
- \* /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/framework/AopProxy.java
- \* /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/support/StaticMethodMatcherPointcut.java
- \* /spring-aop-5-2-20-release-sources-
- jar/org/springframework/aop/config/SpringConfiguredBeanDefinitionParser.java
- \* /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/IntroductionAdvisor.java

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- \* /spring-aop-5-2-20-release-sources-
- jar/org/springframework/aop/aspectj/InstantiationModelAwarePointcutAdvisor.java

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- \* /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/support/NameMatchMethodPointcutAdvisor.java
- \* /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/target/PrototypeTargetSource.java
- \* /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/framework/autoproxy/target/LazyInitTargetSourceCreator.java

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- \* /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/scope/ScopedProxyUtils.java
- \* /spring-aop-5-2-20-release-sources-jar/org/aopalliance/intercept/Interceptor.java
- \* /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/interceptor/AsyncUncaughtExceptionHandler.java
- \*
  - \*/spring-aop-5-2-20-release-sources-jar/org/springframework/aop/support/annotation/AnnotationMatchingPointcut.java
  - \* /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/support/RootClassFilter.java
  - \* /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/support/AopUtils.java
  - \* /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/framework/AdvisedSupport.java
  - \* /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/MethodMatcher.java
  - \* /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/framework/AopProxyUtils.java
  - \* /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/support/NameMatchMethodPointcut.java
  - \* /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/aspectj/TypePatternClassFilter.java
  - \* /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/support/Pointcuts.java
  - \* /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/aspectj/AspectJProxyUtils.java

- \* /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/aspectj/AbstractAspectJAdvice.java
- \*
- /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/support/ComposablePointcut.java
- \* /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/support/ClassFilters.java
- \* /spring-aop-5-2-20-release-sources-
- jar/org/springframework/aop/support/annotation/AnnotationMethodMatcher.java
- \* /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/aspectj/annotation/AspectMetadata.java
- \* /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/framework/JdkDynamicAopProxy.java
- \* /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/framework/ReflectiveMethodInvocation.java
- \* /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/support/MethodMatchers.java
- \* /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/ClassFilter.java
- \* /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/framework/ObjenesisCglibAopProxy.java
- \* /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/support/ControlFlowPointcut.java

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- \* /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/framework/AopInfrastructureBean.java
- \* /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/RawTargetAccess.java
- \* /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/BeforeAdvice.java
- \* /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/framework/AdvisedSupportListener.java
- \*
- /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/AfterAdvice.java
- \* /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/SpringProxy.java
- \* /spring-aop-5-2-20-release-sources-
- jar/org/springframework/aop/framework/InterceptorAndDynamicMethodMatcher.java
- \* /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/IntroductionInterceptor.java

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- \* /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/target/CommonsPool2TargetSource.java
- \* /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/config/AdvisorComponentDefinition.java
- \* /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/target/SingletonTargetSource.java
- \*
- /spring-aop-5-2-20-release-sources-jar/org/aopalliance/intercept/MethodInterceptor.java
- \* /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/target/AbstractPoolingTargetSource.java
- \* /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/TruePointcut.java
- \* /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/support/AbstractRegexpMethodPointcut.java
- \* /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/framework/AdvisorChainFactory.java
- \* /spring-aop-5-2-20-release-sources-
- jar/org/springframework/aop/aspectj/annotation/BeanFactoryAspectInstanceFactory.java
- \* /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/target/AbstractLazyCreationTargetSource.java
- \* /spring-aop-5-2-20-release-sources-
- jar/org/springframework/aop/target/dynamic/AbstractRefreshableTargetSource.java
- \* /spring-aop-5-2-20-release-sources-

jar/org/springframework/aop/framework/autoproxy/BeanFactoryAdvisorRetrievalHelper.java  
 \* /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/config/AopConfigUtils.java  
 \*  
 /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/framework/ProxyConfig.java  
 \* /spring-aop-5-2-20-release-sources-  
 jar/org/springframework/aop/framework/autoproxy/target/QuickTargetSourceCreator.java  
 \* /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/IntroductionAwareMethodMatcher.java  
 \* /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/interceptor/AsyncExecutionInterceptor.java  
 \* /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/support/annotation/AnnotationClassFilter.java  
 \* /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/aspectj/AspectJPrecedenceInformation.java  
 \* /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/TrueMethodMatcher.java  
 \* /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/support/IntroductionInfoSupport.java  
 \* /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/framework/DefaultAdvisorChainFactory.java  
 \*  
 /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/TargetSource.java  
 \* /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/support/RegexpMethodPointcutAdvisor.java  
 \* /spring-aop-5-2-20-release-sources-  
 jar/org/springframework/aop/aspectj/annotation/InstantiationModelAwarePointcutAdvisorImpl.java  
 \* /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/support/StaticMethodMatcher.java  
 \* /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/target/HotSwappableTargetSource.java  
 \* /spring-aop-5-2-20-release-sources-  
 jar/org/springframework/aop/framework/AbstractAdvisingBeanPostProcessor.java  
 \* /spring-aop-5-2-20-release-sources-jar/org/aopalliance/intercept/ConstructorInvocation.java  
 \* /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/framework/Advised.java  
 \* /spring-aop-5-2-20-release-sources-  
 jar/org/springframework/aop/framework/adapter/DefaultAdvisorAdapterRegistry.java  
 \* /spring-aop-5-2-20-release-sources-  
 jar/org/springframework/aop/framework/autoproxy/DefaultAdvisorAutoProxyCreator.java  
 \*  
 /spring-aop-5-2-20-release-sources-  
 jar/org/springframework/aop/interceptor/SimpleAsyncUncaughtExceptionHandler.java  
 \* /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/aspectj/AspectJExpressionPointcut.java  
 \* /spring-aop-5-2-20-release-sources-  
 jar/org/springframework/aop/framework/AbstractSingletonProxyFactoryBean.java  
 \* /spring-aop-5-2-20-release-sources-jar/org/aopalliance/aop/AspectException.java  
 \* /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/target/EmptyTargetSource.java  
 \* /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/interceptor/ExposeBeanNameAdvisors.java  
 \* /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/aspectj/SimpleAspectInstanceFactory.java  
 \* /spring-aop-5-2-20-release-sources-  
 jar/org/springframework/aop/framework/adapter/AfterReturningAdviceInterceptor.java  
 \* /spring-aop-5-2-20-release-sources-  
 jar/org/springframework/aop/aspectj/annotation/NotAnAtAspectException.java  
 \*  
 /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/aspectj/annotation/AspectJProxyFactory.java  
 \* /spring-aop-5-2-20-release-sources-  
 jar/org/springframework/aop/framework/autoproxy/target/AbstractBeanFactoryBasedTargetSourceCreator.java  
 \* /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/framework/ProxyProcessorSupport.java  
 \* /spring-aop-5-2-20-release-sources-

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jar/org/springframework/aop/framework/autoproxy/ProxyCreationContext.java
* /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/framework/autoproxy/AutoProxyUtils.java
* /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/aspectj/RuntimeTestWalker.java
* /spring-aop-5-2-20-release-sources-
jar/org/springframework/aop/framework/adapter/ThrowsAdviceInterceptor.java
* /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/aspectj/AspectJPointcutAdvisor.java
* /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/framework/adapter/AdvisorAdapterRegistry.java
*
/spring-aop-5-2-20-release-sources-jar/org/springframework/aop/scope/ScopedProxyFactoryBean.java
* /spring-aop-5-2-20-release-sources-
jar/org/springframework/aop/framework/autoproxy/AbstractBeanFactoryAwareAdvisingPostProcessor.java
* /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/MethodBeforeAdvice.java
* /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/framework/ProxyCreatorSupport.java
* /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/support/DynamicMethodMatcher.java
* /spring-aop-5-2-20-release-sources-
jar/org/springframework/aop/target/AbstractBeanFactoryBasedTargetSource.java
* /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/config/ConfigBeanDefinitionParser.java
* /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/config/AopNamespaceUtils.java
* /spring-aop-5-2-20-release-sources-
jar/org/springframework/aop/support/StaticMethodMatcherPointcutAdvisor.java
* /spring-aop-5-2-20-release-sources-
jar/org/springframework/aop/framework/adapter/GlobalAdvisorAdapterRegistry.java
*
/spring-aop-5-2-20-release-sources-jar/org/springframework/aop/TrueClassFilter.java
* /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/interceptor/AsyncExecutionAspectSupport.java
* /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/target/AbstractPrototypeBasedTargetSource.java
* /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/aspectj/DeclareParentsAdvisor.java
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Found in path(s):

```

 * /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/framework/ProxyFactoryBean.java
 * /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/framework/CglibAopProxy.java
 * /spring-aop-5-2-20-release-sources-
jar/org/springframework/aop/framework/autoproxy/AbstractAutoProxyCreator.java
 *
 * /spring-aop-5-2-20-release-sources-
jar/org/springframework/aop/aspectj/annotation/AbstractAspectJAdvisorFactory.java
 * /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/framework/DefaultAopProxyFactory.java
 * /spring-aop-5-2-20-release-sources-jar/org/aopalliance/intercept/Joinpoint.java
 * /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/support/DefaultIntroductionAdvisor.java
 * /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/DynamicIntroductionAdvice.java
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- \* /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/aspectj/AspectJAfterThrowingAdvice.java
- \* /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/aspectj/AspectJMethodBeforeAdvice.java
- \*
- /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/TargetClassAware.java
- \* /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/aspectj/AspectJAfterAdvice.java
- \* /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/ProxyMethodInvocation.java
- \* /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/aspectj/SingletonAspectInstanceFactory.java
- \* /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/aspectj/annotation/PrototypeAspectInstanceFactory.java

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Found in path(s):

- \* /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/config/AopNamespaceHandler.java
- \* /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/aspectj/MethodInvocationProceedingJoinPoint.java
- \* /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/interceptor/ExposeInvocationInterceptor.java
- \*
- /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/config/AspectEntry.java
- \* /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/aspectj/autoproxy/AspectJPrecedenceComparator.java
- \* /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/aspectj/annotation/BeanFactoryAspectJAdvisorsBuilder.java
- \* /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/interceptor/AbstractMonitoringInterceptor.java
- \* /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/aspectj/autoproxy/AspectJAwareAdvisorAutoProxyCreator.java
- \* /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/config/AdviceEntry.java
- \* /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/config/AdvisorEntry.java
- \* /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/aspectj/AspectJAdviceParameterNameDiscoverer.java
- \* /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/framework/AopContext.java

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* /spring-aop-5-2-20-release-sources-
jar/org/springframework/aop/aspectj/annotation/ReflectiveAspectJAdvisorFactory.java
*
/spring-aop-5-2-20-release-sources-
jar/org/springframework/aop/framework/adaptor/MethodBeforeAdviceInterceptor.java
* /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/config/PointcutEntry.java
* /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/interceptor/CustomizableTraceInterceptor.java
* /spring-aop-5-2-20-release-sources-
jar/org/springframework/aop/framework/autoproxy/AbstractAdvisorAutoProxyCreator.java
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* /spring-aop-5-2-20-release-sources-jar/org/aopalliance/intercept/Invocation.java
* /spring-aop-5-2-20-release-sources-jar/org/aopalliance/aop/Advice.java
* /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/framework/autoproxy/TargetSourceCreator.java
* /spring-aop-5-2-20-release-sources-jar/org/aopalliance/intercept/ConstructorInterceptor.java
*
/spring-aop-5-2-20-release-sources-jar/org/springframework/aop/framework/ProxyFactory.java
* /spring-aop-5-2-20-release-sources-
jar/org/springframework/aop/aspectj/annotation/MetadataAwareAspectInstanceFactory.java
* /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/aspectj/AspectJAfterReturningAdvice.java
* /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/target/ThreadLocalTargetSource.java
* /spring-aop-5-2-20-release-sources-jar/org/aopalliance/intercept/MethodInvocation.java
* /spring-aop-5-2-20-release-sources-
jar/org/springframework/aop/aspectj/annotation/SingletonMetadataAwareAspectInstanceFactory.java
* /spring-aop-5-2-20-release-sources-
jar/org/springframework/aop/aspectj/annotation/SimpleMetadataAwareAspectInstanceFactory.java
* /spring-aop-5-2-20-release-sources-
jar/org/springframework/aop/config/AspectJAutoProxyBeanDefinitionParser.java
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- \* /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/aspectj/AspectJAroundAdvice.java
- \* /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/interceptor/PerformanceMonitorInterceptor.java
- \* /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/aspectj/AspectInstanceFactory.java
- \*
- /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/support/DefaultBeanFactoryPointcutAdvisor.java
- \* /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/config/MethodLocatingFactoryBean.java
- \* /spring-aop-5-2-20-release-sources-
- jar/org/springframework/aop/interceptor/JamonPerformanceMonitorInterceptor.java
- \* /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/support/DefaultPointcutAdvisor.java
- \* /spring-aop-5-2-20-release-sources-
- jar/org/springframework/aop/aspectj/annotation/AnnotationAwareAspectJAutoProxyCreator.java
- \* /spring-aop-5-2-20-release-sources-
- jar/org/springframework/aop/support/DelegatePerTargetObjectIntroductionInterceptor.java
- \* /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/support/AbstractExpressionPointcut.java
- \* /spring-aop-5-2-20-release-sources-
- jar/org/springframework/aop/config/AbstractInterceptorDrivenBeanDefinitionDecorator.java
- \* /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/support/ExpressionPointcut.java
- \*
- /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/support/AbstractBeanFactoryPointcutAdvisor.java
- \* /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/interceptor/SimpleTraceInterceptor.java
- \* /spring-aop-5-2-20-release-sources-
- jar/org/springframework/aop/framework/autoproxy/InfrastructureAdvisorAutoProxyCreator.java
- \* /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/aspectj/AspectJExpressionPointcutAdvisor.java
- \* /spring-aop-5-2-20-release-sources-
- jar/org/springframework/aop/framework/autoproxy/BeanNameAutoProxyCreator.java
- \* /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/Advisor.java
- \* /spring-aop-5-2-20-release-sources-
- jar/org/springframework/aop/config/SimpleBeanFactoryAwareAspectInstanceFactory.java
- \* /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/support/AbstractPointcutAdvisor.java
- \* /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/config/AspectComponentDefinition.java
- \*

/spring-aop-5-2-20-release-sources-jar/org/springframework/aop/interceptor/AbstractTraceInterceptor.java  
\* /spring-aop-5-2-20-release-sources-  
jar/org/springframework/aop/aspectj/annotation/LazySingletonAspectInstanceFactoryDecorator.java  
\* /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/support/DelegatingIntroductionInterceptor.java  
\* /spring-aop-5-2-20-release-sources-jar/org/springframework/aop/support/AbstractGenericPointcutAdvisor.java

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* /spring-tx-5-2-20-release-sources-jar/org/springframework/jca/cci/object/MappingRecordOperation.java
* /spring-tx-5-2-20-release-sources-jar/org/springframework/dao/support/DaoSupport.java
*
/spring-tx-5-2-20-release-sources-jar/org/springframework/jca/context/BootstrapContextAware.java
* /spring-tx-5-2-20-release-sources-jar/org/springframework/jca/endpoint/AbstractMessageEndpointFactory.java
* /spring-tx-5-2-20-release-sources-jar/org/springframework/jca/endpoint/GenericMessageEndpointManager.java
* /spring-tx-5-2-20-release-sources-jar/org/springframework/jca/cci/core/support/CciDaoSupport.java
* /spring-tx-5-2-20-release-sources-
jar/org/springframework/transaction/event/TransactionalEventListenerFactory.java
* /spring-tx-5-2-20-release-sources-jar/org/springframework/transaction/jta/WebLogicJtaTransactionManager.java
* /spring-tx-5-2-20-release-sources-
jar/org/springframework/transaction/config/AnnotationDrivenBeanDefinitionParser.java
* /spring-tx-5-2-20-release-sources-jar/org/springframework/jca/cci/connection/CciLocalTransactionManager.java
* /spring-tx-5-2-20-release-sources-
jar/org/springframework/transaction/annotation/TransactionManagementConfigurationSelector.java
*
/spring-tx-5-2-20-release-sources-jar/org/springframework/transaction/support/TransactionSynchronization.java
* /spring-tx-5-2-20-release-sources-
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jar/org/springframework/transaction/support/ResourceTransactionDefinition.java  
 \* /spring-tx-5-2-20-release-sources-jar/org/springframework/jca/cci/core/RecordExtractor.java  
 \* /spring-tx-5-2-20-release-sources-jar/org/springframework/jca/cci/core/CciTemplate.java  
 \* /spring-tx-5-2-20-release-sources-  
 jar/org/springframework/transaction/interceptor/AbstractFallbackTransactionAttributeSource.java  
 \* /spring-tx-5-2-20-release-sources-jar/org/springframework/transaction/support/TransactionCallback.java  
 \* /spring-tx-5-2-20-release-sources-jar/org/springframework/transaction/interceptor/RollbackRuleAttribute.java  
 \* /spring-tx-5-2-20-release-sources-  
 jar/org/springframework/jca/cci/connection/TransactionAwareConnectionFactoryProxy.java  
 \* /spring-tx-5-2-20-release-sources-jar/org/springframework/jca/cci/object/SimpleRecordOperation.java  
 \* /spring-tx-5-2-20-release-sources-jar/org/springframework/transaction/InvalidTimeoutException.java  
 \*  
 /spring-tx-5-2-20-release-sources-jar/org/springframework/transaction/interceptor/DefaultTransactionAttribute.java  
 \* /spring-tx-5-2-20-release-sources-jar/org/springframework/jca/cci/CannotGetCciConnectionException.java  
 \* /spring-tx-5-2-20-release-sources-jar/org/springframework/transaction/support/SimpleTransactionStatus.java  
 \* /spring-tx-5-2-20-release-sources-jar/org/springframework/transaction/support/TransactionTemplate.java  
 \* /spring-tx-5-2-20-release-sources-jar/org/springframework/transaction/jta/SpringJtaSynchronizationAdapter.java  
 \* /spring-tx-5-2-20-release-sources-jar/org/springframework/jca/support/LocalConnectionFactoryBean.java  
 \* /spring-tx-5-2-20-release-sources-jar/org/springframework/jca/cci/RecordTypeNotSupportedException.java  
 \* /spring-tx-5-2-20-release-sources-jar/org/springframework/jca/endpoint/GenericMessageEndpointFactory.java  
 \* /spring-tx-5-2-20-release-sources-jar/org/springframework/jca/cci/connection/SingleConnectionFactory.java  
 \*  
 /spring-tx-5-2-20-release-sources-jar/org/springframework/transaction/jta/JtaTransactionManager.java  
 \* /spring-tx-5-2-20-release-sources-jar/org/springframework/jca/cci/connection/ConnectionHolder.java  
 \* /spring-tx-5-2-20-release-sources-jar/org/springframework/transaction/support/ResourceHolderSupport.java  
 \* /spring-tx-5-2-20-release-sources-jar/org/springframework/transaction/HeuristicCompletionException.java  
 \* /spring-tx-5-2-20-release-sources-  
 jar/org/springframework/transaction/support/ResourceHolderSynchronization.java  
 \* /spring-tx-5-2-20-release-sources-jar/org/springframework/dao/support/DataAccessUtils.java  
 \* /spring-tx-5-2-20-release-sources-jar/org/springframework/transaction/annotation/Isolation.java  
 \* /spring-tx-5-2-20-release-sources-jar/org/springframework/transaction/support/DefaultTransactionDefinition.java  
 \* /spring-tx-5-2-20-release-sources-jar/org/springframework/jca/cci/CannotCreateRecordException.java  
 \*  
 /spring-tx-5-2-20-release-sources-jar/org/springframework/jca/cci/CciOperationNotSupportedException.java  
 \* /spring-tx-5-2-20-release-sources-  
 jar/org/springframework/transaction/interceptor/NameMatchTransactionAttributeSource.java  
 \* /spring-tx-5-2-20-release-sources-jar/org/springframework/jca/cci/core/ConnectionCallback.java  
 \* /spring-tx-5-2-20-release-sources-  
 jar/org/springframework/dao/support/ChainedPersistenceExceptionTranslator.java  
 \* /spring-tx-5-2-20-release-sources-  
 jar/org/springframework/transaction/config/TransactionManagementConfigUtils.java  
 \* /spring-tx-5-2-20-release-sources-jar/org/springframework/jca/work/SimpleTaskWorkManager.java  
 \* /spring-tx-5-2-20-release-sources-  
 jar/org/springframework/transaction/interceptor/MatchAlwaysTransactionAttributeSource.java  
 \* /spring-tx-5-2-20-release-sources-jar/org/springframework/jca/cci/object/MappingCommAreaOperation.java  
 \* /spring-tx-5-2-20-release-sources-jar/org/springframework/jca/context/SpringContextResourceAdapter.java  
 \*

/spring-tx-5-2-20-release-sources-jar/org/springframework/transaction/jta/JtaTransactionObject.java  
\* /spring-tx-5-2-20-release-sources-jar/org/springframework/transaction/jta/SimpleTransactionFactory.java  
\* /spring-tx-5-2-20-release-sources-jar/org/springframework/jca/cci/connection/ConnectionFactoryUtils.java  
\* /spring-tx-5-2-20-release-sources-jar/org/springframework/dao/IncorrectResultSizeDataAccessException.java  
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\* /spring-tx-5-2-20-release-sources-jar/org/springframework/transaction/TransactionException.java  
\* /spring-tx-5-2-20-release-sources-jar/org/springframework/transaction/jta/JtaAfterCompletionSynchronization.java  
\*  
/spring-tx-5-2-20-release-sources-jar/org/springframework/dao/DuplicateKeyException.java  
\* /spring-tx-5-2-20-release-sources-jar/org/springframework/transaction/support/TransactionSynchronizationAdapter.java  
\* /spring-tx-5-2-20-release-sources-jar/org/springframework/transaction/config/TxNamespaceHandler.java  
\* /spring-tx-5-2-20-release-sources-jar/org/springframework/jca/cci/connection/NotSupportedRecordFactory.java  
\* /spring-tx-5-2-20-release-sources-jar/org/springframework/jca/work/DelegatingWork.java  
\* /spring-tx-5-2-20-release-sources-jar/org/springframework/transaction/TransactionUsageException.java  
\* /spring-tx-5-2-20-release-sources-jar/org/springframework/dao/DataIntegrityViolationException.java  
\* /spring-tx-5-2-20-release-sources-jar/org/springframework/transaction/InvalidIsolationLevelException.java  
\* /spring-tx-5-2-20-release-sources-jar/org/springframework/dao/PessimisticLockingFailureException.java  
\* /spring-tx-5-2-20-release-sources-jar/org/springframework/transaction/support/ResourceTransactionManager.java  
\*  
/spring-tx-5-2-20-release-sources-jar/org/springframework/transaction/IllegalTransactionStateException.java  
\* /spring-tx-5-2-20-release-sources-jar/org/springframework/transaction/TransactionTimedOutException.java  
\* /spring-tx-5-2-20-release-sources-jar/org/springframework/dao/annotation/PersistenceExceptionTranslationAdvisor.java  
\* /spring-tx-5-2-20-release-sources-jar/org/springframework/transaction/interceptor/DelegatingTransactionAttribute.java  
\* /spring-tx-5-2-20-release-sources-jar/org/springframework/dao/TypeMismatchDataAccessException.java

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* /spring-tx-5-2-20-release-sources-jar/org/springframework/dao/CannotAcquireLockException.java
* /spring-tx-5-2-20-release-sources-jar/org/springframework/dao/InvalidDataAccessResourceUsageException.java
* /spring-tx-5-2-20-release-sources-jar/org/springframework/dao/DeadlockLoserDataAccessException.java
* /spring-tx-5-2-20-release-sources-
jar/org/springframework/transaction/TransactionSuspensionNotSupportedException.java
*
/spring-tx-5-2-20-release-sources-jar/org/springframework/transaction/jta/ManagedTransactionAdapter.java
* /spring-tx-5-2-20-release-sources-jar/org/springframework/dao/InvalidDataAccessApiUsageException.java
* /spring-tx-5-2-20-release-sources-
jar/org/springframework/transaction/support/DelegatingTransactionDefinition.java
* /spring-tx-5-2-20-release-sources-
jar/org/springframework/dao/IncorrectUpdateSemanticsDataAccessException.java
* /spring-tx-5-2-20-release-sources-jar/org/springframework/transaction/jta/TransactionFactory.java
* /spring-tx-5-2-20-release-sources-jar/org/springframework/dao/PermissionDeniedDataAccessException.java
* /spring-tx-5-2-20-release-sources-jar/org/springframework/transaction/NoTransactionException.java
* /spring-tx-5-2-20-release-sources-jar/org/springframework/dao/TransientDataAccessResourceException.java
* /spring-tx-5-2-20-release-sources-jar/org/springframework/transaction/CannotCreateTransactionException.java
*
/spring-tx-5-2-20-release-sources-jar/org/springframework/transaction/UnexpectedRollbackException.java
* /spring-tx-5-2-20-release-sources-jar/org/springframework/dao/QueryTimeoutException.java
* /spring-tx-5-2-20-release-sources-jar/org/springframework/dao/CleanupFailureDataAccessException.java
* /spring-tx-5-2-20-release-sources-
jar/org/springframework/transaction/interceptor/TransactionAttributeSourceEditor.java
* /spring-tx-5-2-20-release-sources-jar/org/springframework/transaction/jta/UserTransactionAdapter.java
* /spring-tx-5-2-20-release-sources-jar/org/springframework/dao/CannotSerializeTransactionException.java
* /spring-tx-5-2-20-release-sources-jar/org/springframework/dao/RecoverableDataAccessException.java
* /spring-tx-5-2-20-release-sources-jar/org/springframework/jca/cci/InvalidResultSetAccessException.java
* /spring-tx-5-2-20-release-sources-jar/org/springframework/dao/EmptyResultDataAccessException.java
* /spring-tx-5-2-20-release-sources-jar/org/springframework/transaction/interceptor/NoRollbackRuleAttribute.java
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\* /spring-tx-5-2-20-release-sources-jar/org/springframework/jca/cci/core/RecordCreator.java

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jar/org/springframework/transaction/jta/WebSphereUowTransactionManager.java

\* /spring-tx-5-2-20-release-sources-jar/org/springframework/transaction/ReactiveTransactionManager.java

\* /spring-tx-5-2-20-release-sources-

jar/org/springframework/transaction/interceptor/RuleBasedTransactionAttribute.java

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/spring-tx-5-2-20-release-sources-
jar/org/springframework/transaction/annotation/EnableTransactionManagement.java
* /spring-tx-5-2-20-release-sources-jar/org/springframework/jca/work/WorkManagerTaskExecutor.java
* /spring-tx-5-2-20-release-sources-jar/org/springframework/transaction/PlatformTransactionManager.java
* /spring-tx-5-2-20-release-sources-jar/org/springframework/transaction/support/SimpleTransactionScope.java
* /spring-tx-5-2-20-release-sources-jar/org/springframework/transaction/reactive/TransactionalOperator.java
* /spring-tx-5-2-20-release-sources-
jar/org/springframework/transaction/annotation/ProxyTransactionManagementConfiguration.java
* /spring-tx-5-2-20-release-sources-
jar/org/springframework/transaction/interceptor/TransactionAttributeSourcePointcut.java
* /spring-tx-5-2-20-release-sources-
jar/org/springframework/dao/support/PersistenceExceptionTranslationInterceptor.java
* /spring-tx-5-2-20-release-sources-
jar/org/springframework/transaction/reactive/AbstractReactiveTransactionManager.java
*
/spring-tx-5-2-20-release-sources-jar/org/springframework/transaction/interceptor/TransactionAspectSupport.java
* /spring-tx-5-2-20-release-sources-jar/org/springframework/transaction/interceptor/TransactionInterceptor.java
* /spring-tx-5-2-20-release-sources-
jar/org/springframework/transaction/support/AbstractPlatformTransactionManager.java
* /spring-tx-5-2-20-release-sources-jar/org/springframework/transaction/config/TxAdviceBeanDefinitionParser.java
* /spring-tx-5-2-20-release-sources-
jar/org/springframework/transaction/annotation/TransactionManagementConfigurer.java
* /spring-tx-5-2-20-release-sources-
jar/org/springframework/transaction/support/TransactionSynchronizationManager.java
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* /spring-tx-5-2-20-release-sources-jar/org/springframework/transaction/event/TransactionalEventListener.java
* /spring-tx-5-2-20-release-sources-
jar/org/springframework/transaction/support/TransactionSynchronizationUtils.java
*

```

/spring-tx-5-2-20-release-sources-jar/org/springframework/transaction/event/TransactionPhase.java  
\* /spring-tx-5-2-20-release-sources-jar/org/springframework/dao/annotation/PersistenceExceptionTranslationPostProcessor.java  
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\* /spring-tx-5-2-20-release-sources-jar/org/springframework/jca/cci/connection/DelegatingConnectionFactory.java  
\* /spring-tx-5-2-20-release-sources-jar/org/springframework/dao/OptimisticLockingFailureException.java  
\* /spring-tx-5-2-20-release-sources-jar/org/springframework/jca/context/BootstrapContextAwareProcessor.java  
\*  
/spring-tx-5-2-20-release-sources-jar/org/springframework/dao/UncategorizedDataAccessException.java  
\* /spring-tx-5-2-20-release-sources-jar/org/springframework/transaction/TransactionSystemException.java

```

* /spring-tx-5-2-20-release-sources-
jar/org/springframework/transaction/interceptor/BeanFactoryTransactionAttributeSourceAdvisor.java
* /spring-tx-5-2-20-release-sources-jar/org/springframework/jca/cci/object/EisOperation.java
* /spring-tx-5-2-20-release-sources-
jar/org/springframework/transaction/interceptor/TransactionAttributeSourceAdvisor.java
* /spring-tx-5-2-20-release-sources-jar/org/springframework/dao/DataAccessResourceFailureException.java
* /spring-tx-5-2-20-release-sources-
jar/org/springframework/jca/cci/connection/ConnectionSpecConnectionFactoryAdapter.java
* /spring-tx-5-2-20-release-sources-jar/org/springframework/jca/support/SimpleBootstrapContext.java
* /spring-tx-5-2-20-release-sources-jar/org/springframework/dao/DataRetrievalFailureException.java
*
/spring-tx-5-2-20-release-sources-jar/org/springframework/jca/cci/core/support/CommAreaRecord.java
* /spring-tx-5-2-20-release-sources-jar/org/springframework/dao/ConcurrencyFailureException.java
* /spring-tx-5-2-20-release-sources-jar/org/springframework/dao/NonTransientDataAccessException.java
* /spring-tx-5-2-20-release-sources-jar/org/springframework/jca/cci/core/CciOperations.java
* /spring-tx-5-2-20-release-sources-
jar/org/springframework/transaction/support/CallbackPreferringPlatformTransactionManager.java
* /spring-tx-5-2-20-release-sources-jar/org/springframework/dao/TransientDataAccessException.java
* /spring-tx-5-2-20-release-sources-
jar/org/springframework/transaction/support/TransactionCallbackWithoutResult.java
* /spring-tx-5-2-20-release-sources-jar/org/springframework/dao/DataAccessException.java
* /spring-tx-5-2-20-release-sources-jar/org/springframework/jca/support/ResourceAdapterFactoryBean.java
* /spring-tx-5-2-20-release-sources-jar/org/springframework/jca/context/ResourceAdapterApplicationContext.java
*
/spring-tx-5-2-20-release-sources-jar/org/springframework/dao/NonTransientDataAccessResourceException.java
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\* /spring-tx-5-2-20-release-sources-jar/org/springframework/transaction/TransactionDefinition.java  
 \* /spring-tx-5-2-20-release-sources-jar/org/springframework/transaction/annotation/AnnotationTransactionAttributeSource.java  
 \* /spring-tx-5-2-20-release-sources-jar/org/springframework/transaction/TransactionManager.java  
 \*  
 /spring-tx-5-2-20-release-sources-jar/org/springframework/transaction/support/AbstractTransactionStatus.java  
 \* /spring-tx-5-2-20-release-sources-jar/org/springframework/transaction/StaticTransactionDefinition.java  
 \* /spring-tx-5-2-20-release-sources-jar/org/springframework/transaction/reactive/TransactionSynchronizationManager.java  
 \* /spring-tx-5-2-20-release-sources-jar/org/springframework/transaction/reactive/TransactionContext.java

```

* /spring-tx-5-2-20-release-sources-
jar/org/springframework/transaction/annotation/AbstractTransactionManagementConfiguration.java
* /spring-tx-5-2-20-release-sources-
jar/org/springframework/transaction/annotation/TransactionAnnotationParser.java
* /spring-tx-5-2-20-release-sources-jar/org/springframework/transaction/reactive/TransactionSynchronization.java
* /spring-tx-5-2-20-release-sources-jar/org/springframework/transaction/support/WithoutTransactionOperations.java
* /spring-tx-5-2-20-release-sources-jar/org/springframework/transaction/ReactiveTransaction.java
*
/spring-tx-5-2-20-release-sources-jar/org/springframework/transaction/reactive/TransactionCallback.java
* /spring-tx-5-2-20-release-sources-jar/org/springframework/transaction/TransactionExecution.java
* /spring-tx-5-2-20-release-sources-
jar/org/springframework/transaction/config/JtaTransactionManagerFactoryBean.java
* /spring-tx-5-2-20-release-sources-jar/org/springframework/transaction/reactive/TransactionalOperatorImpl.java
* /spring-tx-5-2-20-release-sources-jar/org/springframework/transaction/reactive/TransactionContextManager.java
* /spring-tx-5-2-20-release-sources-jar/org/springframework/transaction/support/DefaultTransactionStatus.java
* /spring-tx-5-2-20-release-sources-
jar/org/springframework/transaction/interceptor/TransactionProxyFactoryBean.java
* /spring-tx-5-2-20-release-sources-jar/org/springframework/transaction/reactive/TransactionContextHolder.java
* /spring-tx-5-2-20-release-sources-
jar/org/springframework/transaction/interceptor/MethodMapTransactionAttributeSource.java
*
/spring-tx-5-2-20-release-sources-
jar/org/springframework/transaction/annotation/SpringTransactionAnnotationParser.java
* /spring-tx-5-2-20-release-sources-
jar/org/springframework/transaction/interceptor/CompositeTransactionAttributeSource.java
* /spring-tx-5-2-20-release-sources-jar/org/springframework/transaction/reactive/GenericReactiveTransaction.java
* /spring-tx-5-2-20-release-sources-jar/org/springframework/transaction/support/TransactionOperations.java
* /spring-tx-5-2-20-release-sources-
jar/org/springframework/transaction/reactive/TransactionSynchronizationUtils.java
* /spring-tx-5-2-20-release-sources-
jar/org/springframework/transaction/annotation/JtaTransactionAnnotationParser.java
* /spring-tx-5-2-20-release-sources-
jar/org/springframework/transaction/reactive/ReactiveResourceSynchronization.java
* /spring-tx-5-2-20-release-sources-jar/org/springframework/transaction/interceptor/TransactionAttributeEditor.java
* /spring-tx-5-2-20-release-sources-
jar/org/springframework/transaction/annotation/Ejb3TransactionAnnotationParser.java
*
/spring-tx-5-2-20-release-sources-jar/org/springframework/transaction/TransactionStatus.java
* /spring-tx-5-2-20-release-sources-
jar/org/springframework/transaction/event/ApplicationListenerMethodTransactionalAdapter.java
* /spring-tx-5-2-20-release-sources-
jar/org/springframework/transaction/interceptor/TransactionAttributeSource.java
* /spring-tx-5-2-20-release-sources-jar/org/springframework/transaction/annotation/Propagation.java
* /spring-tx-5-2-20-release-sources-jar/org/springframework/transaction/interceptor/TransactionAttribute.java

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* /spring-beans-5-2-20-release-sources-
jar/org/springframework/beans/factory/groovy/GroovyBeanDefinitionReader.java
* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/propertyeditors/PathEditor.java
```

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*
/spring-beans-5-2-20-release-sources-
jar/org/springframework/beans/factory/config/ConstructorArgumentValues.java
* /spring-beans-5-2-20-release-sources-
jar/org/springframework/beans/factory/annotation/AutowiredAnnotationBeanPostProcessor.java
* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/support/RootBeanDefinition.java
* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/support/AbstractBeanFactory.java
* /spring-beans-5-2-20-release-sources-
jar/org/springframework/beans/factory/config/PlaceholderConfigurerSupport.java
* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/support/ConstructorResolver.java
* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/xml/ParserContext.java
* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/support/AbstractBeanDefinition.java
* /spring-beans-5-2-20-release-sources-
jar/org/springframework/beans/factory/support/AbstractAutowireCapableBeanFactory.java
*
/spring-beans-5-2-20-release-sources-jar/org/springframework/beans/AbstractNestablePropertyAccessor.java
* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/GenericTypeAwarePropertyDescriptor.java
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jar/org/springframework/beans/factory/config/RuntimeBeanNameReference.java
* /spring-beans-5-2-20-release-sources-
jar/org/springframework/beans/factory/xml/DocumentDefaultsDefinition.java
* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/parsing/Problem.java
*
/spring-beans-5-2-20-release-sources-
jar/org/springframework/beans/factory/config/ConfigurableListableBeanFactory.java
* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/propertyeditors/PatternEditor.java
* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/parsing/ImportDefinition.java
* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/config/DeprecatedBeanWarner.java

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* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/ConfigurablePropertyAccessor.java
* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/xml/XmlReaderContext.java
* /spring-beans-5-2-20-release-sources-
jar/org/springframework/beans/factory/config/ProviderCreatingFactoryBean.java
* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/propertyeditors/PropertiesEditor.java
* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/support/NullBean.java
*
/spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/config/BeanExpressionResolver.java
* /spring-beans-5-2-20-release-sources-
jar/org/springframework/beans/propertyeditors/ByteArrayPropertyEditor.java
* /spring-beans-5-2-20-release-sources-
jar/org/springframework/beans/factory/config/ObjectFactoryCreatingFactoryBean.java
* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/ListableBeanFactoryExtensions.kt
* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/xml/NamespaceHandlerSupport.java
* /spring-beans-5-2-20-release-sources-
jar/org/springframework/beans/propertyeditors/CharArrayPropertyEditor.java
* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/config/EmbeddedValueResolver.java
* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/parsing/AliasDefinition.java
* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/config/PropertiesFactoryBean.java
*
/spring-beans-5-2-20-release-sources-jar/org/springframework/beans/propertyeditors/ClassEditor.java
* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/support/LookupOverride.java
* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/BeanClassLoaderAware.java
* /spring-beans-5-2-20-release-sources-
jar/org/springframework/beans/factory/config/ServiceLocatorFactoryBean.java
* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/support/MethodOverride.java
* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/propertyeditors/CharacterEditor.java
* /spring-beans-5-2-20-release-sources-
jar/org/springframework/beans/factory/annotation/CustomAutowireConfigurer.java
* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/config/MapFactoryBean.java
* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/config/ListFactoryBean.java
* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/propertyeditors/ResourceBundleEditor.java
*
/spring-beans-5-2-20-release-sources-jar/org/springframework/beans/PropertyAccessorUtils.java
* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/config/PropertyPathFactoryBean.java
* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/wiring/BeanWiringInfo.java
* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/support/ManagedProperties.java
* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/BeansException.java
* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/BeanWrapper.java
* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/propertyeditors/ClassArrayEditor.java
* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/support/ChildBeanDefinition.java
* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/BeanMetadataAttribute.java
*
/spring-beans-5-2-20-release-sources-jar/org/springframework/beans/FatalBeanException.java
* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/support/BeanDefinitionReader.java
* /spring-beans-5-2-20-release-sources-
jar/org/springframework/beans/factory/xml/AbstractSingleBeanDefinitionParser.java
* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/parsing/Location.java

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\* /spring-beans-5-2-20-release-sources-

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jar/org/springframework/beans/factory/config/YamlPropertiesFactoryBean.java
* /spring-beans-5-2-20-release-sources-
jar/org/springframework/beans/propertyeditors/StringArrayPropertyEditor.java
*
/spring-beans-5-2-20-release-sources-jar/org/springframework/beans/TypeConverterDelegate.java
* /spring-beans-5-2-20-release-sources-
jar/org/springframework/beans/factory/config/ConfigurableBeanFactory.java
* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/xml/ResourceEntityResolver.java
* /spring-beans-5-2-20-release-sources-
jar/org/springframework/beans/factory/support/DefaultBeanNameGenerator.java
* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/BeanMetadataElement.java
* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/config/BeanDefinitionVisitor.java
* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/config/BeanPostProcessor.java
* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/annotation/Autowired.java
* /spring-beans-5-2-20-release-sources-
jar/org/springframework/beans/factory/groovy/GroovyBeanDefinitionWrapper.java
*
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* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/support/BeanDefinitionBuilder.java
* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/config/TypedStringValue.java
* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/xml/PluggableSchemaResolver.java
* /spring-beans-5-2-20-release-sources-
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* /spring-beans-5-2-20-release-sources-
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* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/xml/BeansDtdResolver.java
* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/annotation/AnnotationBeanUtils.java
* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/PropertyDescriptorUtils.java
*
/spring-beans-5-2-20-release-sources-jar/org/springframework/beans/TypeConverterSupport.java
* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/xml/DelegatingEntityResolver.java
* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/support/AutowireUtils.java
* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/TypeConverter.java
* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/config/YamlMapFactoryBean.java
* /spring-beans-5-2-20-release-sources-
jar/org/springframework/beans/factory/config/InstantiationAwareBeanPostProcessor.java
* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/ExtendedBeanInfo.java
* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/propertyeditors/CustomMapEditor.java
* /spring-beans-5-2-20-release-sources-
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* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/config/RuntimeBeanReference.java
*
/spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/config/BeanFactoryPostProcessor.java
* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/propertyeditors/UUIDEditor.java
* /spring-beans-5-2-20-release-sources-
jar/org/springframework/beans/factory/support/AbstractBeanDefinitionReader.java
* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/PropertyValue.java
* /spring-beans-5-2-20-release-sources-

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jar/org/springframework/beans/factory/config/PreferencesPlaceholderConfigurer.java
* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/propertyeditors/CustomCollectionEditor.java
* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/PropertyBatchUpdateException.java
* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/BeanFactoryUtils.java
* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/support/MethodOverrides.java
*
/spring-beans-5-2-20-release-sources-
jar/org/springframework/beans/factory/config/AutowireCapableBeanFactory.java
* /spring-beans-5-2-20-release-sources-
jar/org/springframework/beans/factory/config/PropertyPlaceholderConfigurer.java
* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/InjectionPoint.java
* /spring-beans-5-2-20-release-sources-
jar/org/springframework/beans/factory/annotation/ParameterResolutionDelegate.java
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* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/annotation/Autowire.java
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\* /spring-beans-5-2-20-release-sources-

jar/org/springframework/beans/factory/parsing/ConstructorArgumentEntry.java

\* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/xml/NamespaceHandler.java

\* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/parsing/NullSourceExtractor.java

\*

/spring-beans-5-2-20-release-sources-jar/org/springframework/beans/propertyeditors/CurrencyEditor.java

\* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/propertyeditors/InputSourceEditor.java

\* /spring-beans-5-2-20-release-sources-

jar/org/springframework/beans/factory/parsing/EmptyReaderEventListener.java

\* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/ConversionNotSupportedException.java

\* /spring-beans-5-2-20-release-sources-

jar/org/springframework/beans/factory/parsing/PassThroughSourceExtractor.java

\* /spring-beans-5-2-20-release-sources-

jar/org/springframework/beans/factory/support/BeanDefinitionValidationException.java

\* /spring-beans-5-2-20-release-sources-

jar/org/springframework/beans/factory/BeanCurrentlyInCreationException.java

\* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/xml/DocumentLoader.java

\* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/support/MutableSortDefinition.java

\*

/spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/parsing/ComponentDefinition.java

\* /spring-beans-5-2-20-release-sources-

jar/org/springframework/beans/factory/config/PropertyResourceConfigurer.java

\* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/propertyeditors/LocaleEditor.java

\* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/propertyeditors/CharsetEditor.java

\* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/config/BeanReference.java

\* /spring-beans-5-2-20-release-sources-

jar/org/springframework/beans/factory/xml/SimplePropertyNamespaceHandler.java

\* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/HierarchicalBeanFactory.java

\* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/BeanFactoryAware.java

\* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/parsing/ProblemReporter.java

\*

/spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/BeanIsNotAFactoryException.java

\* /spring-beans-5-2-20-release-sources-

jar/org/springframework/beans/factory/wiring/ClassNameBeanWiringInfoResolver.java

\* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/annotation/Configurable.java

\* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/PropertyEditorRegistrar.java

\* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/BeanIsAbstractException.java

\* /spring-beans-5-2-20-release-sources-

jar/org/springframework/beans/factory/parsing/BeanDefinitionParsingException.java

\* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/PropertyEditorRegistry.java

\* /spring-beans-5-2-20-release-sources-

jar/org/springframework/beans/factory/BeanCreationNotAllowedException.java

\* /spring-beans-5-2-20-release-sources-

jar/org/springframework/beans/factory/FactoryBeanNotInitializedException.java

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* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/xml/BeanDefinitionDecorator.java
*
/spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/support/MethodReplacer.java
* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/BeanExpressionException.java
* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/wiring/BeanWiringInfoResolver.java
* /spring-beans-5-2-20-release-sources-
jar/org/springframework/beans/factory/parsing/AbstractComponentDefinition.java
* /spring-beans-5-2-20-release-sources-
jar/org/springframework/beans/factory/support/SecurityContextProvider.java
* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/support/SortDefinition.java
* /spring-beans-5-2-20-release-sources-
jar/org/springframework/beans/factory/xml/XmlBeanDefinitionStoreException.java
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* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/BeanInfoFactory.java
* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/SimpleTypeConverter.java
* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/propertyeditors/TimeZoneEditor.java
*
/spring-beans-5-2-20-release-sources-
jar/org/springframework/beans/factory/groovy/GroovyDynamicElementReader.groovy
* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/ExtendedBeanInfoFactory.java
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- \* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/ListableBeanFactory.java
- \* /spring-beans-5-2-20-release-sources-
- jar/org/springframework/beans/factory/support/CglibSubclassingInstantiationStrategy.java
- \*
- /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/config/DependencyDescriptor.java
- \* /spring-beans-5-2-20-release-sources-
- jar/org/springframework/beans/support/ArgumentConvertingMethodInvoker.java
- \* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/annotation/InjectionMetadata.java
- \* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/AbstractPropertyAccessor.java
- \* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/config/YamlProcessor.java
- \* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/parsing/ParseState.java
- \* /spring-beans-5-2-20-release-sources-
- jar/org/springframework/beans/factory/support/DefaultSingletonBeanRegistry.java
- \* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/parsing/PropertyEntry.java
- \* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/BeanFactory.java
- \* /spring-beans-5-2-20-release-sources-
- jar/org/springframework/beans/factory/support/BeanDefinitionValueResolver.java
- \*
- /spring-beans-5-2-20-release-sources-
- jar/org/springframework/beans/factory/support/FactoryBeanRegistrySupport.java
- \* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/propertyeditors/URIEditor.java
- \* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/annotation/Value.java
- \* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/xml/XmlBeanDefinitionReader.java
- \* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/parsing/QualifierEntry.java
- \* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/DirectFieldAccessor.java
- \* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/support/BeanDefinitionDefaults.java
- \* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/FactoryBean.java
- \* /spring-beans-5-2-20-release-sources-
- jar/org/springframework/beans/factory/support/StaticListableBeanFactory.java
- \*
- /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/parsing/ReaderContext.java
- \* /spring-beans-5-2-20-release-sources-
- jar/org/springframework/beans/factory/support/PropertiesBeanDefinitionReader.java
- \* /spring-beans-5-2-20-release-sources-
- jar/org/springframework/beans/factory/support/DefaultListableBeanFactory.java
- \* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/config/BeanDefinition.java
- \* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/support/ReplaceOverride.java
- \* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/BeanWrapperImpl.java

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* /spring-beans-5-2-20-release-sources-
jar/org/springframework/beans/factory/support/SimpleAutowireCandidateResolver.java
* /spring-beans-5-2-20-release-sources-
jar/org/springframework/beans/factory/xml/BeanDefinitionParserDelegate.java
* /spring-beans-5-2-20-release-sources-
jar/org/springframework/beans/factory/support/GenericTypeAwareAutowireCandidateResolver.java
*
/spring-beans-5-2-20-release-sources-
jar/org/springframework/beans/factory/support/AutowireCandidateResolver.java
* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/BeanUtils.java
* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/annotation/Lookup.java
* /spring-beans-5-2-20-release-sources-
jar/org/springframework/beans/factory/support/BeanDefinitionReaderUtils.java
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* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/SmartInitializingSingleton.java
* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/NotReadablePropertyException.java
* /spring-beans-5-2-20-release-sources-
jar/org/springframework/beans/factory/xml/AbstractSimpleBeanDefinitionParser.java
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/spring-beans-5-2-20-release-sources-
jar/org/springframework/beans/factory/annotation/AnnotatedBeanDefinition.java
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- \* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/support/SimpleSecurityContextProvider.java
- \* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/InitializingBean.java
- \*
- /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/config/CustomScopeConfigurer.java
- \* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/config/AbstractFactoryBean.java
- \* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/config/CustomEditorConfigurer.java
- \* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/parsing/FailFastProblemReporter.java
- \* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/support/SimpleInstantiationStrategy.java
- \* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/PropertyMatches.java
- \* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/xml/SimpleConstructorNamespaceHandler.java
- \* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/xml/AbstractBeanDefinitionParser.java
- \* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/support/PagedListHolder.java
- \*
- /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/annotation/Required.java
- \* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/config/FieldRetrievingFactoryBean.java
- \* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/PropertyValues.java
- \* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/support/ManagedArray.java
- \* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/config/PropertyOverrideConfigurer.java
- \* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/NotWritablePropertyException.java
- \* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/annotation/QualifierAnnotationAutowireCandidateResolver.java
- \* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/PropertyAccessor.java
- \* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/support/BeanDefinitionRegistry.java
- \* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/support/ManagedMap.java
- \*
- /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/ObjectFactory.java
- \* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/support/InstantiationStrategy.java
- \* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/parsing/BeanComponentDefinition.java
- \* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/BeanDefinitionStoreException.java



\* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/PropertyAccessException.java  
 \* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/config/InstantiationAwareBeanPostProcessorAdapter.java  
 \* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/config/DestructionAwareBeanPostProcessor.java  
 \* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/parsing/CompositeComponentDefinition.java  
 \* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/support/ManagedList.java  
 \*  
 /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/support/BeanDefinitionResource.java  
 \* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/config/MethodInvokingFactoryBean.java  
 \* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/xml/XmlBeanFactory.java  
 \* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/PropertyAccessorFactory.java  
 \* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/config/NamedBeanHolder.java  
 \* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/NoUniqueBeanDefinitionException.java  
 \* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/propertyeditors/CustomNumberEditor.java  
 \* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/NoSuchBeanDefinitionException.java  
 \* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/MethodInvocationException.java  
 \*  
 /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/support/MergedBeanDefinitionPostProcessor.java  
 \* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/support/SimpleBeanDefinitionRegistry.java  
 \* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/xml/DefaultBeanDefinitionDocumentReader.java  
 \* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/Mergeable.java  
 \* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/support/ManagedSet.java  
 \* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/support/BeanDefinitionOverrideException.java  
 \* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/BeanCreationException.java  
 \* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/BeanNotOfRequiredTypeException.java  
 \* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/Aware.java  
 \*  
 /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/config/BeanExpressionContext.java  
 \* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/propertyeditors/CustomDateEditor.java  
 \* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/wiring/BeanConfigurerSupport.java  
 \* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/xml/DefaultNamespaceHandlerResolver.java  
 \* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/annotation/AnnotationBeanWiringInfoResolver.java  
 \* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/SmartFactoryBean.java  
 \* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/PropertyEditorRegistrySupport.java  
 \* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/BeanFactoryExtensions.kt  
 \* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/MutablePropertyValues.java

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*
/spring-beans-5-2-20-release-sources-
jar/org/springframework/beans/factory/annotation/BeanFactoryAnnotationUtils.java
* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/InvalidPropertyException.java
* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/xml/DefaultDocumentLoader.java
* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/support/PropertyComparator.java
* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/DisposableBean.java
* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/BeanInstantiationException.java
* /spring-beans-5-2-20-release-sources-
jar/org/springframework/beans/factory/CannotLoadBeanClassException.java
* /spring-beans-5-2-20-release-sources-
jar/org/springframework/beans/factory/support/AutowiredCandidateQualifier.java
* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/propertyeditors/CustomBooleanEditor.java
* /spring-beans-5-2-20-release-sources-
jar/org/springframework/beans/factory/annotation/RequiredAnnotationBeanPostProcessor.java
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/spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/UnsatisfiedDependencyException.java
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jar/org/springframework/beans/factory/serviceloader/ServiceFactoryBean.java
* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/PropertyValuesEditor.java
* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/parsing/ReaderEventListener.java
*
/spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/parsing/DefaultsDefinition.java
* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/support/BeanNameGenerator.java
* /spring-beans-5-2-20-release-sources-
jar/org/springframework/beans/factory/serviceloader/ServiceLoaderFactoryBean.java
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* /spring-beans-5-2-20-release-sources-
jar/org/springframework/beans/factory/xml/BeanDefinitionDocumentReader.java
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Found in path(s):

- \* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/propertyeditors/InputStreamEditor.java
- \* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/xml/NamespaceHandlerResolver.java
- \* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/propertyeditors/ReaderEditor.java
- \*
- \*/spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/NamedBean.java
- \* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/propertyeditors/FileEditor.java
- \* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/serviceloader/ServiceListFactoryBean.java
- \* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/parsing/SourceExtractor.java
- \* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/NullValueInNestedPathException.java
- \* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/support/ImplicitlyAppearedSingletonException.java
- \* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/config/Scope.java
- \* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/support/ResourceEditorRegistrar.java
- \* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/xml/UtilNamespaceHandler.java
- \* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/BeanInitializationException.java
- \*
- \*/spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/config/SmartInstantiationAwareBeanPostProcessor.java
- \* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/propertyeditors/URLEditor.java
- \* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/config/BeanDefinitionCustomizer.java
- \* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/propertyeditors/ZoneIdEditor.java
- \* /spring-beans-5-2-20-release-sources-jar/org/springframework/beans/factory/BeanNameAware.java

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* /spring-context-5-2-20-release-sources-1-jar/org/springframework/context/LifecycleProcessor.java
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Found in path(s):

```

* /spring-context-5-2-20-release-sources-1-jar/org/springframework/context/ApplicationEventPublisherAware.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/context/annotation/ImportAware.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/context/annotation/ConflictingBeanDefinitionException.java
*
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/jmx/export/notification/NotificationPublisherAware.java
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Found in path(s):

- \* /spring-context-5-2-20-release-sources-1-jar/org/springframework/remoting/RemoteConnectFailureException.java
- \* /spring-context-5-2-20-release-sources-1-jar/org/springframework/jmx/export/MBeanExportException.java
- \* /spring-context-5-2-20-release-sources-1-jar/org/springframework/scheduling/config/SchedulerBeanDefinitionParser.java
- \*
  - /spring-context-5-2-20-release-sources-1-jar/org/springframework/context/annotation/EnableMBeanExport.java
- \* /spring-context-5-2-20-release-sources-1-jar/org/springframework/remoting/RemoteLookupFailureException.java
- \* /spring-context-5-2-20-release-sources-1-jar/org/springframework/remoting/rmi/RmiClientInterceptor.java
- \* /spring-context-5-2-20-release-sources-1-jar/org/springframework/remoting/soap/SoapFaultException.java
- \* /spring-context-5-2-20-release-sources-1-jar/org/springframework/validation/beanvalidation/LocaleContextMessageInterpolator.java
- \* /spring-context-5-2-20-release-sources-1-jar/org/springframework/scripting/support/RefreshableScriptTargetSource.java
- \* /spring-context-5-2-20-release-sources-1-jar/org/springframework/format/FormatterRegistrar.java
- \* /spring-context-5-2-20-release-sources-1-jar/org/springframework/jmx/access/MBeanConnectFailureException.java
- \* /spring-context-5-2-20-release-sources-1-jar/org/springframework/context/event/ContextStoppedEvent.java
- \*
  - /spring-context-5-2-20-release-sources-1-jar/org/springframework/context/ApplicationContextException.java
- \* /spring-context-5-2-20-release-sources-1-jar/org/springframework/remoting/support/RemoteInvocationTraceInterceptor.java
- \* /spring-context-5-2-20-release-sources-1-jar/org/springframework/context/event/ContextClosedEvent.java
- \* /spring-context-5-2-20-release-sources-1-jar/org/springframework/context/annotation/LoadTimeWeavingConfigurer.java
- \* /spring-context-5-2-20-release-sources-1-jar/org/springframework/validation/BindingResultUtils.java
- \* /spring-context-5-2-20-release-sources-1-jar/org/springframework/context/NoSuchMessageException.java
- \* /spring-context-5-2-20-release-sources-1-jar/org/springframework/ui/context/ThemeSource.java
- \* /spring-context-5-2-20-release-sources-1-jar/org/springframework/jmx/export/naming/SelfNaming.java
- \* /spring-context-5-2-20-release-sources-1-jar/org/springframework/context/annotation/ScopeMetadata.java
- \*
  - /spring-context-5-2-20-release-sources-1-jar/org/springframework/scheduling/SchedulingAwareRunnable.java
- \* /spring-context-5-2-20-release-sources-1-jar/org/springframework/instrument/classloading/LoadTimeWeaver.java
- \* /spring-context-5-2-20-release-sources-1-jar/org/springframework/ejb/access/EjbAccessException.java
- \* /spring-context-5-2-20-release-sources-1-jar/org/springframework/scheduling/support/DelegatingErrorHandlingRunnable.java
- \* /spring-context-5-2-20-release-sources-1-jar/org/springframework/jndi/JndiLookupFailureException.java
- \* /spring-context-5-2-20-release-sources-1-jar/org/springframework/ejb/config/JeeNamespaceHandler.java
- \* /spring-context-5-2-20-release-sources-1-jar/org/springframework/jmx/export/UnableToRegisterMBeanException.java

\* /spring-context-5-2-20-release-sources-1-  
 jar/org/springframework/ejb/config/LocalStatelessSessionBeanDefinitionParser.java  
 \* /spring-context-5-2-20-release-sources-1-jar/org/springframework/ui/context/HierarchicalThemeSource.java  
 \* /spring-context-5-2-20-release-sources-1-jar/org/springframework/jmx/export/metadata/JmxAttributeSource.java  
 \*  
 /spring-context-5-2-20-release-sources-1-jar/org/springframework/scheduling/Trigger.java  
 \* /spring-context-5-2-20-release-sources-1-  
 jar/org/springframework/context/config/SpringConfiguredBeanDefinitionParser.java  
 \* /spring-context-5-2-20-release-sources-1-  
 jar/org/springframework/remoting/rmi/CodebaseAwareObjectInputStream.java  
 \* /spring-context-5-2-20-release-sources-1-jar/org/springframework/validation/MessageCodesResolver.java  
 \* /spring-context-5-2-20-release-sources-1-  
 jar/org/springframework/jmx/export/notification/UnableToSendNotificationException.java  
 \* /spring-context-5-2-20-release-sources-1-jar/org/springframework/context/event/ApplicationContextEvent.java  
 \* /spring-context-5-2-20-release-sources-1-jar/org/springframework/context/HierarchicalMessageSource.java  
 \* /spring-context-5-2-20-release-sources-1-jar/org/springframework/remoting/rmi/RmiInvocationHandler.java  
 \* /spring-context-5-2-20-release-sources-1-jar/org/springframework/context/event/ContextRefreshedEvent.java  
 \*  
 /spring-context-5-2-20-release-sources-1-jar/org/springframework/format/number/AbstractNumberFormatter.java  
 \* /spring-context-5-2-20-release-sources-1-  
 jar/org/springframework/jmx/export/annotation/AnnotationMBeanExporter.java  
 \* /spring-context-5-2-20-release-sources-1-jar/org/springframework/scheduling/config/TaskNamespaceHandler.java  
 \* /spring-context-5-2-20-release-sources-1-  
 jar/org/springframework/ejb/config/RemoteStatelessSessionBeanDefinitionParser.java  
 \* /spring-context-5-2-20-release-sources-1-  
 jar/org/springframework/jmx/export/assembly/AutodetectCapableMBeanInfoAssembler.java  
 \* /spring-context-5-2-20-release-sources-1-jar/org/springframework/ui/context/Theme.java  
 \* /spring-context-5-2-20-release-sources-1-jar/org/springframework/context/ApplicationContextAware.java  
 \* /spring-context-5-2-20-release-sources-1-jar/org/springframework/context/Phased.java  
 \* /spring-context-5-2-20-release-sources-1-  
 jar/org/springframework/jmx/export/assembly/MBeanInfoAssembler.java  
 \*  
 /spring-context-5-2-20-release-sources-1-jar/org/springframework/jmx/access/MBeanInfoRetrievalException.java  
 \* /spring-context-5-2-20-release-sources-1-jar/org/springframework/context/weaving/LoadTimeWeaverAware.java  
 \* /spring-context-5-2-20-release-sources-1-  
 jar/org/springframework/remoting/support/DefaultRemoteInvocationFactory.java  
 \* /spring-context-5-2-20-release-sources-1-jar/org/springframework/remoting/rmi/RmiBasedExporter.java  
 \* /spring-context-5-2-20-release-sources-1-jar/org/springframework/context/event/ContextStartedEvent.java  
 \* /spring-context-5-2-20-release-sources-1-  
 jar/org/springframework/ejb/config/JndiLookupBeanDefinitionParser.java  
 \* /spring-context-5-2-20-release-sources-1-jar/org/springframework/ui/context/support/SimpleTheme.java  
 \* /spring-context-5-2-20-release-sources-1-jar/org/springframework/validation/BindingErrorProcessor.java  
 \* /spring-context-5-2-20-release-sources-1-  
 jar/org/springframework/remoting/RemoteInvocationFailureException.java  
 \*  
 /spring-context-5-2-20-release-sources-1-jar/org/springframework/remoting/RemoteProxyFailureException.java  
 \* /spring-context-5-2-20-release-sources-1-  
 jar/org/springframework/remoting/support/DefaultRemoteInvocationExecutor.java

```

* /spring-context-5-2-20-release-sources-1-jar/org/springframework/jmx/access/InvalidInvocationException.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/scheduling/TriggerContext.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/context/config/ContextNamespaceHandler.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/format/Formatter.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/remoting/support/UrlBasedRemoteAccessor.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/jmx/access/InvocationFailureException.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/scheduling/SchedulingException.java
*
/spring-context-5-2-20-release-sources-1-jar/org/springframework/jmx/JmxException.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/scripting/ScriptSource.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/jmx/export/MBeanExporterListener.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/context/annotation/AnnotationConfigBeanDefinitionParser.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/context/support/LiveBeansViewMBean.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/jmx/MBeanServerNotFoundException.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/remoting/support/RemoteInvocationBasedAccessor.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/ui/context/support/UiApplicationContextUtils.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/jmx/export/metadata/InvalidMetadataException.java
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*/
/**
* { @link FactoryBean } that obtains a WebSphere { @link javax.management.MBeanServer }
* reference through WebSphere's proprietary { @code AdminServiceFactory } API,
* available on WebSphere 5.1 and higher.
*
* <p>Exposes the { @code MBeanServer } for bean references.
*
* <p>This { @code FactoryBean } is

```



a direct alternative to { @link MBeanServerFactoryBean},

- \* which uses standard JMX 1.2 API to access the platform's { @link MBeanServer}.
- \*
- \* <p>See the javadocs for WebSphere's
- \* <a
- href="https://www.ibm.com/support/knowledgecenter/SSEQTJ\_9.0.0/com.ibm.websphere.javadoc.doc/web/apidocs/com/ibm/websphere/management/AdminServiceFactory.html">{ @code AdminServiceFactory}</a>
- \* and
- \* <a
- href="https://www.ibm.com/support/knowledgecenter/SSEQTJ\_9.0.0/com.ibm.websphere.javadoc.doc/web/apidocs/com/ibm/websphere/management/MBeanFactory.html">{ @code MBeanFactory}</a>.
- \*
- \* @author Juergen Hoeller
- \* @author Rob Harrop
- \* @since 2.0.3
- \* @see javax.management.MBeanServer
- \* @see MBeanServerFactoryBean
- \*/

Found in path(s):

- \* /spring-context-5-2-20-release-sources-1-jar/org/springframework/jmx/support/WebSphereMBeanServerFactoryBean.java

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- \* /spring-context-5-2-20-release-sources-1-jar/org/springframework/remoting/support/RemoteInvocationExecutor.java
- \* /spring-context-5-2-20-release-sources-1-jar/org/springframework/remoting/support/RemoteInvocationFactory.java
- \* /spring-context-5-2-20-release-sources-1-jar/org/springframework/jmx/export/metadata/ManagedOperationParameter.java
- \*

/spring-context-5-2-20-release-sources-1-jar/org/springframework/jmx/export/SpringModelMBean.java

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Found in path(s):

\* /spring-context-5-2-20-release-sources-1-

jar/org/springframework/context/annotation/ConfigurationClassEnhancer.java

\* /spring-context-5-2-20-release-sources-1-

jar/org/springframework/context/annotation/CommonAnnotationBeanPostProcessor.java

\* /spring-context-5-2-20-release-sources-1-

jar/org/springframework/context/annotation/ClassPathScanningCandidateComponentProvider.java

\*

/spring-context-5-2-20-release-sources-1-jar/org/springframework/context/annotation/Lazy.java

\* /spring-context-5-2-20-release-sources-1-

jar/org/springframework/context/annotation/ComponentScanAnnotationParser.java

\* /spring-context-5-2-20-release-sources-1-jar/org/springframework/format/annotation/DateTimeFormat.java

\* /spring-context-5-2-20-release-sources-1-

jar/org/springframework/cache/config/AnnotationDrivenCacheBeanDefinitionParser.java

\* /spring-context-5-2-20-release-sources-1-jar/org/springframework/ui/ConcurrentModel.java

\* /spring-context-5-2-20-release-sources-1-jar/org/springframework/cache/annotation/CachePut.java

\* /spring-context-5-2-20-release-sources-1-

jar/org/springframework/validation/beanvalidation/SpringValidatorAdapter.java

\* /spring-context-5-2-20-release-sources-1-

jar/org/springframework/context/annotation/ConfigurationClassPostProcessor.java

\* /spring-context-5-2-20-release-sources-1-

jar/org/springframework/validation/support/BindingAwareModelMap.java

\*

/spring-context-5-2-20-release-sources-1-jar/org/springframework/context/support/AbstractApplicationContext.java

\* /spring-context-5-2-20-release-sources-1-

jar/org/springframework/validation/support/BindingAwareConcurrentModel.java

\* /spring-context-5-2-20-release-sources-1-jar/org/springframework/context/event/SourceFilteringListener.java

\* /spring-context-5-2-20-release-sources-1-

jar/org/springframework/context/annotation/ConfigurationClassUtils.java

\* /spring-context-5-2-20-release-sources-1-jar/org/springframework/validation/beanvalidation/LocalValidatorFactoryBean.java  
\* /spring-context-5-2-20-release-sources-1-jar/org/springframework/context/index/CandidateComponentsIndexLoader.java  
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Found in path(s):

\* /spring-context-5-2-20-release-sources-1-jar/org/springframework/ui/ModelMapExtensions.kt  
\* /spring-context-5-2-20-release-sources-1-jar/org/springframework/ui/ModelExtensions.kt  
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\* /spring-context-5-2-20-release-sources-1-jar/org/springframework/validation/MapBindingResult.java  
\* /spring-context-5-2-20-release-sources-1-jar/org/springframework/context/annotation/ImportSelector.java  
\* /spring-context-5-2-20-release-sources-1-jar/org/springframework/scheduling/concurrent/DefaultManagedTaskExecutor.java

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*
/spring-context-5-2-20-release-sources-1-jar/org/springframework/validation/AbstractBindingResult.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/context/annotation/ScopedProxyMode.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/cache/support/AbstractValueAdaptingCache.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/context/support/AbstractResourceBasedMessageSource.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/context/annotation/DeferredImportSelector.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/jmx/support/RegistrationPolicy.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/context/annotation/Configuration.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/scheduling/concurrent/DefaultManagedTaskScheduler.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/validation/beanvalidation/MethodValidationInterceptor.java
*
/spring-context-5-2-20-release-sources-1-
jar/org/springframework/context/event/AbstractApplicationEventMulticaster.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/cache/concurrent/ConcurrentMapCache.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/context/annotation/AutoProxyRegistrar.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/format/number/money/Js354NumberFormatAnnotationFormatterFactory.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/context/annotation/FullyQualifiedAnnotationBeanNameGenerator.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/scheduling/annotation/ScheduledAnnotationBeanPostProcessor.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/context/annotation/Bean.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/scripting/groovy/GroovyScriptFactory.java
*
/spring-context-5-2-20-release-sources-1-
jar/org/springframework/scheduling/concurrent/ConcurrentTaskExecutor.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/context/expression/StandardBeanExpressionResolver.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/validation/AbstractErrors.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/validation/beanvalidation/MethodValidationPostProcessor.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/context/annotation/ConfigurationClassParser.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/context/annotation/ScannedGenericBeanDefinition.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/ejb/config/AbstractIndiLocatingBeanDefinitionParser.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/context/annotation/ContextAnnotationAutowireCandidateResolver.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/context/support/SimpleThreadScope.java
*
/spring-context-5-2-20-release-sources-1-jar/org/springframework/validation/BindException.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/context/annotation/ConfigurationCondition.java
* /spring-context-5-2-20-release-sources-1-

```

```

jar/org/springframework/format/support/DefaultFormattingConversionService.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/scheduling/concurrent/ThreadPoolTaskExecutor.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/cache/support/SimpleCacheManager.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/context/annotation/Condition.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/cache/support/NoOpCache.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/context/index/CandidateComponentsIndex.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/cache/support/NoOpCacheManager.java
*
/spring-context-5-2-20-release-sources-1-jar/org/springframework/cache/interceptor/CacheAspectSupport.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/context/annotation/ComponentScan.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/jmx/export/assembler/InterfaceBasedMBeanInfoAssembler.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/context/annotation/AnnotationConfigApplicationContext.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/context/ConfigurableApplicationContext.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/scheduling/config/TaskExecutorFactoryBean.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/context/annotation/LoadTimeWeavingConfiguration.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/context/annotation/PropertySource.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/context/annotation/MBeanExportConfiguration.java
*
/spring-context-5-2-20-release-sources-1-jar/org/springframework/context/annotation/ConditionContext.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/jmx/export/metadata/AbstractJmxAttribute.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/cache/concurrent/ConcurrentMapCacheManager.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/jmx/export/annotation/ManagedAttribute.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/context/annotation/AnnotationBeanNameGenerator.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/context/support/PostProcessorRegistrationDelegate.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/context/annotation/ConfigurationClassBeanDefinitionReader.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/scheduling/concurrent/ExecutorConfigurationSupport.java
*
/spring-context-5-2-20-release-sources-1-
jar/org/springframework/context/support/AbstractRefreshableApplicationContext.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/cache/interceptor/SimpleKey.java
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Found in path(s):

- \* /spring-context-5-2-20-release-sources-1-jar/org/springframework/cache/interceptor/SimpleKeyGenerator.java
- \* /spring-context-5-2-20-release-sources-1-
- jar/org/springframework/format/datetime/standard/MonthDayFormatter.java
- \* /spring-context-5-2-20-release-sources-1-jar/org/springframework/remoting/rmi/RmiClientInterceptorUtils.java
- \*
- /spring-context-5-2-20-release-sources-1-
- jar/org/springframework/context/config/AbstractPropertyLoadingBeanDefinitionParser.java
- \* /spring-context-5-2-20-release-sources-1-jar/org/springframework/cache/interceptor/CacheEvaluationContext.java
- \* /spring-context-5-2-20-release-sources-1-jar/org/springframework/scripting/bsh/BshScriptFactory.java
- \* /spring-context-5-2-20-release-sources-1-jar/org/springframework/format/Parser.java
- \* /spring-context-5-2-20-release-sources-1-jar/org/springframework/context/annotation/Primary.java
- \* /spring-context-5-2-20-release-sources-1-
- jar/org/springframework/jmx/export/annotation/ManagedNotifications.java
- \* /spring-context-5-2-20-release-sources-1-
- jar/org/springframework/scheduling/annotation/SchedulingConfiguration.java
- \* /spring-context-5-2-20-release-sources-1-
- jar/org/springframework/scheduling/config/ExecutorBeanDefinitionParser.java
- \* /spring-context-5-2-20-release-sources-1-
- jar/org/springframework/context/annotation/ScopeMetadataResolver.java
- \*
- /spring-context-5-2-20-release-sources-1-jar/org/springframework/scheduling/TaskScheduler.java
- \* /spring-context-5-2-20-release-sources-1-jar/org/springframework/jndi/JndiPropertySource.java
- \* /spring-context-5-2-20-release-sources-1-jar/org/springframework/cache/support/CompositeCacheManager.java
- \* /spring-context-5-2-20-release-sources-1-
- jar/org/springframework/scheduling/config/ScheduledTasksBeanDefinitionParser.java
- \* /spring-context-5-2-20-release-sources-1-jar/org/springframework/cache/annotation/Caching.java
- \* /spring-context-5-2-20-release-sources-1-
- jar/org/springframework/context/config/PropertyOverrideBeanDefinitionParser.java
- \* /spring-context-5-2-20-release-sources-1-jar/org/springframework/format/Printer.java
- \* /spring-context-5-2-20-release-sources-1-jar/org/springframework/jndi/JndiLocatorDelegate.java
- \* /spring-context-5-2-20-release-sources-1-jar/org/springframework/scripting/support/StandardScriptUtils.java
- \* /spring-context-5-2-20-release-sources-1-
- jar/org/springframework/format/datetime/standard/YearMonthFormatter.java
- \*
- /spring-context-5-2-20-release-sources-1-
- jar/org/springframework/format/datetime/standard/TemporalAccessorParser.java

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* /spring-context-5-2-20-release-sources-1-jar/org/springframework/cache/annotation/CacheEvict.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/scripting/groovy/GroovyObjectCustomizer.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/context/support/GenericXmlApplicationContext.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/format/datetime/standard/TemporalAccessorPrinter.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/remoting/support/RemoteInvocationUtils.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/format/datetime/standard/DurationFormatter.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/cache/interceptor/KeyGenerator.java
*
/spring-context-5-2-20-release-sources-1-jar/org/springframework/scheduling/annotation/Schedules.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/cache/annotation/Cacheable.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/format/datetime/standard/PeriodFormatter.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/format/support/FormatterPropertyEditorAdapter.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/instrument/classloading/weblogic/WebLogicLoadTimeWeaver.java
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```

```

/**
* Indicates that a component is only eligible for registration when all
* { @linkplain #value specified conditions } match.
*
* <p>A condition is any state that can be determined programmatically
* before the bean definition is due to be registered (see { @link Condition } for details).
*
*
* <p>The { @code @Conditional } annotation may be used in any of the following ways:
*
* as a type-level annotation on any class directly or indirectly annotated with
* { @code @Component }, including { @link Configuration @Configuration } classes
* as a meta-annotation, for the purpose of composing custom stereotype

```

- \* annotations</li>
- \* <li>as a method-level annotation on any { @link Bean @Bean } method</li>
- \* </ul>
- \*
- \* <p>If a { @code @Configuration } class is marked with { @code @Conditional },
- \* all of the { @code @Bean } methods, { @link Import @Import } annotations, and
- \* { @link ComponentScan @ComponentScan } annotations associated with that
- \* class will be subject to the conditions.
- \*
- \* <p><strong>NOTE</strong>: Inheritance of { @code @Conditional } annotations
- \* is not supported; any conditions from superclasses or from overridden
- \* methods will not be considered. In order to enforce these semantics,
- \* { @code @Conditional } itself is not declared as
- \* { @link java.lang.annotation.Inherited
- \* @Inherited }; furthermore, any
- \* custom <em>composed annotation</em> that is meta-annotated with
- \* { @code @Conditional } must not be declared as { @code @Inherited }.
- \*
- \* @author Phillip Webb
- \* @author Sam Brannen
- \* @since 4.0
- \* @see Condition
- \*/

Found in path(s):

\* /spring-context-5-2-20-release-sources-1-jar/org/springframework/context/annotation/Conditional.java

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\* /spring-context-5-2-20-release-sources-1-jar/org/springframework/cache/interceptor/AbstractCacheInvoker.java

\* /spring-context-5-2-20-release-sources-1-jar/org/springframework/jndi/support/SimpleJndiBeanFactory.java

\* /spring-context-5-2-20-release-sources-1-



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jar/org/springframework/instrument/classloading/InstrumentationLoadTimeWeaver.java
*
/spring-context-5-2-20-release-sources-1-jar/org/springframework/ui/ModelMap.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/scheduling/annotation/Async.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/context/annotation/ParserStrategyUtils.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/cache/interceptor/CompositeCacheOperationSource.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/context/event/EventExpressionEvaluator.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/context/event/ApplicationEventMulticaster.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/scheduling/support/TaskUtils.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/jmx/support/MBeanServerConnectionFactoryBean.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/cache/annotation/SpringCacheAnnotationParser.java
*
/spring-context-5-2-20-release-sources-1-
jar/org/springframework/context/annotation/AnnotationConfigRegistry.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/context/event/SimpleApplicationEventMulticaster.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/context/ApplicationListener.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/context/MessageSource.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/instrument/classloading/jboss/JBossLoadTimeWeaver.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/validation/DataBinder.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/context/event/ApplicationListenerMethodAdapter.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/validation/ObjectError.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/context/event/EventListenerMethodProcessor.java
*
/spring-context-5-2-20-release-sources-1-
jar/org/springframework/jmx/export/annotation/AnnotationJmxAttributeSource.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/context/support/ResourceBundleMessageSource.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/format/datetime/standard/InstantFormatter.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/jmx/support/MBeanServerFactoryBean.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/cache/annotation/AnnotationCacheOperationSource.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/context/support/BeanDefinitionDsl.kt
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/scheduling/config/ScheduledTaskRegistrar.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/cache/support/AbstractCacheManager.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/context/annotation/ImportBeanDefinitionRegistrar.java
*
/spring-context-5-2-20-release-sources-1-
jar/org/springframework/context/annotation/AnnotatedBeanDefinitionReader.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/context/weaving/DefaultContextLoadTimeWeaver.java

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* /spring-context-5-2-20-release-sources-1-jar/org/springframework/ui/Model.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/context/event/EventListener.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/jmx/access/MBeanClientInterceptor.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/context/support/GenericApplicationContextExtensions.kt
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/context/support/StaticApplicationContext.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/context/support/DefaultMessageSourceResolvable.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/context/SmartLifecycle.java
*
/spring-context-5-2-20-release-sources-1-jar/org/springframework/context/annotation/ConfigurationClass.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/jmx/support/ConnectorServerFactoryBean.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/context/annotation/AnnotationConfigApplicationContextExtensions.kt
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/cache/interceptor/CacheOperationSource.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/context/ApplicationEventPublisher.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/scheduling/annotation/Scheduled.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/cache/interceptor/CacheProxyFactoryBean.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/cache/CacheManager.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/context/annotation/ClassPathBeanDefinitionScanner.java
*
/spring-context-5-2-20-release-sources-1-
jar/org/springframework/instrument/classloading/ShadowingClassLoader.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/context/support/AbstractMessageSource.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/cache/Cache.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/context/support/GenericApplicationContext.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/cache/interceptor/CacheOperationSourcePointcut.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/context/support/ReloadableResourceBundleMessageSource.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/context/support/ApplicationContextAwareProcessor.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/context/config/PropertyPlaceholderBeanDefinitionParser.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/jndi/JndiTemplateEditor.java
*
/spring-context-5-2-20-release-sources-1-jar/org/springframework/cache/annotation/CacheAnnotationParser.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/context/ApplicationEvent.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/scripting/support/StandardScriptFactory.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/context/annotation/Import.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/context/support/StaticMessageSource.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/context/ResourceLoaderAware.java
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\* /spring-context-5-2-20-release-sources-1-jar/org/springframework/format/datetime/joda/DateTimeParser.java  
 \* /spring-context-5-2-20-release-sources-1-jar/org/springframework/context/annotation/FilterType.java  
 \* /spring-context-5-2-20-release-sources-1-jar/org/springframework/context/annotation/Description.java  
 \*  
 /spring-context-5-2-20-release-sources-1-jar/org/springframework/scheduling/concurrent/CustomizableThreadFactory.java  
 \* /spring-context-5-2-20-release-sources-1-jar/org/springframework/format/datetime/joda/ReadableInstantPrinter.java  
 \* /spring-context-5-2-20-release-sources-1-jar/org/springframework/context/support/MessageSourceResourceBundle.java  
 \* /spring-context-5-2-20-release-sources-1-jar/org/springframework/format/datetime/joda/LocalDateParser.java  
 \* /spring-context-5-2-20-release-sources-1-jar/org/springframework/format/datetime/joda/LocalDateTimeParser.java  
 \* /spring-context-5-2-20-release-sources-1-jar/org/springframework/format/datetime/joda/ReadablePartialPrinter.java  
 \* /spring-context-5-2-20-release-sources-1-jar/org/springframework/context/i18n/TimeZoneAwareLocaleContext.java  
 \* /spring-context-5-2-20-release-sources-1-jar/org/springframework/validation/beanvalidation/OptionalValidatorFactoryBean.java  
 \* /spring-context-5-2-20-release-sources-1-jar/org/springframework/format/datetime/joda/MillisecondInstantPrinter.java  
 \*  
 /spring-context-5-2-20-release-sources-1-jar/org/springframework/context/i18n/LocaleContext.java  
 \* /spring-context-5-2-20-release-sources-1-jar/org/springframework/format/datetime/joda/LocalTimeParser.java  
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- \* /spring-context-5-2-20-release-sources-1-jar/org/springframework/jmx/export/annotation/ManagedNotification.java
- \* /spring-context-5-2-20-release-sources-1-jar/org/springframework/validation/beanvalidation/SpringConstraintValidatorFactory.java
- \* /spring-context-5-2-20-release-sources-1-jar/org/springframework/format/datetime/joda/MonthDayFormatter.java
- \*
- /spring-context-5-2-20-release-sources-1-jar/org/springframework/scripting/ScriptEvaluator.java
- \* /spring-context-5-2-20-release-sources-1-jar/org/springframework/scheduling/config/AnnotationDrivenBeanDefinitionParser.java
- \* /spring-context-5-2-20-release-sources-1-jar/org/springframework/cache/annotation/CacheConfig.java
- \* /spring-context-5-2-20-release-sources-1-jar/org/springframework/context/annotation/Role.java
- \* /spring-context-5-2-20-release-sources-1-jar/org/springframework/scripting/support/StandardScriptEvalException.java
- \* /spring-context-5-2-20-release-sources-1-jar/org/springframework/format/number/money/CurrencyUnitFormatter.java
- \* /spring-context-5-2-20-release-sources-1-jar/org/springframework/jmx/export/annotation/ManagedOperationParameters.java
- \* /spring-context-5-2-20-release-sources-1-jar/org/springframework/format/number/PercentStyleFormatter.java
- \* /spring-context-5-2-20-release-sources-1-jar/org/springframework/context/event/EventListenerFactory.java
- \*
- /spring-context-5-2-20-release-sources-1-jar/org/springframework/remoting/RemoteTimeoutException.java
- \* /spring-context-5-2-20-release-sources-1-jar/org/springframework/format/datetime/joda/YearMonthFormatter.java
- \* /spring-context-5-2-20-release-sources-1-jar/org/springframework/context/PayloadApplicationEvent.java
- \* /spring-context-5-2-20-release-sources-1-jar/org/springframework/format/datetime/joda/PeriodFormatter.java
- \* /spring-context-5-2-20-release-sources-1-jar/org/springframework/jmx/export/annotation/ManagedOperationParameter.java
- \* /spring-context-5-2-20-release-sources-1-jar/org/springframework/jmx/export/annotation/ManagedMetric.java
- \* /spring-context-5-2-20-release-sources-1-jar/org/springframework/context/annotation/ComponentScans.java
- \* /spring-context-5-2-20-release-sources-1-jar/org/springframework/jmx/export/annotation/ManagedOperation.java
- \* /spring-context-5-2-20-release-sources-1-jar/org/springframework/jmx/export/annotation/ManagedResource.java
- \*
- /spring-context-5-2-20-release-sources-1-jar/org/springframework/format/datetime/joda/DurationFormatter.java
- \* /spring-context-5-2-20-release-sources-1-jar/org/springframework/scripting/config/LangNamespaceHandler.java
- \* /spring-context-5-2-20-release-sources-1-jar/org/springframework/scheduling/support/CronTrigger.java
- \* /spring-context-5-2-20-release-sources-1-jar/org/springframework/context/annotation/ImportResource.java

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*/
/**
* Abstract the invocation of a cache operation.
*
* <p>Does not provide a way to transmit checked exceptions but
* provide a special exception that should be used to wrap any
* exception that was thrown by the underlying invocation.
* Callers are expected to handle this issue type specifically.
*
* @author Stephane Nicoll
* @since 4.1
*/

```

Found in path(s):

```
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/cache/interceptor/CacheOperationInvoker.java
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```
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/format/AnnotationFormatterFactory.java
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* /spring-context-5-2-20-release-sources-1-jar/org/springframework/validation/annotation/Validated.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/cache/interceptor/BasicOperation.java
*
/spring-context-5-2-20-release-sources-1-
jar/org/springframework/validation/beanvalidation/MessageSourceResourceBundleLocator.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/scheduling/config/ContextLifecycleScheduledTaskRegistrar.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/context/annotation/PropertySources.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/context/ApplicationContext.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/scheduling/annotation/AsyncConfigurerSupport.java
No license file was found, but licenses were detected in source scan.

```

```

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```

Found in path(s):

```

* /spring-context-5-2-20-release-sources-1-jar/org/springframework/jmx/export/metadata/ManagedOperation.java
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```

```

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```

Found in path(s):

```
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/context/support/EmbeddedValueResolutionSupport.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/context/annotation/AnnotatedElementKey.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/scheduling/config/IntervalTask.java
*
/spring-context-5-2-20-release-sources-1-jar/org/springframework/scheduling/config/FixedRateTask.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/format/number/CurrencyStyleFormatter.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/scheduling/config/CronTask.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/scheduling/annotation/AnnotationAsyncExecutionInterceptor.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/scheduling/annotation/AsyncConfigurer.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/jmx/export/assembler/MethodExclusionMBeanInfoAssembler.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/scheduling/concurrent/ConcurrentTaskScheduler.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/instrument/classloading/SimpleInstrumentableClassLoader.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/scheduling/config/TriggerTask.java
*
/spring-context-5-2-20-release-sources-1-jar/org/springframework/remoting/rmi/RmiProxyFactoryBean.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/cache/interceptor/BeanFactoryCacheOperationSourceAdvisor.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/cache/interceptor/CacheInterceptor.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/context/config/LoadTimeWeaverBeanDefinitionParser.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/jndi/JndiAccessor.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/format/datetime/standard/DateTimeContext.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/scripting/support/StaticScriptSource.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/context/support/ClassPathXmlApplicationContext.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/cache/interceptor/NamedCacheResolver.java
*
/spring-context-5-2-20-release-sources-1-jar/org/springframework/stereotype/Service.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/context/annotation/AspectJAutoProxyRegistrar.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/jmx/export/NotificationListenerBean.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/scripting/ScriptFactory.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/cache/support/NullValue.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/context/annotation/BeanFactoryAccessor.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/scheduling/concurrent/ScheduledExecutorTask.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/context/support/AbstractXmlApplicationContext.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/format/datetime/standard/DateTimeFormatterFactoryBean.java
```

```

*
/spring-context-5-2-20-release-sources-1-jar/org/springframework/cache/config/CacheNamespaceHandler.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/jmx/support/NotificationListenerHolder.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/context/support/ConversionServiceFactoryBean.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/context/support/AbstractRefreshableConfigApplicationContext.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/instrument/classloading/tomcat/TomcatLoadTimeWeaver.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/jmx/export/metadata/ManagedMetric.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/validation/DefaultMessageCodesResolver.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/scheduling/support/MethodInvokingRunnable.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/jmx/export/metadata/ManagedResource.java
*
/spring-context-5-2-20-release-sources-1-
jar/org/springframework/ejb/access/SimpleRemoteSlsbInvokerInterceptor.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/context/event/EventPublicationInterceptor.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/jmx/access/MBeanProxyFactoryBean.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/format/support/FormattingConversionServiceFactoryBean.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/jmx/export/naming/MetadataNamingStrategy.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/scripting/support/StandardScriptEvaluator.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/context/expression/MapAccessor.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/instrument/classloading/SimpleLoadTimeWeaver.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/scheduling/config/Task.java
*
/spring-context-5-2-20-release-sources-1-jar/org/springframework/jmx/export/naming/ObjectNamingStrategy.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/format/datetime/standard/Jsr310DateTimeFormatAnnotationFormatterFactory.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/format/datetime/joda/JodaDateTimeFormatAnnotationFormatterFactory.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/context/expression/EnvironmentAccessor.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/validation/beanvalidation/CustomValidatorBean.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/jmx/export/metadata/JmxMetadataUtils.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/context/weaving/LoadTimeWeaverAwareProcessor.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/scripting/groovy/GroovyScriptEvaluator.java
*
/spring-context-5-2-20-release-sources-1-jar/org/springframework/format/number/NumberStyleFormatter.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/jmx/export/metadata/ManagedNotification.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/instrument/classloading/weblogic/WebLogicClassPreProcessorAdapter.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/context/config/MBeanExportBeanDefinitionParser.java

```



```

* /spring-context-5-2-20-release-sources-1-jar/org/springframework/jndi/TypeMismatchNamingException.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/scheduling/concurrent/ReschedulingRunnable.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/scheduling/config/FixedDelayTask.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/scripting/bsh/BshScriptEvaluator.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/scheduling/config/ScheduledTask.java
*
/spring-context-5-2-20-release-sources-1-
jar/org/springframework/cache/concurrent/ConcurrentMapCacheFactoryBean.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/format/datetime/joda/DateTimeFormatterFactory.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/context/MessageSourceResolvable.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/instrument/classloading/glassfish/GlassFishLoadTimeWeaver.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/format/datetime/DateTimeFormatAnnotationFormatterFactory.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/cache/interceptor/SimpleCacheErrorHandler.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/ejb/access/LocalSlsbInvokerInterceptor.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/instrument/classloading/SimpleThrowawayClassLoader.java
*
/spring-context-5-2-20-release-sources-1-
jar/org/springframework/instrument/classloading/websphere/WebSphereLoadTimeWeaver.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/format/datetime/joda/DateTimeFormatterFactoryBean.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/jmx/access/ConnectorDelegate.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/context/annotation/AnnotationScopeMetadataResolver.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/cache/interceptor/CacheErrorHandler.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/format/number/money/MonetaryAmountFormatter.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/cache/support/SimpleValueWrapper.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/stereotype/Repository.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/jndi/IndiObjectTargetSource.java
*
/spring-context-5-2-20-release-sources-1-jar/org/springframework/format/datetime/joda/JodaTimeContext.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/stereotype/Controller.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/format/datetime/DateFormatRegistrar.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/jmx/export/assembler/AbstractMBeanInfoAssembler.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/context/EnvironmentAware.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/format/datetime/joda/JodaTimeFormatterRegistrar.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/remoting/support/RemoteExporter.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/context/expression/BeanExpressionContextAccessor.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/context/i18n/SimpleLocaleContext.java

```

```

* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/context/annotation/Jsr330ScopeMetadataResolver.java
*
/spring-context-5-2-20-release-sources-1-
jar/org/springframework/context/support/ApplicationListenerDetector.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/stereotype/Component.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/jmx/support/MetricType.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/remoting/support/RemoteAccessor.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/stereotype/Indexed.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/ui/ExtendedModelMap.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/context/support/DelegatingMessageSource.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/context/i18n/SimpleTimeZoneAwareLocaleContext.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/ejb/access/AbstractRemoteSlsbInvokerInterceptor.java
*
/spring-context-5-2-20-release-sources-1-
jar/org/springframework/format/number/NumberFormatAnnotationFormatterFactory.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/scheduling/config/ScheduledTaskHolder.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/remoting/rmi/JndiRmiProxyFactoryBean.java
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```

Found in path(s):

```

* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/jmx/export/naming/IdentityNamingStrategy.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/scheduling/annotation/AsyncAnnotationBeanPostProcessor.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/validation/Errors.java
*
/spring-context-5-2-20-release-sources-1-jar/org/springframework/context/event/SmartApplicationListener.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/cache/annotation/CachingConfigurationSelector.java

```

```

* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/remoting/support/SimpleHttpServerFactoryBean.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/jmx/export/notification/NotificationPublisher.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/jmx/support/JmxUtils.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/context/support/MessageSourceSupport.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/jndi/JndiLocatorSupport.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/jmx/export/naming/KeyNamingStrategy.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/validation/FieldError.java
*
/spring-context-5-2-20-release-sources-1-
jar/org/springframework/scheduling/annotation/AsyncAnnotationAdvisor.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/context/annotation/BeanMethod.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/context/annotation/ConfigurationMethod.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/ejb/access/LocalStatelessSessionProxyFactoryBean.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/context/support/FileSystemXmlApplicationContext.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/remoting/RemoteAccessException.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/context/Lifecycle.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/ejb/access/SimpleRemoteStatelessSessionProxyFactoryBean.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/cache/interceptor/CacheOperationExpressionEvaluator.java
*
/spring-context-5-2-20-release-sources-1-
jar/org/springframework/jmx/export/ assembler/MethodNameBasedMBeanInfoAssembler.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/validation/DirectFieldBindingResult.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/context/MessageSourceAware.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/cache/interceptor/CachePutOperation.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/ejb/access/AbstractSlsbInvokerInterceptor.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/validation/beanvalidation/BeanValidationPostProcessor.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/scheduling/annotation/EnableAsync.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/scheduling/concurrent/ThreadPoolTaskScheduler.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/jndi/JndiObjectFactoryBean.java
*
/spring-context-5-2-20-release-sources-1-jar/org/springframework/context/support/ApplicationObjectSupport.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/context/weaving/AspectJWeavingEnabler.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/format/datetime/standard/DateTimeConverters.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/context/event/GenericApplicationListener.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/scripting/ScriptCompilationException.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/jmx/export/notification/ModelMBeanNotificationPublisher.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/jmx/export/MBeanExportOperations.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/validation/DefaultBindingErrorProcessor.java

```

```

* /spring-context-5-2-20-release-sources-1-jar/org/springframework/context/support/MessageSourceAccessor.java
*
/spring-context-5-2-20-release-sources-1-
jar/org/springframework/instrument/classloading/weblogic/WebLogicClassLoaderAdapter.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/scripting/config/ScriptBeanDefinitionParser.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/validation/SmartValidator.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/context/config/MBeanServerBeanDefinitionParser.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/context/annotation/ConditionEvaluator.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/jmx/access/NotificationListenerRegistrar.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/scheduling/concurrent/ThreadPoolExecutorFactoryBean.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/scheduling/annotation/SchedulingConfigurer.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/scheduling/annotation/AbstractAsyncConfiguration.java
*
/spring-context-5-2-20-release-sources-1-
jar/org/springframework/jmx/export/assembler/AbstractReflectiveMBeanInfoAssembler.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/context/annotation/AnnotationConfigUtils.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/format/datetime/standard/YearFormatter.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/cache/config/CacheAdviceParser.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/format/datetime/DateFormatter.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/remoting/support/RemoteInvocation.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/cache/interceptor/CacheOperation.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/context/EmbeddedValueResolverAware.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/format/datetime/joda/JodaTimeConverters.java
*
/spring-context-5-2-20-release-sources-1-jar/org/springframework/remoting/support/RemotingSupport.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/format/support/FormattingConversionService.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/context/annotation/Scope.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/cache/interceptor/CacheResolver.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/context/annotation/Profile.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/format/annotation/NumberFormat.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/scheduling/concurrent/DefaultManagedAwareThreadFactory.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/cache/annotation/CachingConfigurer.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/jmx/export/assembler/MetadataMBeanInfoAssembler.java
*
/spring-context-5-2-20-release-sources-1-jar/org/springframework/context/event/DefaultEventListenerFactory.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/jmx/export/metadata/ManagedAttribute.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/scheduling/annotation/ProxyAsyncConfiguration.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/context/support/ContextTypeMatchClassLoader.java

```

\* /spring-context-5-2-20-release-sources-1-  
 jar/org/springframework/format/datetime/joda/JodaTimeContextHolder.java  
 \* /spring-context-5-2-20-release-sources-1-jar/org/springframework/cache/annotation/EnableCaching.java  
 \* /spring-context-5-2-20-release-sources-1-jar/org/springframework/jmx/support/MBeanRegistrationSupport.java  
 \* /spring-context-5-2-20-release-sources-1-  
 jar/org/springframework/scheduling/concurrent/ForkJoinPoolFactoryBean.java  
 \* /spring-context-5-2-20-release-sources-1-jar/org/springframework/context/expression/BeanFactoryResolver.java  
 \*  
 /spring-context-5-2-20-release-sources-1-  
 jar/org/springframework/context/annotation/ComponentScanBeanDefinitionParser.java  
 \* /spring-context-5-2-20-release-sources-1-jar/org/springframework/scripting/bsh/BshScriptUtils.java  
 \* /spring-context-5-2-20-release-sources-1-  
 jar/org/springframework/context/expression/CachedExpressionEvaluator.java  
 \* /spring-context-5-2-20-release-sources-1-jar/org/springframework/scheduling/SchedulingTaskExecutor.java  
 \* /spring-context-5-2-20-release-sources-1-jar/org/springframework/context/i18n/LocaleContextHolder.java  
 \* /spring-context-5-2-20-release-sources-1-  
 jar/org/springframework/instrument/classloading/WeavingTransformer.java  
 \* /spring-context-5-2-20-release-sources-1-  
 jar/org/springframework/scheduling/concurrent/ScheduledExecutorFactoryBean.java  
 \* /spring-context-5-2-20-release-sources-1-jar/org/springframework/remoting/support/RemoteInvocationResult.java  
 \* /spring-context-5-2-20-release-sources-1-jar/org/springframework/context/annotation/DependsOn.java  
 \*  
 /spring-context-5-2-20-release-sources-1-jar/org/springframework/cache/config/CacheManagementConfigUtils.java  
 \* /spring-context-5-2-20-release-sources-1-jar/org/springframework/remoting/rmi/RmiInvocationWrapper.java  
 \* /spring-context-5-2-20-release-sources-1-  
 jar/org/springframework/context/expression/MethodBasedEvaluationContext.java  
 \* /spring-context-5-2-20-release-sources-1-  
 jar/org/springframework/ui/context/support/ResourceBundleThemeSource.java  
 \* /spring-context-5-2-20-release-sources-1-  
 jar/org/springframework/context/annotation/AdviceModeImportSelector.java  
 \* /spring-context-5-2-20-release-sources-1-  
 jar/org/springframework/cache/interceptor/NameMatchCacheOperationSource.java  
 \* /spring-context-5-2-20-release-sources-1-jar/org/springframework/cache/interceptor/CacheableOperation.java  
 \* /spring-context-5-2-20-release-sources-1-  
 jar/org/springframework/scheduling/config/TaskManagementConfigUtils.java  
 \* /spring-context-5-2-20-release-sources-1-jar/org/springframework/cache/interceptor/SimpleCacheResolver.java  
 \*  
 /spring-context-5-2-20-release-sources-1-jar/org/springframework/scheduling/support/CronSequenceGenerator.java  
 \* /spring-context-5-2-20-release-sources-1-  
 jar/org/springframework/scripting/support/ScriptFactoryPostProcessor.java  
 \* /spring-context-5-2-20-release-sources-1-jar/org/springframework/scripting/support/ResourceScriptSource.java  
 \* /spring-context-5-2-20-release-sources-1-jar/org/springframework/context/annotation/BeanAnnotationHelper.java  
 \* /spring-context-5-2-20-release-sources-1-  
 jar/org/springframework/scheduling/annotation/AsyncConfigurationSelector.java  
 \* /spring-context-5-2-20-release-sources-1-  
 jar/org/springframework/format/datetime/standard/DateTimeFormatterRegistrar.java  
 \* /spring-context-5-2-20-release-sources-1-  
 jar/org/springframework/cache/interceptor/AbstractFallbackCacheOperationSource.java

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* /spring-context-5-2-20-release-sources-1-jar/org/springframework/context/support/DefaultLifecycleProcessor.java
*
/spring-context-5-2-20-release-sources-1-jar/org/springframework/cache/interceptor/CacheEvictOperation.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/scripting/config/ScriptingDefaultsParser.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/validation/MessageCodeFormatter.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/context/support/LiveBeansView.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/cache/annotation/ProxyCachingConfiguration.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/remoting/rmi/RemoteInvocationSerializingExporter.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/remoting/rmi/JndiRmiClientInterceptor.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/format/datetime/standard/DateTimeFormatterFactory.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/instrument/classloading/ResourceOverridingShadowingClassLoader.java
*
/spring-context-5-2-20-release-sources-1-jar/org/springframework/remoting/rmi/RmiServiceExporter.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/validation/AbstractPropertyBindingResult.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/remoting/rmi/JndiRmiServiceExporter.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/instrument/classloading/websphere/WebSphereClassLoaderAdapter.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/context/annotation/EnableLoadTimeWeaving.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/jmx/support/ObjectNameManager.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/validation/BeanPropertyBindingResult.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/jndi/JndiTemplate.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/jmx/export/MBeanExporter.java
*
/spring-context-5-2-20-release-sources-1-jar/org/springframework/format/FormatterRegistry.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/format/datetime/standard/DateTimeContextHolder.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/scheduling/annotation/AsyncResult.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/scripting/config/LangNamespaceUtils.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/context/support/GenericGroovyApplicationContext.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/ui/context/support/DelegatingThemeSource.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/cache/interceptor/CacheOperationInvocationContext.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/scheduling/annotation/EnableScheduling.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/jndi/JndiCallback.java
*
/spring-context-5-2-20-release-sources-1-jar/org/springframework/context/annotation/AdviceMode.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/jndi/JndiObjectLocator.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/context/event/EventExpressionRootObject.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/context/support/PropertySourcesPlaceholderConfigurer.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/cache/interceptor/AbstractCacheResolver.java

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* /spring-context-5-2-20-release-sources-1-jar/org/springframework/format/datetime/standard/MonthFormatter.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/jmx/export/asmblr/SimpleReflectiveMBeanInfoAssembler.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/cache/annotation/CachingConfigurerSupport.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/validation/Validator.java
*
/spring-context-5-2-20-release-sources-1-jar/org/springframework/context/annotation/ScopedProxyCreator.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/remoting/support/RemoteInvocationBasedExporter.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/context/event/GenericApplicationListenerAdapter.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/context/annotation/ProfileCondition.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/jmx/export/asmblr/AbstractConfigurableMBeanInfoAssembler.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/cache/interceptor/VariableNotAvailableException.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/validation/BindingResult.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/scheduling/support/PeriodicTrigger.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/context/annotation/ImportRegistry.java
*
/spring-context-5-2-20-release-sources-1-
jar/org/springframework/scheduling/support/ScheduledMethodRunnable.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/scheduling/support/SimpleTriggerContext.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/remoting/rmi/RmiRegistryFactoryBean.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/cache/interceptor/CacheExpressionRootObject.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/validation/ValidationUtils.java
* /spring-context-5-2-20-release-sources-1-jar/org/springframework/context/ApplicationContextInitializer.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/cache/annotation/AbstractCachingConfiguration.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/instrument/classloading/ReflectiveLoadTimeWeaver.java
* /spring-context-5-2-20-release-sources-1-
jar/org/springframework/instrument/classloading/websphere/WebSphereClassPreDefinePlugin.java
*
/spring-context-5-2-20-release-sources-1-
jar/org/springframework/context/annotation/EnableAspectJAutoProxy.java

```

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## A. HISTORY OF THE SOFTWARE

Python was created in the early 1990s by Guido van Rossum at Stichting Mathematisch Centrum (CWI, see <http://www.cwi.nl>) in the Netherlands as a successor of a language called ABC. Guido remains Python's principal author, although it includes many contributions from others.

In 1995, Guido continued his work on Python at the Corporation for National Research Initiatives (CNRI, see <http://www.cnri.reston.va.us>) in Reston, Virginia where he released several versions of the software.

In May 2000, Guido and the Python core development team moved to BeOpen.com to form the BeOpen PythonLabs team. In October of the same year, the PythonLabs team moved to Digital Creations (now Zope Corporation, see <http://www.zope.com>). In 2001, the Python Software Foundation (PSF, see <http://www.python.org/psf/>) was formed, a non-profit organization created specifically to own Python-related Intellectual Property. Zope Corporation is a sponsoring member of the PSF.

All Python releases are Open Source (see <http://www.opensource.org> for the Open Source Definition). Historically, most, but not all, Python releases have also been GPL-compatible; the table below summarizes the various releases.

| Release from   | Derived from | Year      | Owner      | GPL-compatible? (1) |
|----------------|--------------|-----------|------------|---------------------|
| 0.9.0 thru 1.2 |              | 1991-1995 | CWI        | yes                 |
| 1.3 thru 1.5.2 | 1.2          | 1995-1999 | CNRI       | yes                 |
| 1.6            | 1.5.2        | 2000      | CNRI       | no                  |
| 2.0            | 1.6          | 2000      | BeOpen.com | no                  |



|       |           |           |         |     |
|-------|-----------|-----------|---------|-----|
| 1.6.1 |           |           |         |     |
| 1.6   | 2001      | CNRI      | yes (2) |     |
| 2.1   | 2.0+1.6.1 | 2001      | PSF     | no  |
| 2.0.1 | 2.0+1.6.1 | 2001      | PSF     | yes |
| 2.1.1 | 2.1+2.0.1 | 2001      | PSF     | yes |
| 2.2   | 2.1.1     | 2001      | PSF     | yes |
| 2.1.2 | 2.1.1     | 2002      | PSF     | yes |
| 2.1.3 | 2.1.2     | 2002      | PSF     | yes |
| 2.2.1 | 2.2       | 2002      | PSF     | yes |
| 2.2.2 | 2.2.1     | 2002      | PSF     | yes |
| 2.3   | 2.2.2     | 2002-2003 | PSF     | yes |

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(2) According to Richard Stallman, 1.6.1 is not GPL-compatible, because its license has a choice of law clause. According to CNRI, however, Stallman's lawyer has told CNRI's lawyer that 1.6.1 is "not incompatible" with the GPL.

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## 1.369 tzlocal 4.2

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## 1.373 spring-context-support

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*
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*
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However, linking a "work that uses the Library" with the Library creates an executable that is a derivative of the Library (because it contains portions of the Library), rather than a "work that uses the library". The executable is therefore covered by this License.

Section 6 states terms for distribution of such executables.

When a "work that uses the Library" uses material from a header file that is part of the Library, the object code for the work may be a derivative work of the Library even though the source code is not. Whether this is true is especially significant if the work can be linked without the Library, or if the work is itself a library. The threshold for this to be true is not precisely defined by law.

If such an object file uses only numerical parameters, data structure layouts and accessors, and small macros and small inline functions (ten lines or less in length), then the use of the object file is unrestricted, regardless of whether it is legally a derivative work. (Executables containing this object code plus portions of the Library will still fall under Section 6.)

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You must give prominent notice with each copy of the work that the Library is used in it and that the Library and its use are covered by this License. You must supply a copy of this License. If the work during execution displays copyright notices, you must include the copyright notice for the Library among them, as well as a reference directing the user to the copy of this License. Also, you must do one of these things:

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library 'Frob' (a library for tweaking knobs) written by James Random Hacker.

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# 1.381 spring-security-web 5.4.10

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Found in path(s):

- \* /spring-security-web-5-4-10-sources-jar/org/springframework/security/web/access/expression/WebExpressionVoter.java
- \* /spring-security-web-5-4-10-sources-jar/org/springframework/security/web/authentication/preauth/RequestAttributeAuthenticationFilter.java
- \* /spring-security-web-5-4-10-sources-jar/org/springframework/security/web/context/package-info.java
- \*
  - /spring-security-web-5-4-10-sources-jar/org/springframework/security/web/authentication/logout/package-info.java
- \* /spring-security-web-5-4-10-sources-jar/org/springframework/security/web/authentication/session/SessionAuthenticationStrategy.java
- \* /spring-security-web-5-4-10-sources-jar/org/springframework/security/web/authentication/preauth/PreAuthenticatedCredentialsNotFoundException.java
- \* /spring-security-web-5-4-10-sources-jar/org/springframework/security/web/authentication/preauth/PreAuthenticatedGrantedAuthoritiesWebAuthenticationDetails.java
- \* /spring-security-web-5-4-10-sources-jar/org/springframework/security/web/context/SecurityContextRepository.java
- \* /spring-security-web-5-4-10-sources-jar/org/springframework/security/web/authentication/ui/package-info.java
- \* /spring-security-web-5-4-10-sources-jar/org/springframework/security/web/firewall/DefaultHttpFirewall.java
- \* /spring-security-web-5-4-10-sources-jar/org/springframework/security/web/authentication/rememberme/package-info.java
- \*
  - /spring-security-web-5-4-10-sources-jar/org/springframework/security/web/authentication/preauth/x509/package-info.java
- \* /spring-security-web-5-4-10-sources-jar/org/springframework/security/web/WebAttributes.java
- \* /spring-security-web-5-4-10-sources-jar/org/springframework/security/web/header/writers/frameoptions/WhiteListedAllowFromStrategy.java
- \* /spring-security-web-5-4-10-sources-jar/org/springframework/security/web/jackson2/package-info.java
- \* /spring-security-web-5-4-10-sources-jar/org/springframework/security/web/firewall/HttpFirewall.java
- \* /spring-security-web-5-4-10-sources-jar/org/springframework/security/web/authentication/SimpleUrlAuthenticationSuccessHandler.java
- \* /spring-security-web-5-4-10-sources-jar/org/springframework/security/web/access/expression/WebExpressionConfigAttribute.java
- \* /spring-security-web-5-4-10-sources-jar/org/springframework/security/web/context/request/async/WebAsyncManagerIntegrationFilter.java
- \*
  - /spring-security-web-5-4-10-sources-jar/org/springframework/security/web/authentication/preauth/j2ee/WebXmlMappableAttributesRetriever.java
- \* /spring-security-web-5-4-10-sources-jar/org/springframework/security/web/access/channel/package-info.java
- \* /spring-security-web-5-4-10-sources-jar/org/springframework/security/web/util/ThrowableAnalyzer.java



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* /spring-security-web-5-4-10-sources-jar/org/springframework/security/web/util/package-info.java
* /spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/authentication/preauth/j2ee/J2eeBasedPreAuthenticatedWebAuthenticationD
etailsSource.java
* /spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/authentication/www/DigestAuthUtils.java
* /spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/authentication/logout/SimpleUrlLogoutSuccessHandler.java
* /spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/util/matcher/NegatedRequestMatcher.java
*
/spring-security-web-5-4-10-sources-jar/org/springframework/security/web/authentication/preauth/j2ee/package-
info.java
* /spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/authentication/rememberme/PersistentTokenRepository.java
* /spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/authentication/logout/HttpStatusReturningLogoutSuccessHandler.java
* /spring-security-web-5-4-10-sources-jar/org/springframework/security/web/package-info.java
* /spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/authentication/logout/DelegatingLogoutSuccessHandler.java
* /spring-security-web-5-4-10-sources-jar/org/springframework/security/web/SecurityFilterChain.java
* /spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/authentication/logout/LogoutSuccessHandler.java
* /spring-security-web-5-4-10-sources-
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* /spring-security-web-5-4-10-sources-
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/spring-security-web-5-4-10-sources-
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* /spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/context/SaveContextOnUpdateOrErrorResponseWrapper.java
* /spring-security-web-5-4-10-sources-jar/org/springframework/security/web/authentication/switchuser/package-
info.java
* /spring-security-web-5-4-10-sources-jar/org/springframework/security/web/authentication/session/package-
info.java
* /spring-security-web-5-4-10-sources-jar/org/springframework/security/web/DefaultSecurityFilterChain.java
* /spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/authentication/rememberme/CookieTheftException.java
* /spring-security-web-5-4-10-sources-jar/org/springframework/security/web/debug/Logger.java
*
/spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/authentication/SavedRequestAwareAuthenticationSuccessHandler.java
* /spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/authentication/HttpStatusEntryPoint.java
* /spring-security-web-5-4-10-sources-jar/org/springframework/security/web/authentication/www/package-info.java

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\* /spring-security-web-5-4-10-sources-jar/org/springframework/security/web/authentication/package-info.java  
 \* /spring-security-web-5-4-10-sources-jar/org/springframework/security/web/jaasapi/package-info.java  
 \* /spring-security-web-5-4-10-sources-jar/org/springframework/security/web/access/package-info.java  
 \* /spring-security-web-5-4-10-sources-jar/org/springframework/security/web/header/writers/frameoptions/AllowFromStrategy.java  
 \* /spring-security-web-5-4-10-sources-jar/org/springframework/security/web/authentication/preauth/websphere/package-info.java  
 \* /spring-security-web-5-4-10-sources-jar/org/springframework/security/web/servletapi/package-info.java  
 \*  
 /spring-security-web-5-4-10-sources-jar/org/springframework/security/web/session/package-info.java  
 \* /spring-security-web-5-4-10-sources-jar/org/springframework/security/web/debug/DebugFilter.java  
 \* /spring-security-web-5-4-10-sources-jar/org/springframework/security/web/util/ThrowableCauseExtractor.java  
 \* /spring-security-web-5-4-10-sources-jar/org/springframework/security/web/firewall/RequestWrapper.java  
 \* /spring-security-web-5-4-10-sources-jar/org/springframework/security/web/authentication/session/SessionAuthenticationException.java  
 \* /spring-security-web-5-4-10-sources-jar/org/springframework/security/web/util/matcher/OrRequestMatcher.java  
 \* /spring-security-web-5-4-10-sources-jar/org/springframework/security/web/authentication/preauth/websphere/WASUsernameAndGroupsExtractor.java  
 \* /spring-security-web-5-4-10-sources-jar/org/springframework/security/web/authentication/rememberme/RememberMeAuthenticationException.java  
 \* /spring-security-web-5-4-10-sources-jar/org/springframework/security/web/authentication/preauth/websphere/DefaultWASUsernameAndGroupsExtractor.java  
 \*  
 /spring-security-web-5-4-10-sources-jar/org/springframework/security/web/authentication/preauth/j2ee/J2eePreAuthenticatedProcessingFilter.java  
 \* /spring-security-web-5-4-10-sources-jar/org/springframework/security/web/authentication/preauth/x509/SubjectDnX509PrincipalExtractor.java  
 \* /spring-security-web-5-4-10-sources-jar/org/springframework/security/web/header/writers/frameoptions/RegExpAllowFromStrategy.java  
 \* /spring-security-web-5-4-10-sources-jar/org/springframework/security/web/header/writers/frameoptions/StaticAllowFromStrategy.java  
 \* /spring-security-web-5-4-10-sources-jar/org/springframework/security/web/authentication/session/NullAuthenticatedSessionStrategy.java  
 \* /spring-security-web-5-4-10-sources-jar/org/springframework/security/web/savedrequest/SavedCookie.java  
 \* /spring-security-web-5-4-10-sources-jar/org/springframework/security/web/authentication/AuthenticationSuccessHandler.java  
 \*  
 /spring-security-web-5-4-10-sources-jar/org/springframework/security/web/header/Header.java  
 \* /spring-security-web-5-4-10-sources-jar/org/springframework/security/web/authentication/preauth/package-info.java  
 \* /spring-security-web-5-4-10-sources-jar/org/springframework/security/web/authentication/preauth/x509/X509AuthenticationFilter.java  
 \* /spring-security-web-5-4-10-sources-jar/org/springframework/security/web/savedrequest/HttpSessionRequestCache.java  
 \* /spring-security-web-5-4-10-sources-jar/org/springframework/security/web/savedrequest/NullRequestCache.java  
 \* /spring-security-web-5-4-10-sources-jar/org/springframework/security/web/access/expression/package-info.java  
 \* /spring-security-web-5-4-10-sources-

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jar/org/springframework/security/web/util/matcher/RegexRequestMatcher.java
* /spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/session/SimpleRedirectInvalidSessionStrategy.java
* /spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/firewall/RequestRejectedException.java
*
/spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/authentication/preauth/PreAuthenticatedGrantedAuthoritiesUserDetailsService.java
* /spring-security-web-5-4-10-sources-jar/org/springframework/security/web/savedrequest/RequestCache.java
* /spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/authentication/rememberme/PersistentRememberMeToken.java
* /spring-security-web-5-4-10-sources-jar/org/springframework/security/web/util/matcher/AndRequestMatcher.java
* /spring-security-web-5-4-10-sources-jar/org/springframework/security/web/firewall/FirewalledRequest.java
* /spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/session/SimpleRedirectSessionInformationExpiredStrategy.java
* /spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/servletapi/HttpServletRequestFactory.java
* /spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/access/expression/WebSecurityExpressionRoot.java
*
/spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/header/writers/frameoptions/AbstractRequestParameterAllowFromStrategy.java
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* /spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/context/HttpRequestResponseHolder.java
* /spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/access/expression/DefaultWebSecurityExpressionHandler.java
* /spring-security-web-5-4-10-sources-
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* /spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/util/OnCommittedResponseWrapper.java
* /spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/authentication/preauth/PreAuthenticatedAuthenticationProvider.java
* /spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/context/NullSecurityContextRepository.java
*
/spring-security-web-5-4-10-sources-jar/org/springframework/security/web/session/InvalidSessionStrategy.java
* /spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/authentication/session/RegisterSessionAuthenticationStrategy.java
* /spring-security-web-5-4-10-sources-jar/org/springframework/security/web/util/TextEscapeUtils.java
* /spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/authentication/logout/CompositeLogoutHandler.java
* /spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/authentication/rememberme/InvalidCookieException.java
* /spring-security-web-5-4-10-sources-jar/org/springframework/security/web/RedirectStrategy.java

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* /spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/authentication/preauth/PreAuthenticatedAuthenticationToken.java
* /spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/authentication/switchuser/SwitchUserAuthorityChanger.java
*
/spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/savedrequest/RequestCacheAwareFilter.java
* /spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/access/channel/AbstractRetryEntryPoint.java
* /spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/context/SecurityContextPersistenceFilter.java
* /spring-security-web-5-4-10-sources-jar/org/springframework/security/web/access/intercept/package-info.java
* /spring-security-web-5-4-10-sources-jar/org/springframework/security/web/savedrequest/SavedRequest.java
* /spring-security-web-5-4-10-sources-jar/org/springframework/security/web/session/SessionManagementFilter.java
* /spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/authentication/preauth/x509/X509PrincipalExtractor.java
* /spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/authentication/rememberme/InMemoryTokenRepositoryImpl.java
*
/spring-security-web-5-4-10-sources-jar/org/springframework/security/web/savedrequest/package-info.java
* /spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/authentication/AuthenticationFailureHandler.java
* /spring-security-web-5-4-10-sources-jar/org/springframework/security/web/util/RedirectUrlBuilder.java
* /spring-security-web-5-4-10-sources-jar/org/springframework/security/web/DefaultRedirectStrategy.java
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Found in path(s):

```

* /spring-security-web-5-4-10-sources-jar/org/springframework/security/web/access/ExceptionTranslationFilter.java
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Found in path(s):

\* /spring-security-web-5-4-10-sources-  
 jar/org/springframework/security/web/server/util/matcher/NegatedServerWebExchangeMatcher.java  
 \* /spring-security-web-5-4-10-sources-  
 jar/org/springframework/security/web/server/authorization/AuthorizationWebFilter.java  
 \* /spring-security-web-5-4-10-sources-  
 jar/org/springframework/security/web/server/authentication/logout/LogoutWebFilter.java  
 \*  
 /spring-security-web-5-4-10-sources-  
 jar/org/springframework/security/web/server/DefaultServerRedirectStrategy.java  
 \* /spring-security-web-5-4-10-sources-  
 jar/org/springframework/security/web/server/util/matcher/AndServerWebExchangeMatcher.java  
 \* /spring-security-web-5-4-10-sources-  
 jar/org/springframework/security/web/server/savedrequest/CookieServerRequestCache.java  
 \* /spring-security-web-5-4-10-sources-  
 jar/org/springframework/security/web/server/context/WebSessionServerSecurityContextRepository.java  
 \* /spring-security-web-5-4-10-sources-jar/org/springframework/security/web/firewall/RequestRejectedHandler.java  
 \* /spring-security-web-5-4-10-sources-  
 jar/org/springframework/security/web/session/HttpSessionIdChangedEvent.java  
 \* /spring-security-web-5-4-10-sources-  
 jar/org/springframework/security/web/server/authentication/AuthenticationConverterServerWebExchangeMatcher.j  
 ava  
 \* /spring-security-web-5-4-10-sources-  
 jar/org/springframework/security/web/server/DelegatingServerAuthenticationEntryPoint.java  
 \*  
 /spring-security-web-5-4-10-sources-  
 jar/org/springframework/security/web/authentication/session/SessionFixationProtectionStrategy.java  
 \* /spring-security-web-5-4-10-sources-  
 jar/org/springframework/security/web/server/savedrequest/WebSessionServerRequestCache.java  
 \* /spring-security-web-5-4-10-sources-  
 jar/org/springframework/security/web/firewall/HttpStatusRequestRejectedHandler.java  
 \* /spring-security-web-5-4-10-sources-  
 jar/org/springframework/security/web/firewall/DefaultRequestRejectedHandler.java  
 \* /spring-security-web-5-4-10-sources-

jar/org/springframework/security/web/server/authorization/DelegatingReactiveAuthorizationManager.java  
\* /spring-security-web-5-4-10-sources-  
jar/org/springframework/security/web/server/util/matcher/PathPatternParserServerWebExchangeMatcher.java  
\* /spring-security-web-5-4-10-sources-  
jar/org/springframework/security/web/server/authentication/SwitchUserWebFilter.java  
\*  
/spring-security-web-5-4-10-sources-  
jar/org/springframework/security/web/server/authentication/AnonymousAuthenticationWebFilter.java  
\* /spring-security-web-5-4-10-sources-  
jar/org/springframework/security/web/savedrequest/CookieRequestCache.java  
\* /spring-security-web-5-4-10-sources-  
jar/org/springframework/security/web/server/util/matcher/OrServerWebExchangeMatcher.java  
\* /spring-security-web-5-4-10-sources-  
jar/org/springframework/security/web/server/authentication/AuthenticationWebFilter.java  
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\* /spring-security-web-5-4-10-sources-jar/org/springframework/security/web/FilterInvocation.java  
\* /spring-security-web-5-4-10-sources-jar/org/springframework/security/web/access/DefaultWebInvocationPrivilegeEvaluator.java  
\*  
/spring-security-web-5-4-10-sources-jar/org/springframework/security/web/csrf/MissingCsrfTokenException.java  
\* /spring-security-web-5-4-10-sources-jar/org/springframework/security/web/context/HttpSessionSecurityContextRepository.java  
\* /spring-security-web-5-4-10-sources-jar/org/springframework/security/web/server/csrf/CsrfWebFilter.java  
\* /spring-security-web-5-4-10-sources-jar/org/springframework/security/web/csrf/CsrfFilter.java  
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 \* /spring-security-web-5-4-10-sources-  
 jar/org/springframework/security/web/access/evaluation/AbstractVariableEvaluationContextPostProcessor.java  
 \* /spring-security-web-5-4-10-sources-  
 jar/org/springframework/security/web/authentication/DelegatingAuthenticationFailureHandler.java  
 \*  
 /spring-security-web-5-4-10-sources-  
 jar/org/springframework/security/web/access/DelegatingAccessDeniedHandler.java  
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 jar/org/springframework/security/web/context/support/SecurityWebApplicationContextUtils.java  
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 jar/org/springframework/security/web/jackson2/PreAuthenticatedAuthenticationTokenDeserializer.java  
 \* /spring-security-web-5-4-10-sources-  
 jar/org/springframework/security/web/server/jackson2/DefaultCsrfServerTokenMixin.java  
 \* /spring-security-web-5-4-10-sources-  
 jar/org/springframework/security/web/server/jackson2/WebServerJackson2Module.java



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```
*/spring-security-web-5-4-10-sources-jar/org/springframework/security/web/csrf/LazyCsrfTokenRepository.java
*/spring-security-web-5-4-10-sources-jar/org/springframework/security/web/csrf/CookieCsrfTokenRepository.java
*/spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/session/SessionInformationExpiredEvent.java
*
/spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/access/evaluation/DelegatingEvaluationContext.java
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jar/org/springframework/security/web/server/header/StrictTransportSecurityServerHttpHeadersWriter.java
* /spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/server/header/CacheControlServerHttpHeadersWriter.java
* /spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/server/util/matcher/MediaTypeServerWebExchangeMatcher.java
*
/spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/server/header/ServerHttpHeadersWriter.java
* /spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/server/savedrequest/ServerRequestCache.java
* /spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/server/header/XContentTypeOptionsServerHttpHeadersWriter.java
* /spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/server/authentication/ServerAuthenticationEntryPointFailureHandler.java
* /spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/server/authentication/logout/ServerLogoutHandler.java
* /spring-security-web-5-4-10-sources-jar/org/springframework/security/web/server/csrf/CsrfException.java
* /spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/server/ui/LoginPageGeneratingWebFilter.java
* /spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/server/header/HttpHeaderWriterWebFilter.java
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/spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/server/authentication/WebFilterChainServerAuthenticationSuccessHandler.java
va
* /spring-security-web-5-4-10-sources-jar/org/springframework/security/web/server/ServerRedirectStrategy.java
* /spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/server/util/matcher/ServerWebExchangeMatchers.java
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\* /spring-security-web-5-4-10-sources-  
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 \* /spring-security-web-5-4-10-sources-  
 jar/org/springframework/security/web/server/context/ReactorContextWebFilter.java  
 \* /spring-security-web-5-4-10-sources-  
 jar/org/springframework/security/web/server/context/SecurityContextServerWebExchange.java  
 \* /spring-security-web-5-4-10-sources-  
 jar/org/springframework/security/web/server/authorization/ServerAccessDeniedHandler.java  
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 \* /spring-security-web-5-4-10-sources-  
 jar/org/springframework/security/web/server/authentication/ServerAuthenticationFailureHandler.java  
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 jar/org/springframework/security/web/server/util/matcher/ServerWebExchangeMatcher.java  
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 \* /spring-security-web-5-4-10-sources-  
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 \* /spring-security-web-5-4-10-sources-  
 jar/org/springframework/security/web/server/ServerFormLoginAuthenticationConverter.java  
 \* /spring-security-web-5-4-10-sources-  
 jar/org/springframework/security/web/server/authorization/AuthorizationContext.java  
 \* /spring-security-web-5-4-10-sources-  
 jar/org/springframework/security/web/server/authentication/RedirectServerAuthenticationFailureHandler.java  
 \* /spring-security-web-5-4-10-sources-jar/org/springframework/security/web/server/csrf/DefaultCsrfToken.java  
 \* /spring-security-web-5-4-10-sources-  
 jar/org/springframework/security/web/server/authorization/HttpStatusServerAccessDeniedHandler.java  
 \*  
 /spring-security-web-5-4-10-sources-  
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 \* /spring-security-web-5-4-10-sources-  
 jar/org/springframework/security/web/server/ui/LogoutPageGeneratingWebFilter.java  
 \* /spring-security-web-5-4-10-sources-jar/org/springframework/security/web/server/SecurityWebFilterChain.java  
 \* /spring-security-web-5-4-10-sources-  
 jar/org/springframework/security/web/server/header/XFrameOptionsServerHttpHeadersWriter.java

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* /spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/server/util/matcher/ServerWebExchangeMatcherEntry.java
* /spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/server/header/CompositeServerHttpHeadersWriter.java
* /spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/server/authentication/RedirectServerAuthenticationSuccessHandler.java
* /spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/server/authentication/ServerAuthenticationSuccessHandler.java
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jar/org/springframework/security/web/server/ServerAuthenticationEntryPoint.java
* /spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/server/authentication/logout/SecurityContextServerLogoutHandler.java
* /spring-security-web-5-4-10-sources-jar/org/springframework/security/web/server/csrf/CsrfToken.java
* /spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/server/context/ServerSecurityContextRepository.java
* /spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/authentication/rememberme/PersistentTokenBasedRememberMeServices.java
a
* /spring-security-web-5-4-10-sources-jar/org/springframework/security/web/server/WebFilterExchange.java
* /spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/server/authentication/RedirectServerAuthenticationEntryPoint.java
*
/spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/server/csrf/ServerCsrfTokenRepository.java
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*/spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/authentication/DelegatingAuthenticationEntryPoint.java
*/spring-security-web-5-4-10-sources-jar/org/springframework/security/web/util/matcher/ELRequestMatcher.java
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* /spring-security-web-5-4-10-sources-jar/org/springframework/security/web/csrf/CsrfAuthenticationStrategy.java
* /spring-security-web-5-4-10-sources-jar/org/springframework/security/web/csrf/CsrfToken.java
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/spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/method/annotation/CsrfTokenArgumentResolver.java
* /spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/bind/annotation/AuthenticationPrincipal.java
* /spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/bind/support/AuthenticationPrincipalArgumentResolver.java
* /spring-security-web-5-4-10-sources-
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* /spring-security-web-5-4-10-sources-
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jar/org/springframework/security/web/header/writers/DelegatingRequestMatcherHeaderWriter.java
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jar/org/springframework/security/web/header/writers/XContentTypeOptionsHeaderWriter.java
* /spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/method/annotation/AuthenticationPrincipalArgumentResolver.java
* /spring-security-web-5-4-10-sources-jar/org/springframework/security/web/util/matcher/AnyRequestMatcher.java
* /spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/authentication/session/SessionFixationProtectionEvent.java
* /spring-security-web-5-4-10-sources-jar/org/springframework/security/web/csrf/CsrfException.java
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\* /spring-security-web-5-4-10-sources-jar/org/springframework/security/web/csrf/CsrfLogoutHandler.java  
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/spring-security-web-5-4-10-sources-  
jar/org/springframework/security/web/session/InvalidSessionAccessDeniedHandler.java  
\* /spring-security-web-5-4-10-sources-jar/org/springframework/security/web/csrf/InvalidCsrfTokenException.java  
\* /spring-security-web-5-4-10-sources-jar/org/springframework/security/web/csrf/DefaultCsrfToken.java  
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jar/org/springframework/security/web/authentication/session/ChangeSessionIdAuthenticationStrategy.java  
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\* /spring-security-web-5-4-10-sources-  
jar/org/springframework/security/web/authentication/preauth/AbstractPreAuthenticatedProcessingFilter.java  
\* /spring-security-web-5-4-10-sources-  
jar/org/springframework/security/web/authentication/ExceptionMappingAuthenticationFailureHandler.java  
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/spring-security-web-5-4-10-sources-  
jar/org/springframework/security/web/server/header/ReferrerPolicyServerHttpHeadersWriter.java  
\* /spring-security-web-5-4-10-sources-jar/org/springframework/security/web/http/SecurityHeaders.java  
\* /spring-security-web-5-4-10-sources-  
jar/org/springframework/security/web/context/request/async/SecurityContextCallableProcessingInterceptor.java  
\* /spring-security-web-5-4-10-sources-  
jar/org/springframework/security/web/server/authentication/HttpStatusServerEntryPoint.java  
\* /spring-security-web-5-4-10-sources-  
jar/org/springframework/security/web/server/header/ContentSecurityPolicyServerHttpHeadersWriter.java  
\* /spring-security-web-5-4-10-sources-  
jar/org/springframework/security/web/server/authentication/ServerHttpBasicAuthenticationConverter.java  
\* /spring-security-web-5-4-10-sources-  
jar/org/springframework/security/web/access/RequestMatcherDelegatingAccessDeniedHandler.java

```

*
/spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/reactive/result/method/annotation/AuthenticationPrincipalArgumentResolver.
java
* /spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/authentication/ForwardAuthenticationFailureHandler.java
* /spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/server/header/FeaturePolicyServerHttpHeadersWriter.java
* /spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/server/authentication/DelegatingServerAuthenticationSuccessHandler.java
* /spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/authentication/ForwardAuthenticationSuccessHandler.java
* /spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/authentication/ui/DefaultLoginPageGeneratingFilter.java
* /spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/server/authentication/ServerX509AuthenticationConverter.java
* /spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/server/MatcherSecurityWebFilterChain.java
*
/spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/server/authentication/logout/HttpStatusReturningServerLogoutSuccessHandle
r.java
* /spring-security-web-5-4-10-sources-jar/org/springframework/security/web/firewall/FirewalledResponse.java
* /spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/server/authentication/ServerAuthenticationConverter.java
* /spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/authentication/SimpleUrlAuthenticationFailureHandler.java
* /spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/authentication/ui/DefaultLogoutPageGeneratingFilter.java
* /spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/header/writers/CacheControlHeadersWriter.java
* /spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/server/header/XXssProtectionServerHttpHeadersWriter.java
*
/spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/reactive/result/view/CsrfRequestDataValueProcessor.java
* /spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/server/authentication/ServerFormLoginAuthenticationConverter.java
* /spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/server/authorization/ServerWebExchangeDelegatingServerAccessDeniedHan
dler.java
* /spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/server/authentication/logout/DelegatingServerLogoutHandler.java
* /spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/authentication/logout/ForwardLogoutSuccessHandler.java
* /spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/server/ServerHttpBasicAuthenticationConverter.java

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Found in path(s):

```
* /spring-security-web-5-4-10-sources-jar/org/springframework/security/web/jackson2/WebJackson2Module.java
* /spring-security-web-5-4-10-sources-jar/org/springframework/security/web/session/SessionInformationExpiredStrategy.java
* /spring-security-web-5-4-10-sources-jar/org/springframework/security/web/jackson2/SavedCookieMixin.java
*
* /spring-security-web-5-4-10-sources-jar/org/springframework/security/web/jackson2/CookieMixin.java
* /spring-security-web-5-4-10-sources-jar/org/springframework/security/web/jackson2/DefaultCsrfTokenMixin.java
* /spring-security-web-5-4-10-sources-jar/org/springframework/security/web/jackson2/DefaultSavedRequestMixin.java
* /spring-security-web-5-4-10-sources-jar/org/springframework/security/web/jackson2/PreAuthenticatedAuthenticationTokenMixin.java
* /spring-security-web-5-4-10-sources-jar/org/springframework/security/web/jackson2/ServletJackson2Module.java
* /spring-security-web-5-4-10-sources-jar/org/springframework/security/web/jackson2/WebAuthenticationDetailsMixin.java
* /spring-security-web-5-4-10-sources-jar/org/springframework/security/web/jackson2/CookieDeserializer.java
```

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Found in path(s):

```

* /spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/access/ExpressionBasedFilterInvocationSecurityMetadataSource.j
ava
* /spring-security-web-5-4-10-sources-jar/org/springframework/security/web/util/matcher/IpAddressMatcher.java
* /spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/authentication/logout/LogoutSuccessEventPublishingLogoutHandler.java
*
/spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/server/csrf/CookieServerCsrfTokenRepository.java
* /spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/authentication/www/BasicAuthenticationConverter.java
* /spring-security-web-5-4-10-sources-jar/org/springframework/security/web/header/HeaderWriterFilter.java
* /spring-security-web-5-4-10-sources-jar/org/springframework/security/web/session/ConcurrentSessionFilter.java
* /spring-security-web-5-4-10-sources-jar/org/springframework/security/web/access/intercept/RequestKey.java
* /spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/authentication/AuthenticationConverter.java
* /spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/authentication/AuthenticationEntryPointFailureHandler.java
* /spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/util/matcher/MediaTypeRequestMatcher.java
*
/spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/util/matcher/AntPathRequestMatcher.java
* /spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/header/writers/FeaturePolicyHeaderWriter.java
* /spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/server/header/ClearSiteDataServerHttpHeadersWriter.java
* /spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/server/authentication/logout/HeaderWriterServerLogoutHandler.java
* /spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/authentication/session/ConcurrentSessionControlAuthenticationStrategy.java
* /spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/header/writers/CompositeHeaderWriter.java
* /spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/header/writers/ReferrerPolicyHeaderWriter.java
* /spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/authentication/AbstractAuthenticationTargetUrlRequestHandler.java
*
/spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/server/authentication/ReactivePreAuthenticatedAuthenticationManager.java
* /spring-security-web-5-4-10-sources-jar/org/springframework/security/web/header/writers/HstsHeaderWriter.java
* /spring-security-web-5-4-10-sources-

```

```

jar/org/springframework/security/web/header/writers/XXssProtectionHeaderWriter.java
* /spring-security-web-5-4-10-sources-jar/org/springframework/security/web/util/matcher/RequestMatcher.java
* /spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/authentication/logout/CookieClearingLogoutHandler.java
* /spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/server/transport/HttpsRedirectWebFilter.java
* /spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/header/writers/HpkpHeaderWriter.java
* /spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/header/writers/ClearSiteDataHeaderWriter.java
*
/spring-security-web-5-4-10-sources-jar/org/springframework/security/web/header/writers/StaticHeadersWriter.java
* /spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/reactive/result/method/annotation/CurrentSecurityContextArgumentResolver.
java
* /spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/authentication/AuthenticationFilter.java
* /spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/method/annotation/CurrentSecurityContextArgumentResolver.java
* /spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/header/writers/ContentSecurityPolicyHeaderWriter.java
* /spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/authentication/logout/HeaderWriterLogoutHandler.java
* /spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/header/writers/frameoptions/XFrameOptionsHeaderWriter.java
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```

Found in path(s):

```

* /spring-security-web-5-4-10-sources-jar/org/springframework/security/web/FilterChainProxy.java
* /spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/access/channel/SecureChannelProcessor.java
* /spring-security-web-5-4-10-sources-jar/org/springframework/security/web/access/AccessDeniedHandler.java

```

```

*
/spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/access/intercept/DefaultFilterInvocationSecurityMetadataSource.java
* /spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/savedrequest/DefaultSavedRequest.java
* /spring-security-web-5-4-10-sources-jar/org/springframework/security/web/PortResolverImpl.java
* /spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/savedrequest/SimpleSavedRequest.java
* /spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/access/channel/RetryWithHttpEntryPoint.java
* /spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/access/channel/ChannelDecisionManager.java
* /spring-security-web-5-4-10-sources-jar/org/springframework/security/web/PortMapper.java
* /spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/authentication/rememberme/RememberMeAuthenticationFilter.java
* /spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/access/channel/ChannelEntryPoint.java
*
/spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/authentication/switchuser/SwitchUserFilter.java
* /spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/authentication/logout/LogoutFilter.java
* /spring-security-web-5-4-10-sources-jar/org/springframework/security/web/session/HttpSessionCreatedEvent.java
* /spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/authentication/LoginUrlAuthenticationEntryPoint.java
* /spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/authentication/switchuser/AuthenticationSwitchUserEvent.java
* /spring-security-web-5-4-10-sources-jar/org/springframework/security/web/PortResolver.java
* /spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/access/channel/RetryWithHttpsEntryPoint.java
* /spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/authentication/RememberMeServices.java
*
/spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/authentication/UsernamePasswordAuthenticationFilter.java
* /spring-security-web-5-4-10-sources-jar/org/springframework/security/web/AuthenticationEntryPoint.java
* /spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/savedrequest/SavedRequestAwareWrapper.java
* /spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/servletapi/SecurityContextHolderAwareRequestWrapper.java
* /spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/access/channel/ChannelProcessingFilter.java
* /spring-security-web-5-4-10-sources-jar/org/springframework/security/web/savedrequest/FastHttpDateFormat.java
* /spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/authentication/WebAuthenticationDetailsSource.java
* /spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/authentication/logout/SecurityContextLogoutHandler.java
* /spring-security-web-5-4-10-sources-

```

```

jar/org/springframework/security/web/authentication/www/DigestAuthenticationEntryPoint.java
*
/spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/authentication/WebAuthenticationDetails.java
* /spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/authentication/www/BasicAuthenticationEntryPoint.java
* /spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/access/intercept/FilterInvocationSecurityMetadataSource.java
* /spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/access/WebInvocationPrivilegeEvaluator.java
* /spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/authentication/NullRememberMeServices.java
* /spring-security-web-5-4-10-sources-jar/org/springframework/security/web/access/AccessDeniedHandlerImpl.java
* /spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/authentication/www/BasicAuthenticationFilter.java
* /spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/session/HttpSessionEventPublisher.java
*
/spring-security-web-5-4-10-sources-jar/org/springframework/security/web/savedrequest/Enumerator.java
* /spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/servletapi/SecurityContextHolderAwareRequestFilter.java
* /spring-security-web-5-4-10-sources-jar/org/springframework/security/web/PortMapperImpl.java
* /spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/authentication/AnonymousAuthenticationFilter.java
* /spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/authentication/rememberme/TokenBasedRememberMeServices.java
* /spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/authentication/logout/LogoutHandler.java
* /spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/authentication/switchuser/SwitchUserGrantedAuthority.java
* /spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/authentication/www/NonceExpiredException.java
*
/spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/session/HttpSessionDestroyedEvent.java
* /spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/access/channel/ChannelDecisionManagerImpl.java
* /spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/access/intercept/FilterSecurityInterceptor.java
* /spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/authentication/AbstractAuthenticationProcessingFilter.java
* /spring-security-web-5-4-10-sources-jar/org/springframework/security/web/access/channel/ChannelProcessor.java
* /spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/access/channel/InsecureChannelProcessor.java
* /spring-security-web-5-4-10-sources-jar/org/springframework/security/web/util/UrlUtils.java
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```

* /spring-security-web-5-4-10-sources-
jar/org/springframework/security/web/util/matcher/ELRequestMatcherContext.java

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Found in path(s):

```

* /spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/core/userdetails/UserDetailsMapFactoryBean.java
* /spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/annotation/method/configuration/EnableReactiveMethodSecurity.java
* /spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/annotation/method/configuration/ReactiveMethodSecuritySelector.java

```

```

*
/spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/annotation/web/reactive/EnableWebFluxSecurity.java
* /spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/core/userdetails/ReactiveUserDetailsServiceResourceFactoryBean.java
* /spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/annotation/authentication/configuration/GlobalAuthenticationConfigurerAd
apter.java
* /spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/provisioning/UserDetailsManagerResourceFactoryBean.java
* /spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/web/server/SecurityWebFiltersOrder.java
* /spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/web/server/AbstractServerWebExchangeMatcherRegistry.java
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```

Found in path(s):

```

* /spring-security-config-5-4-10-sources-jar/org/springframework/security/config/http/SessionCreationPolicy.java
* /spring-security-config-5-4-10-sources-jar/org/springframework/security/config/DebugBeanDefinitionParser.java
* /spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/core/GrantedAuthorityDefaults.java
*
/spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/http/FilterChainMapBeanDefinitionDecorator.java
* /spring-security-config-5-4-10-sources-jar/org/springframework/security/config/authentication/package-info.java
* /spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/http/FilterInvocationSecurityMetadataSourceParser.java
* /spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/method/InterceptMethodsBeanDefinitionDecorator.java
* /spring-security-config-5-4-10-sources-jar/org/springframework/security/config/method/package-info.java
* /spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/method/ProtectPointcutPostProcessor.java

```

```

* /spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/http/UserDetailsServiceFactoryBean.java
* /spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/ldap/LdapProviderBeanDefinitionParser.java
*
/spring-security-config-5-4-10-sources-jar/org/springframework/security/config/http/ChannelAttributeFactory.java
* /spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/http/FilterChainBeanDefinitionParser.java
* /spring-security-config-5-4-10-sources-jar/org/springframework/security/config/BeanIds.java
* /spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/ldap/ContextSourceSettingPostProcessor.java
* /spring-security-config-5-4-10-sources-jar/org/springframework/security/config/http/package-info.java
* /spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/ldap/LdapUserServiceBeanDefinitionParser.java
* /spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/method/MethodSecurityMetadataSourceBeanDefinitionParser.java
* /spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/authentication/PasswordEncoderParser.java
* /spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/http/PortMappingsBeanDefinitionParser.java
*
/spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/authentication/UserServiceBeanDefinitionParser.java
* /spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/http/HttpFirewallBeanDefinitionParser.java
* /spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/annotation/web/messaging/MessageSecurityMetadataSourceRegistry.java
* /spring-security-config-5-4-10-sources-jar/org/springframework/security/config/package-info.java
* /spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/http/DefaultFilterChainValidator.java
* /spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/authentication/AuthenticationProviderBeanDefinitionParser.java
* /spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/authentication/AbstractUserDetailsServiceBeanDefinitionParser.java
*
/spring-security-config-5-4-10-sources-jar/org/springframework/security/config/http/MatcherType.java
* /spring-security-config-5-4-10-sources-jar/org/springframework/security/config/ldap/package-info.java
* /spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/authentication/JdbcUserServiceBeanDefinitionParser.java
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- \* /spring-security-config-5-4-10-sources-
- jar/org/springframework/security/config/annotation/web/configurers/saml2/Saml2LoginConfigurer.java
- \* /spring-security-config-5-4-10-sources-
- jar/org/springframework/security/config/annotation/web/configurers/oauth2/client/OAuth2LoginConfigurer.java
- \*
- /spring-security-config-5-4-10-sources-
- jar/org/springframework/security/config/annotation/web/builders/FilterOrderRegistration.java
- \* /spring-security-config-5-4-10-sources-
- jar/org/springframework/security/config/authentication/AuthenticationManagerBeanDefinitionParser.java
- \* /spring-security-config-5-4-10-sources-
- jar/org/springframework/security/config/annotation/web/configurers/DefaultLoginPageConfigurer.java

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Found in path(s):

- \* /spring-security-config-5-4-10-sources-
- jar/org/springframework/security/config/annotation/rsocket/SecuritySocketAcceptorInterceptorConfiguration.java
- \* /spring-security-config-5-4-10-sources-
- jar/org/springframework/security/config/annotation/rsocket/RSocketSecurityConfiguration.java
- \* /spring-security-config-5-4-10-sources-
- jar/org/springframework/security/config/annotation/rsocket/RSocketSecurity.java
- \*

/spring-security-config-5-4-10-sources-  
jar/org/springframework/security/config/annotation/rsocket/PayloadInterceptorOrder.java  
\* /spring-security-config-5-4-10-sources-  
jar/org/springframework/security/config/annotation/rsocket/EnableRSocketSecurity.java  
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\* /spring-security-config-5-4-10-sources-  
jar/org/springframework/security/config/http/HandlerMappingIntrospectorFactoryBean.java  
\* /spring-security-config-5-4-10-sources-  
jar/org/springframework/security/config/http/GrantedAuthorityDefaultsParserUtils.java

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* /spring-security-config-5-4-10-sources-jar/org/springframework/security/config/http/OrderDecorator.java
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```
* /spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/method/GlobalMethodSecurityBeanDefinitionParser.java
* /spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/http/CorsBeanDefinitionParser.java
* /spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/annotation/web/configurers/X509Configurer.java
*
/spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/websocket/WebSocketMessageBrokerSecurityBeanDefinitionParser.java
```

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* /spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/annotation/web/configuration/WebSecurityConfigurerAdapter.java
* /spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/annotation/method/configuration/GlobalMethodSecuritySelector.java
* /spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/annotation/web/configurers/ExceptionHandlerConfigurer.java
* /spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/annotation/web/configurers/ServletApiConfigurer.java
* /spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/authentication/AuthenticationManagerFactoryBean.java
* /spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/http/FormLoginBeanDefinitionParser.java
*
/spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/annotation/web/configurers/ExpressionUrlAuthorizationConfigurer.java
* /spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/annotation/configuration/AutowireBeanFactoryObjectPostProcessor.java
* /spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/annotation/web/configurers/oauth2/client/OAuth2ClientConfigurerUtils.java
a
* /spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/core/userdetails/UserDetailsResourceFactoryBean.java
* /spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/annotation/web/configurers/SecurityContextConfigurer.java
* /spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/annotation/web/configurers/CorsConfigurer.java
* /spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/annotation/web/configurers/UrlAuthorizationConfigurer.java
*
/spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/annotation/method/configuration/MethodSecurityMetadataSourceAdvisorRegistrar.java

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\* /spring-security-config-5-4-10-sources-jar/org/springframework/security/config/method/MethodConfigUtils.java

\* /spring-security-config-5-4-10-sources-jar/org/springframework/security/config/http/WebConfigUtils.java

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\* /spring-security-config-5-4-10-sources-

jar/org/springframework/security/config/http/OAuth2ClientBeanDefinitionParser.java

\* /spring-security-config-5-4-10-sources-

jar/org/springframework/security/config/web/server/ServerSecurityMarker.kt

\* /spring-security-config-5-4-10-sources-jar/org/springframework/security/config/Elements.java

\*

/spring-security-config-5-4-10-sources-

jar/org/springframework/security/config/web/server/ServerContentTypeOptionsDsl.kt

\* /spring-security-config-5-4-10-sources-

jar/org/springframework/security/config/web/server/ServerFrameOptionsDsl.kt

\* /spring-security-config-5-4-10-sources-

jar/org/springframework/security/config/web/servlet/RequiresChannelDsl.kt

\* /spring-security-config-5-4-10-sources-jar/org/springframework/security/config/web/servlet/CsrfDsl.kt

\* /spring-security-config-5-4-10-sources-jar/org/springframework/security/config/web/server/ServerCorsDsl.kt

\* /spring-security-config-5-4-10-sources-

jar/org/springframework/security/config/web/servlet/headers/HttpPublicKeyPinningDsl.kt

\* /spring-security-config-5-4-10-sources-

jar/org/springframework/security/config/annotation/web/configuration/WebSecurityCustomizer.java

\* /spring-security-config-5-4-10-sources-

jar/org/springframework/security/config/http/OAuth2ResourceServerBeanDefinitionParser.java

\*

/spring-security-config-5-4-10-sources-

jar/org/springframework/security/config/web/servlet/oauth2/login/AuthorizationEndpointDsl.kt

\* /spring-security-config-5-4-10-sources-

```

jar/org/springframework/security/config/http/AuthenticationConfigBuilder.java
* /spring-security-config-5-4-10-sources-jar/org/springframework/security/config/web/servlet/HttpSecurityDsl.kt
* /spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/annotation/web/builders/WebSecurity.java
* /spring-security-config-5-4-10-sources-jar/org/springframework/security/config/web/servlet/SecurityMarker.kt
* /spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/web/servlet/headers/FrameOptionsDsl.kt
* /spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/web/server/ServerOAuth2LoginDsl.kt
* /spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/annotation/web/configuration/OAuth2ClientConfiguration.java
* /spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/web/servlet/SessionManagementDsl.kt
*
/spring-security-config-5-4-10-sources-jar/org/springframework/security/config/web/server/ServerCsrfDsl.kt
* /spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/annotation/authentication/configurers/ldap/LdapAuthenticationProviderCon
figurer.java
* /spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/web/servlet/oauth2/resourceserver/OAuth2ResourceServerSecurityMarker.
kt
* /spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/web/servlet/session/SessionSecurityMarker.kt
* /spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/web/server/ServerHttpSecurity.java
* /spring-security-config-5-4-10-sources-jar/org/springframework/security/config/web/servlet/HeadersDsl.kt
* /spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/web/servlet/headers/ContentTypeOptionsDsl.kt
*
/spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/web/servlet/AbstractRequestMatcherDsl.kt
* /spring-security-config-5-4-10-sources-jar/org/springframework/security/config/web/server/ServerLogoutDsl.kt
* /spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/web/servlet/oauth2/login/UserInfoEndpointDsl.kt
* /spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/web/server/ServerHttpSecurityDsl.kt
* /spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/web/servlet/OAuth2ResourceServerDsl.kt
* /spring-security-config-5-4-10-sources-jar/org/springframework/security/config/web/servlet/Saml2Dsl.kt
* /spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/annotation/web/configuration/EnableWebSecurity.java
* /spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/web/server/ServerHttpsRedirectDsl.kt
* /spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/http/OAuth2ClientWebMvcSecurityPostProcessor.java
*
/spring-security-config-5-4-10-sources-jar/org/springframework/security/config/web/server/ServerHttpBasicDsl.kt
* /spring-security-config-5-4-10-sources-

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jar/org/springframework/security/config/annotation/web/configurers/oauth2/server/resource/OAuth2ResourceServer  
 Configurer.java  
 \* /spring-security-config-5-4-10-sources-  
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 \* /spring-security-config-5-4-10-sources-  
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 \* /spring-security-config-5-4-10-sources-  
 jar/org/springframework/security/config/web/server/ServerAnonymousDsl.kt  
 \* /spring-security-config-5-4-10-sources-  
 jar/org/springframework/security/config/web/server/ServerOAuth2ResourceServerDsl.kt  
 \* /spring-security-config-5-4-10-sources-  
 jar/org/springframework/security/config/web/servlet/oauth2/resourceserver/JwtDsl.kt  
 \*  
 /spring-security-config-5-4-10-sources-  
 jar/org/springframework/security/config/oauth2/client/ClientRegistrationsBeanDefinitionParser.java  
 \* /spring-security-config-5-4-10-sources-  
 jar/org/springframework/security/config/oauth2/client/CommonOAuth2Provider.java  
 \* /spring-security-config-5-4-10-sources-  
 jar/org/springframework/security/config/web/servlet/headers/HttpStrictTransportSecurityDsl.kt  
 \* /spring-security-config-5-4-10-sources-  
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 \* /spring-security-config-5-4-10-sources-  
 jar/org/springframework/security/config/http/OAuth2LoginBeanDefinitionParser.java  
 \* /spring-security-config-5-4-10-sources-jar/org/springframework/security/config/web/servlet/AnonymousDsl.kt  
 \* /spring-security-config-5-4-10-sources-  
 jar/org/springframework/security/config/web/server/ServerFormLoginDsl.kt  
 \* /spring-security-config-5-4-10-sources-jar/org/springframework/security/config/web/servlet/FormLoginDsl.kt  
 \* /spring-security-config-5-4-10-sources-  
 jar/org/springframework/security/config/web/servlet/headers/ContentSecurityPolicyDsl.kt  
 \*  
 /spring-security-config-5-4-10-sources-jar/org/springframework/security/config/http/SecurityFilters.java  
 \* /spring-security-config-5-4-10-sources-  
 jar/org/springframework/security/config/annotation/web/configurers/oauth2/client/OAuth2ClientConfigurer.java  
 \* /spring-security-config-5-4-10-sources-  
 jar/org/springframework/security/config/web/server/ServerRequestCacheDsl.kt  
 \* /spring-security-config-5-4-10-sources-jar/org/springframework/security/config/web/server/ServerX509Dsl.kt  
 \* /spring-security-config-5-4-10-sources-  
 jar/org/springframework/security/config/web/server/ServerExceptionHandlerDsl.kt  
 \* /spring-security-config-5-4-10-sources-  
 jar/org/springframework/security/config/web/servlet/oauth2/login/OAuth2LoginSecurityMarker.kt  
 \* /spring-security-config-5-4-10-sources-  
 jar/org/springframework/security/config/web/server/ServerOAuth2ClientDsl.kt  
 \* /spring-security-config-5-4-10-sources-  
 jar/org/springframework/security/config/web/servlet/headers/ReferrerPolicyDsl.kt  
 \*  
 /spring-security-config-5-4-10-sources-  
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 \* /spring-security-config-5-4-10-sources-

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jar/org/springframework/security/config/web/servlet/oauth2/login/TokenEndpointDsl.kt
* /spring-security-config-5-4-10-sources-jar/org/springframework/security/config/web/servlet/PortMapperDsl.kt
* /spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/annotation/web/configuration/WebSecurityConfiguration.java
* /spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/annotation/web/configurers/oauth2/client/ImplicitGrantConfigurer.java
* /spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/web/server/ServerReferrerPolicyDsl.kt
* /spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/web/servlet/headers/HeadersSecurityMarker.kt
* /spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/web/server/ServerXssProtectionDsl.kt
*
/spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/web/servlet/oauth2/client/AuthorizationCodeGrantDsl.kt
* /spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/web/servlet/oauth2/resourceserver/OpaqueTokenDsl.kt
* /spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/web/server/ServerOpaqueTokenDsl.kt
* /spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/web/servlet/headers/XssProtectionConfigDsl.kt
* /spring-security-config-5-4-10-sources-jar/org/springframework/security/config/web/servlet/CorsDsl.kt
* /spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/web/servlet/AuthorizeRequestsDsl.kt
* /spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/annotation/web/WebSecurityConfigurer.java
* /spring-security-config-5-4-10-sources-jar/org/springframework/security/config/web/servlet/OAuth2LoginDsl.kt
*
/spring-security-config-5-4-10-sources-jar/org/springframework/security/config/web/server/ServerHeadersDsl.kt
* /spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/web/servlet/headers/CacheControlDsl.kt
* /spring-security-config-5-4-10-sources-jar/org/springframework/security/config/web/servlet/LogoutDsl.kt
* /spring-security-config-5-4-10-sources-jar/org/springframework/security/config/web/servlet/OAuth2ClientDsl.kt
* /spring-security-config-5-4-10-sources-jar/org/springframework/security/config/web/servlet/X509Dsl.kt
* /spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/web/servlet/oauth2/login/RedirectionEndpointDsl.kt
* /spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/annotation/web/HttpSecurityBuilder.java
* /spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/http/HttpConfigurationBuilder.java
*
/spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/web/server/ServerHttpStrictTransportSecurityDsl.kt
* /spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/web/server/ServerContentSecurityPolicyDsl.kt
* /spring-security-config-5-4-10-sources-
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* /spring-security-config-5-4-10-sources-

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jar/org/springframework/security/config/web/server/ServerCacheControlDsl.kt
* /spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/annotation/web/configuration/HttpSecurityConfiguration.java
* /spring-security-config-5-4-10-sources-jar/org/springframework/security/config/web/server/ServerJwtDsl.kt
* /spring-security-config-5-4-10-sources-jar/org/springframework/security/config/web/servlet/RequestCacheDsl.kt
* /spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/http/CsrfBeanDefinitionParser.java
* /spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/web/server/AuthorizeExchangeDsl.kt
*
/spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/ldap/LdapServerBeanDefinitionParser.java
* /spring-security-config-5-4-10-sources-jar/org/springframework/security/config/web/servlet/HttpBasicDsl.kt
* /spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/web/servlet/oauth2/client/OAuth2ClientSecurityMarker.kt
* /spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/web/servlet/session/SessionConcurrencyDsl.kt
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jar/org/springframework/security/config/debug/SecurityDebugBeanFactoryPostProcessor.java
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* /spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/annotation/web/configurers/AbstractConfigAttributeRequestMatcherRegistry.java
* /spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/annotation/web/servlet/configuration/EnableWebMvcSecurity.java
*
/spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/annotation/authentication/configurers/userdetails/UserDetailsServiceConfigurer.java
* /spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/annotation/web/configuration/SpringWebMvcImportSelector.java
* /spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/annotation/method/configuration/GlobalMethodSecurityAspectJAutoProxyRegistrar.java
* /spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/annotation/web/configurers/AbstractHttpConfigurer.java
* /spring-security-config-5-4-10-sources-
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* /spring-security-config-5-4-10-sources-
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* /spring-security-config-5-4-10-sources-jar/org/springframework/security/config/annotation/SecurityBuilder.java
* /spring-security-config-5-4-10-sources-
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* /spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/annotation/authentication/configurers/provisioning/InMemoryUserDetailsManagerConfigurer.java
* /spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/annotation/web/configurers/RequestCacheConfigurer.java
* /spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/annotation/ObjectPostProcessor.java
* /spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/annotation/web/configurers/AnonymousConfigurer.java
*

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/spring-security-config-5-4-10-sources-
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* /spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/annotation/authentication/ProviderManagerBuilder.java
* /spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/annotation/method/configuration/EnableGlobalMethodSecurity.java
* /spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/annotation/authentication/builders/AuthenticationManagerBuilder.java
* /spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/annotation/authentication/configuration/EnableGlobalAuthentication.java
* /spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/annotation/AlreadyBuiltException.java
* /spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/annotation/AbstractSecurityBuilder.java
* /spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/annotation/authentication/configurers/provisioning/UserDetailsManagerConfigurer.java
*
/spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/annotation/authentication/configurers/userdetails/DaoAuthenticationConfigurer.java
* /spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/annotation/web/configurers/PermitAllSupport.java
* /spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/annotation/web/configurers/JeeConfigurer.java
* /spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/annotation/SecurityConfigurer.java
* /spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/annotation/authentication/configurers/provisioning/JdbcUserDetailsManagerConfigurer.java
* /spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/annotation/web/configurers/PortMapperConfigurer.java
*
/spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/annotation/authentication/configurers/userdetails/UserDetailsAwareConfigurer.java
* /spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/annotation/SecurityConfigurerAdapter.java
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Found in path(s):

- \* /spring-security-config-5-4-10-sources-jar/org/springframework/security/config/annotation/web/configurers/AbstractAuthenticationFilterConfigurer.java
- \* /spring-security-config-5-4-10-sources-jar/org/springframework/security/config/annotation/web/configurers/CsrfConfigurer.java
- \* /spring-security-config-5-4-10-sources-jar/org/springframework/security/config/annotation/authentication/configuration/InitializeAuthenticationProviderBeanManagerConfigurer.java
- \*
- /spring-security-config-5-4-10-sources-jar/org/springframework/security/config/annotation/web/AbstractRequestMatcherRegistry.java
- \* /spring-security-config-5-4-10-sources-jar/org/springframework/security/config/annotation/method/configuration/Jsr250MetadataSourceConfiguration.java
- \* /spring-security-config-5-4-10-sources-jar/org/springframework/security/config/annotation/web/builders/HttpSecurity.java
- \* /spring-security-config-5-4-10-sources-jar/org/springframework/security/config/annotation/web/configurers/openid/OpenIDLoginConfigurer.java
- \* /spring-security-config-5-4-10-sources-jar/org/springframework/security/config/annotation/web/configurers/HeadersConfigurer.java
- \* /spring-security-config-5-4-10-sources-jar/org/springframework/security/config/annotation/web/socket/AbstractSecurityWebSocketMessageBrokerConfigurer.java
- \*
- /spring-security-config-5-4-10-sources-jar/org/springframework/security/config/annotation/method/configuration/GlobalMethodSecurityConfiguration.java
- \* /spring-security-config-5-4-10-sources-jar/org/springframework/security/config/annotation/configuration/ObjectPostProcessorConfiguration.java
- \* /spring-security-config-5-4-10-sources-jar/org/springframework/security/config/annotation/web/configurers/LogoutConfigurer.java
- \* /spring-security-config-5-4-10-sources-jar/org/springframework/security/config/annotation/method/configuration/ReactiveMethodSecurityConfiguration.java
- \*
- /spring-security-config-5-4-10-sources-jar/org/springframework/security/config/annotation/web/servlet/configuration/WebMvcSecurityConfiguration.java
- \* /spring-security-config-5-4-10-sources-jar/org/springframework/security/config/annotation/web/configurers/SessionManagementConfigurer.java
- \* /spring-security-config-5-4-10-sources-jar/org/springframework/security/config/annotation/web/configuration/OAuth2ImportSelector.java
- \*

```

/spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/annotation/web/configurers/HttpBasicConfigurer.java
* /spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/annotation/authentication/configuration/InitializeUserDetailsBeanManager
Configurer.java
* /spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/http/HeadersBeanDefinitionParser.java
* /spring-security-config-5-4-10-sources-jar/org/springframework/security/config/Customizer.java
* /spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/annotation/web/configuration/WebMvcSecurityConfiguration.java
* /spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/annotation/web/reactive/ReactiveOAuth2ClientImportSelector.java
* /spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/annotation/web/reactive/WebFluxSecurityConfiguration.java
* /spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/crypto/RsaKeyConversionServicePostProcessor.java
*
/spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/annotation/authentication/configuration/AuthenticationConfiguration.java
* /spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/annotation/web/reactive/ServerHttpSecurityConfiguration.java
* /spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/http/LogoutBeanDefinitionParser.java
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```

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```

* /spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/http/RememberMeBeanDefinitionParser.java
* /spring-security-config-5-4-10-sources-
jar/org/springframework/security/config/annotation/web/configurers/RememberMeConfigurer.java

```

# 1.383 spring-security-core 5.4.10

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*/spring-security-core-5-4-10-sources-
jar/org/springframework/security/authentication/jaas/AbstractJaasAuthenticationProvider.java
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 */

/**
 * Reviews the Object returned from a secure object invocation, being able to
 * modify the Object or throw an { @link AccessDeniedException }.
 *
 * <p>
 * Typically used to ensure the principal is permitted to access the domain object
 * instance returned by a service layer bean.
 */
```

Can also be used to mutate the domain object

- \* instance so the principal is only able to access authorised bean properties or
- \* `Collection` elements.
- \*
- \* Special consideration should be given to using an `AfterInvocationManager`
- \* on bean methods that modify a database. Typically an
- \* `AfterInvocationManager` is used with read-only methods, such as
- \* `public DomainObject getById(id)`. If used with methods that modify a
- \* database, a transaction manager should be used to ensure any
- \* `AccessDeniedException` will cause a rollback of the changes made by the
- \* transaction.
- \*
- \*
- \* @author Ben Alex
- \* /

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/spring-security-core-5-4-10-sources-jar/org/springframework/security/access/intercept/AfterInvocationManager.java  
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- \* /spring-security-core-5-4-10-sources-
- jar/org/springframework/security/crypto/encrypt/BouncyCastleAesGcmBytesEncryptor.java
- \* /spring-security-core-5-4-10-sources-jar/org/springframework/security/crypto/keygen/BytesKeyGenerator.java
- \* /spring-security-core-5-4-10-sources-jar/org/springframework/security/crypto/keygen/SharedKeyGenerator.java
- \*
- /spring-security-core-5-4-10-sources-
- jar/org/springframework/security/crypto/keygen/HexEncodingStringKeyGenerator.java
- \* /spring-security-core-5-4-10-sources-
- jar/org/springframework/security/crypto/encrypt/HexEncodingTextEncryptor.java
- \* /spring-security-core-5-4-10-sources-jar/org/springframework/security/crypto/keygen/StringKeyGenerator.java
- \* /spring-security-core-5-4-10-sources-jar/org/springframework/security/crypto/encrypt/CipherUtils.java
- \* /spring-security-core-5-4-10-sources-jar/org/springframework/security/crypto/password/PasswordEncoder.java
- \* /spring-security-core-5-4-10-sources-jar/org/springframework/security/crypto/encrypt/BytesEncryptor.java
- \* /spring-security-core-5-4-10-sources-
- jar/org/springframework/security/crypto/keygen/SecureRandomBytesKeyGenerator.java
- \* /spring-security-core-5-4-10-sources-
- jar/org/springframework/security/crypto/password/NoOpPasswordEncoder.java
- \* /spring-security-core-5-4-10-sources-jar/org/springframework/security/crypto/encrypt/TextEncryptor.java
- \*
- /spring-security-core-5-4-10-sources-
- jar/org/springframework/security/crypto/password/StandardPasswordEncoder.java
- \* /spring-security-core-5-4-10-sources-jar/org/springframework/security/crypto/encrypt/AesBytesEncryptor.java
- \* /spring-security-core-5-4-10-sources-
- jar/org/springframework/security/crypto/encrypt/BouncyCastleAesCbcBytesEncryptor.java
- \* /spring-security-core-5-4-10-sources-
- jar/org/springframework/security/crypto/encrypt/BouncyCastleAesBytesEncryptor.java
- \* /spring-security-core-5-4-10-sources-jar/org/springframework/security/crypto/keygen/KeyGenerators.java
- \* /spring-security-core-5-4-10-sources-jar/org/springframework/security/crypto/util/EncodingUtils.java

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\* /spring-security-core-5-4-10-sources-jar/org/springframework/security/jackson2/CoreJackson2Module.java  
\* /spring-security-core-5-4-10-sources-jar/org/springframework/security/jackson2/AnonymousAuthenticationTokenMixin.java  
\* /spring-security-core-5-4-10-sources-jar/org/springframework/security/jackson2/RememberMeAuthenticationTokenMixin.java  
\*  
/spring-security-core-5-4-10-sources-jar/org/springframework/security/jackson2/UnmodifiableSetDeserializer.java  
\* /spring-security-core-5-4-10-sources-jar/org/springframework/security/jackson2/SimpleGrantedAuthorityMixin.java  
\* /spring-security-core-5-4-10-sources-jar/org/springframework/security/jackson2/UserMixin.java  
\* /spring-security-core-5-4-10-sources-jar/org/springframework/security/jackson2/UnmodifiableSetMixin.java  
\* /spring-security-core-5-4-10-sources-jar/org/springframework/security/jackson2/UsernamePasswordAuthenticationTokenMixin.java  
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\* /spring-security-core-5-4-10-sources-jar/org/springframework/security/core/session/SessionIdChangedEvent.java  
\* /spring-security-core-5-4-10-sources-jar/org/springframework/security/core/session/SessionDestroyedEvent.java  
\*  
/spring-security-core-5-4-10-sources-jar/org/springframework/security/access/expressions/method/DefaultMethodSecurityExpressionHandler.java  
\* /spring-security-core-5-4-10-sources-jar/org/springframework/security/authentication/ProviderManager.java

\* /spring-security-core-5-4-10-sources-jar/org/springframework/security/access/expressions/method/MethodSecurityEvaluationContext.java  
\* /spring-security-core-5-4-10-sources-jar/org/springframework/security/authentication/DefaultAuthenticationEventPublisher.java  
\* /spring-security-core-5-4-10-sources-jar/org/springframework/security/core/session/AbstractSessionEvent.java  
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 */
/**
 * @param authentication represents the user in question. Should not be null.
 * @param targetDomainObject the domain object for which permissions should be
 * checked. May be null in which case implementations should return false, as the null
 * condition can be checked explicitly in the expression.
 *
 * @param permission a representation of the permission object as supplied by the
 * expression system. Not null.
 * @return true if the permission is granted, false otherwise
 */
```

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* /spring-security-core-5-4-10-sources-
jar/org/springframework/security/access/method/MapBasedMethodSecurityMetadataSource.java
* /spring-security-core-5-4-10-sources-
jar/org/springframework/security/authentication/rcp/RemoteAuthenticationException.java
* /spring-security-core-5-4-10-sources-jar/org/springframework/security/access/vote/AbstractAclVoter.java
*
/spring-security-core-5-4-10-sources-
jar/org/springframework/security/authentication/event/AuthenticationFailureBadCredentialsEvent.java
* /spring-security-core-5-4-10-sources-jar/org/springframework/security/access/event/AuthorizedEvent.java
* /spring-security-core-5-4-10-sources-jar/org/springframework/security/access/event/LoggerListener.java
* /spring-security-core-5-4-10-sources-
jar/org/springframework/security/authentication/AuthenticationDetailsSource.java
* /spring-security-core-5-4-10-sources-jar/org/springframework/security/util/MethodInvocationUtils.java
* /spring-security-core-5-4-10-sources-
jar/org/springframework/security/authentication/jaas/event/JaasAuthenticationEvent.java
* /spring-security-core-5-4-10-sources-jar/org/springframework/security/util/SimpleMethodInvocation.java
* /spring-security-core-5-4-10-sources-
jar/org/springframework/security/authentication/AnonymousAuthenticationProvider.java
*
/spring-security-core-5-4-10-sources-
jar/org/springframework/security/authentication/UsernamePasswordAuthenticationToken.java
* /spring-security-core-5-4-10-sources-jar/org/springframework/security/util/FieldUtils.java
* /spring-security-core-5-4-10-sources-
jar/org/springframework/security/access/method/AbstractMethodSecurityMetadataSource.java
* /spring-security-core-5-4-10-sources-jar/org/springframework/security/core/userdetails/UserCache.java
* /spring-security-core-5-4-10-sources-jar/org/springframework/security/authentication/AuthenticationManager.java
* /spring-security-core-5-4-10-sources-
jar/org/springframework/security/authentication/dao/DaoAuthenticationProvider.java
* /spring-security-core-5-4-10-sources-
jar/org/springframework/security/core/context/InheritableThreadLocalSecurityContextHolderStrategy.java
* /spring-security-core-5-4-10-sources-jar/org/springframework/security/access/AccessDeniedException.java
* /spring-security-core-5-4-10-sources-jar/org/springframework/security/authentication/event/LoggerListener.java
*
/spring-security-core-5-4-10-sources-
jar/org/springframework/security/authentication/AuthenticationServiceException.java
* /spring-security-core-5-4-10-sources-
jar/org/springframework/security/access/method/MethodSecurityMetadataSource.java
* /spring-security-core-5-4-10-sources-
jar/org/springframework/security/authentication/TestingAuthenticationProvider.java
* /spring-security-core-5-4-10-sources-
jar/org/springframework/security/authentication/event/AuthenticationSuccessEvent.java
* /spring-security-core-5-4-10-sources-

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```

jar/org/springframework/security/authentication/jaas/DefaultLoginExceptionResolver.java
* /spring-security-core-5-4-10-sources-jar/org/springframework/security/core/SpringSecurityMessageSource.java
* /spring-security-core-5-4-10-sources-jar/org/springframework/security/core/Authentication.java
* /spring-security-core-5-4-10-sources-
jar/org/springframework/security/access/annotation/SecuredAnnotationSecurityMetadataSource.java
*
/spring-security-core-5-4-10-sources-
jar/org/springframework/security/authentication/BadCredentialsException.java
* /spring-security-core-5-4-10-sources-
jar/org/springframework/security/access/intercept/aopalliance/MethodSecurityInterceptor.java
* /spring-security-core-5-4-10-sources-jar/org/springframework/security/access/vote/AffirmativeBased.java
* /spring-security-core-5-4-10-sources-jar/org/springframework/security/authentication/AuthenticationProvider.java
* /spring-security-core-5-4-10-sources-
jar/org/springframework/security/authentication/event/AuthenticationFailureLockedEvent.java
* /spring-security-core-5-4-10-sources-
jar/org/springframework/security/access/annotation/JsR250MethodSecurityMetadataSource.java
* /spring-security-core-5-4-10-sources-
jar/org/springframework/security/authentication/event/AbstractAuthenticationEvent.java
* /spring-security-core-5-4-10-sources-
jar/org/springframework/security/access/event/AbstractAuthorizationEvent.java
* /spring-security-core-5-4-10-sources-jar/org/springframework/security/core/AuthenticationException.java
*
/spring-security-core-5-4-10-sources-jar/org/springframework/security/core/context/SecurityContext.java
* /spring-security-core-5-4-10-sources-jar/org/springframework/security/access/AuthorizationServiceException.java
* /spring-security-core-5-4-10-sources-jar/org/springframework/security/access/vote/ConsensusBased.java
* /spring-security-core-5-4-10-sources-
jar/org/springframework/security/authentication/TestingAuthenticationToken.java
* /spring-security-core-5-4-10-sources-jar/org/springframework/security/core/userdetails/UserDetails.java
* /spring-security-core-5-4-10-sources-jar/org/springframework/security/access/ConfigAttribute.java
* /spring-security-core-5-4-10-sources-
jar/org/springframework/security/authentication/event/AuthenticationFailureCredentialsExpiredEvent.java
* /spring-security-core-5-4-10-sources-jar/org/springframework/security/core/GrantedAuthority.java
* /spring-security-core-5-4-10-sources-jar/org/springframework/security/access/vote/UnanimousBased.java
*
/spring-security-core-5-4-10-sources-
jar/org/springframework/security/access/vote/AbstractAccessDecisionManager.java
* /spring-security-core-5-4-10-sources-jar/org/springframework/security/access/SecurityMetadataSource.java
* /spring-security-core-5-4-10-sources-
jar/org/springframework/security/authentication/event/AuthenticationFailureProviderNotFoundEvent.java
* /spring-security-core-5-4-10-sources-
jar/org/springframework/security/authentication/event/InteractiveAuthenticationSuccessEvent.java
* /spring-security-core-5-4-10-sources-
jar/org/springframework/security/authentication/jaas/JaasNameCallbackHandler.java
* /spring-security-core-5-4-10-sources-
jar/org/springframework/security/authentication/jaas/JaasPasswordCallbackHandler.java
* /spring-security-core-5-4-10-sources-
jar/org/springframework/security/authentication/jaas/JaasAuthenticationCallbackHandler.java
* /spring-security-core-5-4-10-sources-jar/org/springframework/security/core/context/SecurityContextHolder.java

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```

*
/spring-security-core-5-4-10-sources-jar/org/springframework/security/core/context/SecurityContextImpl.java
* /spring-security-core-5-4-10-sources-
jar/org/springframework/security/core/userdetails/UsernameNotFoundException.java
* /spring-security-core-5-4-10-sources-
jar/org/springframework/security/authentication/AuthenticationTrustResolverImpl.java
* /spring-security-core-5-4-10-sources-jar/org/springframework/security/authentication/jaas/AuthorityGranter.java
* /spring-security-core-5-4-10-sources-
jar/org/springframework/security/authentication/RememberMeAuthenticationProvider.java
* /spring-security-core-5-4-10-sources-
jar/org/springframework/security/core/context/ThreadLocalSecurityContextHolderStrategy.java
* /spring-security-core-5-4-10-sources-
jar/org/springframework/security/core/context/GlobalSecurityContextHolderStrategy.java
* /spring-security-core-5-4-10-sources-
jar/org/springframework/security/authentication/AuthenticationTrustResolver.java
*
/spring-security-core-5-4-10-sources-jar/org/springframework/security/access/vote/AuthenticatedVoter.java
* /spring-security-core-5-4-10-sources-
jar/org/springframework/security/authentication/ProviderNotFoundException.java
* /spring-security-core-5-4-10-sources-jar/org/springframework/security/core/userdetails/cache/NullUserCache.java
* /spring-security-core-5-4-10-sources-
jar/org/springframework/security/authentication/jaas/event/JaasAuthenticationFailedEvent.java
* /spring-security-core-5-4-10-sources-
jar/org/springframework/security/authentication/AnonymousAuthenticationToken.java
* /spring-security-core-5-4-10-sources-jar/org/springframework/security/core/userdetails/User.java
* /spring-security-core-5-4-10-sources-
jar/org/springframework/security/access/intercept/aspectj/AspectJCallback.java
* /spring-security-core-5-4-10-sources-jar/org/springframework/security/access/vote/RoleVoter.java
* /spring-security-core-5-4-10-sources-jar/org/springframework/security/access/intercept/RunAsManagerImpl.java
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/spring-security-core-5-4-10-sources-
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* /spring-security-core-5-4-10-sources-
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* /spring-security-core-5-4-10-sources-
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* /spring-security-core-5-4-10-sources-
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* /spring-security-core-5-4-10-sources-
jar/org/springframework/security/access/intercept/AfterInvocationProviderManager.java
* /spring-security-core-5-4-10-sources-
jar/org/springframework/security/core/userdetails/memory/UserAttribute.java
* /spring-security-core-5-4-10-sources-
jar/org/springframework/security/authentication/event/AuthenticationFailureDisabledEvent.java
*

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/spring-security-core-5-4-10-sources-jar/org/springframework/security/access/AccessDecisionManager.java  
 \* /spring-security-core-5-4-10-sources-jar/org/springframework/security/access/intercept/RunAsManager.java  
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 \* /spring-security-core-5-4-10-sources-jar/org/springframework/security/authentication/RememberMeAuthenticationToken.java  
 \* /spring-security-core-5-4-10-sources-jar/org/springframework/security/authentication/CredentialsExpiredException.java  
 \* /spring-security-core-5-4-10-sources-jar/org/springframework/security/core/userdetails/UserDetailsService.java  
 \* /spring-security-core-5-4-10-sources-jar/org/springframework/security/access/AfterInvocationProvider.java  
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 \* /spring-security-core-5-4-10-sources-jar/org/springframework/security/core/session/SessionRegistry.java  
 \* /spring-security-core-5-4-10-sources-jar/org/springframework/security/access/annotation/Secured.java  
 \* /spring-security-core-5-4-10-sources-jar/org/springframework/security/access/event/AuthorizationFailureEvent.java  
 \* /spring-security-core-5-4-10-sources-jar/org/springframework/security/authentication/jaas/LoginExceptionResolver.java  
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 \* /spring-security-core-5-4-10-sources-jar/org/springframework/security/authentication/rcp/RemoteAuthenticationProvider.java  
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 /spring-security-core-5-4-10-sources-jar/org/springframework/security/access/intercept/RunAsUserToken.java  
 \* /spring-security-core-5-4-10-sources-jar/org/springframework/security/authentication/jaas/JaasGrantedAuthority.java  
 \* /spring-security-core-5-4-10-sources-jar/org/springframework/security/access/intercept/aopalliance/MethodSecurityMetadataSourceAdvisor.java

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* /spring-security-core-5-4-10-sources-jar/org/springframework/security/access/intercept/NullRunAsManager.java
* /spring-security-core-5-4-10-sources-
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* /spring-security-core-5-4-10-sources-
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* /spring-security-core-5-4-10-sources-jar/org/springframework/security/util/InMemoryResource.java
* /spring-security-core-5-4-10-sources-
jar/org/springframework/security/authentication/jaas/SecurityContextLoginModule.java
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/spring-security-core-5-4-10-sources-
jar/org/springframework/security/authentication/jaas/JaasAuthenticationProvider.java
* /spring-security-core-5-4-10-sources-
jar/org/springframework/security/authentication/InsufficientAuthenticationException.java
* /spring-security-core-5-4-10-sources-jar/org/springframework/security/core/session/SessionInformation.java
* /spring-security-core-5-4-10-sources-
jar/org/springframework/security/authentication/jaas/JaasAuthenticationToken.java
* /spring-security-core-5-4-10-sources-jar/org/springframework/security/access/SecurityConfig.java
* /spring-security-core-5-4-10-sources-
jar/org/springframework/security/access/intercept/RunAsImplAuthenticationProvider.java
* /spring-security-core-5-4-10-sources-jar/org/springframework/security/authentication/LockedException.java
* /spring-security-core-5-4-10-sources-
jar/org/springframework/security/access/intercept/InterceptorStatusToken.java
* /spring-security-core-5-4-10-sources-jar/org/springframework/security/access/AccessDecisionVoter.java
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jar/org/springframework/security/access/prepost/PrePostAdviceReactiveMethodInterceptor.java
* /spring-security-core-5-4-10-sources-
jar/org/springframework/security/authentication/CachingUserDetailsService.java
* /spring-security-core-5-4-10-sources-
jar/org/springframework/security/authorization/AuthorityReactiveAuthorizationManager.java

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/spring-security-core-5-4-10-sources-
jar/org/springframework/security/crypto/password/DelegatingPasswordEncoder.java
* /spring-security-core-5-4-10-sources-
jar/org/springframework/security/crypto/password/Pbkdf2PasswordEncoder.java
* /spring-security-core-5-4-10-sources-
jar/org/springframework/security/core/token/KeyBasedPersistenceTokenService.java
* /spring-security-core-5-4-10-sources-
jar/org/springframework/security/crypto/keygen/Base64StringKeyGenerator.java
* /spring-security-core-5-4-10-sources-
jar/org/springframework/security/crypto/password/MessageDigestPasswordEncoder.java
* /spring-security-core-5-4-10-sources-
jar/org/springframework/security/concurrent/DelegatingSecurityContextCallable.java
* /spring-security-core-5-4-10-sources-
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* /spring-security-core-5-4-10-sources-
jar/org/springframework/security/jackson2/UnmodifiableListDeserializer.java
*
/spring-security-core-5-4-10-sources-
jar/org/springframework/security/authentication/DelegatingReactiveAuthenticationManager.java
* /spring-security-core-5-4-10-sources-
jar/org/springframework/security/concurrent/DelegatingSecurityContextRunnable.java
* /spring-security-core-5-4-10-sources-
jar/org/springframework/security/jackson2/BadCredentialsExceptionMixin.java
* /spring-security-core-5-4-10-sources-
jar/org/springframework/security/core/userdetails/ReactiveUserDetailsPasswordService.java
* /spring-security-core-5-4-10-sources-jar/org/springframework/security/provisioning/JdbcUserDetailsManager.java
* /spring-security-core-5-4-10-sources-
jar/org/springframework/security/crypto/password/Md4PasswordEncoder.java
* /spring-security-core-5-4-10-sources-jar/org/springframework/security/jackson2/UnmodifiableListMixin.java
* /spring-security-core-5-4-10-sources-jar/org/springframework/security/core/Transient.java
* /spring-security-core-5-4-10-sources-
jar/org/springframework/security/scheduling/DelegatingSecurityContextTaskScheduler.java
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jar/org/springframework/security/core/parameters/AnnotationParameterNameDiscoverer.java

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jar/org/springframework/security/core/annotation/AuthenticationPrincipal.java

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\* /spring-security-core-5-4-10-sources-

jar/org/springframework/security/core/annotation/CurrentSecurityContext.java

\* /spring-security-core-5-4-10-sources-

jar/org/springframework/security/authentication/ReactiveAuthenticationManagerResolver.java

\*

/spring-security-core-5-4-10-sources-

jar/org/springframework/security/authentication/event/LogoutSuccessEvent.java

\* /spring-security-core-5-4-10-sources-

jar/org/springframework/security/authentication/ReactiveAuthenticationManagerAdapter.java

\* /spring-security-core-5-4-10-sources-

jar/org/springframework/security/authentication/AuthenticationManagerResolver.java

\* /spring-security-core-5-4-10-sources-jar/org/springframework/security/crypto/scrypt/SCryptPasswordEncoder.java

\* /spring-security-core-5-4-10-sources-

jar/org/springframework/security/core/userdetails/UserDetailsPasswordService.java

\* /spring-security-core-5-4-10-sources-

jar/org/springframework/security/core/token/SecureRandomFactoryBean.java

\* /spring-security-core-5-4-10-sources-

jar/org/springframework/security/authentication/AbstractUserDetailsReactiveAuthenticationManager.java

\* /spring-security-core-5-4-10-sources-

jar/org/springframework/security/crypto/argon2/Argon2PasswordEncoder.java

\*  
/spring-security-core-5-4-10-sources-  
jar/org/springframework/security/authentication/UserDetailsRepositoryReactiveAuthenticationManager.java  
\* /spring-security-core-5-4-10-sources-  
jar/org/springframework/security/access/expressions/method/ExpressionBasedPreInvocationAdvice.java  
\* /spring-security-core-5-4-10-sources-jar/org/springframework/security/crypto/argon2/Argon2EncodingUtils.java  
\* /spring-security-core-5-4-10-sources-  
jar/org/springframework/security/access/hierarchicalroles/RoleHierarchyImpl.java  
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jar/org/springframework/security/crypto/bcrypt/BCryptPasswordEncoder.java  
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\* /spring-security-core-5-4-10-sources-jar/org/springframework/security/authentication/jaas/memory/InMemoryConfiguration.java  
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jar/org/springframework/security/access/expression/SecurityExpressionHandler.java

\* /spring-security-core-5-4-10-sources-jar/org/springframework/security/access/method/package-info.java

\* /spring-security-core-5-4-10-sources-

jar/org/springframework/security/authentication/AuthenticationEventPublisher.java

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/spring-security-core-5-4-10-sources-jar/org/springframework/security/access/prepost/package-info.java

\* /spring-security-core-5-4-10-sources-jar/org/springframework/security/core/authority/AuthorityUtils.java

\* /spring-security-core-5-4-10-sources-jar/org/springframework/security/access/prepost/PostAuthorize.java

\* /spring-security-core-5-4-10-sources-

jar/org/springframework/security/access/prepost/PrePostInvocationAttributeFactory.java

\* /spring-security-core-5-4-10-sources-

jar/org/springframework/security/core/authority/mapping/MappableAttributesRetriever.java

\* /spring-security-core-5-4-10-sources-jar/org/springframework/security/authentication/event/package-info.java

\* /spring-security-core-5-4-10-sources-

jar/org/springframework/security/access/expression/method/ExpressionBasedPostInvocationAdvice.java

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jar/org/springframework/security/access/intercept/aspectj/AspectJMethodSecurityInterceptor.java
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* /spring-security-core-5-4-10-sources-jar/org/springframework/security/core/userdetails/memory/package-info.java
* /spring-security-core-5-4-10-sources-jar/org/springframework/security/crypto/codec/Utf8.java
* /spring-security-core-5-4-10-sources-jar/org/springframework/security/access/vote/RoleHierarchyVoter.java
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* /spring-security-core-5-4-10-sources-
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* /spring-security-core-5-4-10-sources-jar/org/springframework/security/core/package-info.java
* /spring-security-core-5-4-10-sources-jar/org/springframework/security/access/PermissionCacheOptimizer.java
* /spring-security-core-5-4-10-sources-jar/org/springframework/security/core/userdetails/package-info.java
* /spring-security-core-5-4-10-sources-
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* /spring-security-core-5-4-10-sources-
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* /spring-security-core-5-4-10-sources-jar/org/springframework/security/access/prepost/PreFilter.java
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* /spring-security-core-5-4-10-sources-
jar/org/springframework/security/access/expression/DenyAllPermissionEvaluator.java
* /spring-security-core-5-4-10-sources-jar/org/springframework/security/access/intercept/aspectj/package-info.java
* /spring-security-core-5-4-10-sources-jar/org/springframework/security/core/ComparableVersion.java
* /spring-security-core-5-4-10-sources-jar/org/springframework/security/access/prepost/PreInvocationAttribute.java
* /spring-security-core-5-4-10-sources-jar/org/springframework/security/access/intercept/package-info.java
* /spring-security-core-5-4-10-sources-jar/org/springframework/security/access/annotation/Jsr250Voter.java
*
/spring-security-core-5-4-10-sources-
jar/org/springframework/security/access/intercept/aspectj/MethodInvocationAdapter.java
* /spring-security-core-5-4-10-sources-jar/org/springframework/security/core/token/package-info.java
* /spring-security-core-5-4-10-sources-
jar/org/springframework/security/access/expression/AbstractSecurityExpressionHandler.java
* /spring-security-core-5-4-10-sources-
jar/org/springframework/security/core/authority/mapping/MapBasedAttributes2GrantedAuthoritiesMapper.java
* /spring-security-core-5-4-10-sources-
jar/org/springframework/security/crypto/password/AbstractPasswordEncoder.java
* /spring-security-core-5-4-10-sources-
jar/org/springframework/security/core/authority/SimpleGrantedAuthority.java
* /spring-security-core-5-4-10-sources-jar/org/springframework/security/authentication/jaas/event/package-info.java
* /spring-security-core-5-4-10-sources-

```

```

jar/org/springframework/security/core/userdetails/UserDetailsByNameServiceWrapper.java
*
/spring-security-core-5-4-10-sources-jar/org/springframework/security/access/intercept/aopalliance/package-
info.java
* /spring-security-core-5-4-10-sources-
jar/org/springframework/security/task/DelegatingSecurityContextTaskExecutor.java
* /spring-security-core-5-4-10-sources-
jar/org/springframework/security/access/annotation/AnnotationMetadataExtractor.java
* /spring-security-core-5-4-10-sources-
jar/org/springframework/security/access/prepost/PostInvocationAuthorizationAdvice.java
* /spring-security-core-5-4-10-sources-jar/org/springframework/security/core/CredentialsContainer.java
* /spring-security-core-5-4-10-sources-jar/org/springframework/security/core/context/package-info.java
* /spring-security-core-5-4-10-sources-jar/org/springframework/security/jackson2/package-info.java
* /spring-security-core-5-4-10-sources-jar/org/springframework/security/core/authority/mapping/package-info.java
* /spring-security-core-5-4-10-sources-
jar/org/springframework/security/core/authority/mapping/SimpleAuthorityMapper.java
*
/spring-security-core-5-4-10-sources-jar/org/springframework/security/authentication/jaas/package-info.java
* /spring-security-core-5-4-10-sources-
jar/org/springframework/security/provisioning/InMemoryUserDetailsManager.java
* /spring-security-core-5-4-10-sources-jar/org/springframework/security/authentication/rcp/package-info.java
* /spring-security-core-5-4-10-sources-jar/org/springframework/security/access/annotation/package-info.java
* /spring-security-core-5-4-10-sources-
jar/org/springframework/security/access/prepost/PostInvocationAttribute.java
* /spring-security-core-5-4-10-sources-
jar/org/springframework/security/access/prepost/PostInvocationAdviceProvider.java
* /spring-security-core-5-4-10-sources-jar/org/springframework/security/access/prepost/PreAuthorize.java
* /spring-security-core-5-4-10-sources-jar/org/springframework/security/access/method/P.java
* /spring-security-core-5-4-10-sources-
jar/org/springframework/security/access/expression/SecurityExpressionRoot.java
*
/spring-security-core-5-4-10-sources-
jar/org/springframework/security/access/prepost/PrePostAnnotationSecurityMetadataSource.java
* /spring-security-core-5-4-10-sources-
jar/org/springframework/security/task/DelegatingSecurityContextAsyncTaskExecutor.java
* /spring-security-core-5-4-10-sources-jar/org/springframework/security/core/userdetails/jdbc/package-info.java
* /spring-security-core-5-4-10-sources-jar/org/springframework/security/access/package-info.java
* /spring-security-core-5-4-10-sources-
jar/org/springframework/security/concurrent/DelegatingSecurityContextExecutor.java
* /spring-security-core-5-4-10-sources-
jar/org/springframework/security/concurrent/AbstractDelegatingSecurityContextSupport.java
* /spring-security-core-5-4-10-sources-jar/org/springframework/security/core/token/DefaultToken.java
* /spring-security-core-5-4-10-sources-jar/org/springframework/security/crypto/codec/package-info.java
*
/spring-security-core-5-4-10-sources-
jar/org/springframework/security/authentication/InternalAuthenticationServiceException.java
* /spring-security-core-5-4-10-sources-jar/org/springframework/security/provisioning/MutableUserDetails.java
* /spring-security-core-5-4-10-sources-

```

```

jar/org/springframework/security/core/authority/mapping/SimpleMappableAttributesRetriever.java
* /spring-security-core-5-4-10-sources-jar/org/springframework/security/provisioning/GroupManager.java
* /spring-security-core-5-4-10-sources-
jar/org/springframework/security/access/expression/method/AbstractExpressionBasedMethodConfigAttribute.java
* /spring-security-core-5-4-10-sources-jar/org/springframework/security/util/package-info.java
* /spring-security-core-5-4-10-sources-
jar/org/springframework/security/access/prepost/PreInvocationAuthorizationAdvice.java
* /spring-security-core-5-4-10-sources-
jar/org/springframework/security/access/expression/method/PreInvocationExpressionAttribute.java
* /spring-security-core-5-4-10-sources-jar/org/springframework/security/access/event/package-info.java
*
/spring-security-core-5-4-10-sources-
jar/org/springframework/security/access/method/AbstractFallbackMethodSecurityMetadataSource.java
* /spring-security-core-5-4-10-sources-
jar/org/springframework/security/core/userdetails/cache/SpringCacheBasedUserCache.java
* /spring-security-core-5-4-10-sources-jar/org/springframework/security/provisioning/package-info.java
* /spring-security-core-5-4-10-sources-jar/org/springframework/security/core/userdetails/cache/package-info.java
* /spring-security-core-5-4-10-sources-
jar/org/springframework/security/access/expression/method/MethodSecurityExpressionRoot.java
* /spring-security-core-5-4-10-sources-jar/org/springframework/security/access/hierarchicalroles/package-info.java
* /spring-security-core-5-4-10-sources-jar/org/springframework/security/access/expression/ExpressionUtils.java
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Found in path(s):

```

* /spring-security-core-5-4-10-sources-jar/org/springframework/security/jackson2/SecurityJackson2Modules.java
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* WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.
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* limitations under the License.
*/
/**
* A token issued by { @link TokenService}.
*
* <p>
* It is important that the keys assigned to tokens are sufficiently randomised and
* secured that they can serve as identifying a unique user session. Implementations of
* { @link TokenService} are free to use encryption or encoding strategies of their
* choice.
* It is strongly recommended that keys are of sufficient length to balance safety against
* persistence cost. In relation to persistence cost, it is strongly recommended that
* returned keys are small enough for encoding in a cookie.
* </p>
*
* @author Ben Alex
* @since 2.0.1
*/

```

Found in path(s):

`/spring-security-core-5-4-10-sources-jar/org/springframework/security/core/token/Token.java`

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*/
/**
* Base64 encoder which is a reduced version of Robert Harder's public domain

```

\* implementation (version 2.3.7). See <http://iharder.sourceforge.net/current/java/base64/> for more information.

<p>

\* For internal use only.

\*

\* @author  
Luke Taylor

\* @since 3.0

\* @deprecated Use java.util.Base64

\*/

Found in path(s):

\*/spring-security-core-5-4-10-sources-jar/org/springframework/security/crypto/codec/Base64.java

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\*/spring-security-core-5-4-10-sources-jar/org/springframework/security/crypto/encrypt/Encryptors.java

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\*/

Found in path(s):

\* /spring-security-core-5-4-10-sources-  
jar/org/springframework/security/core/userdetails/MapReactiveUserDetailsService.java  
\* /spring-security-core-5-4-10-sources-  
jar/org/springframework/security/crypto/factory/PasswordEncoderFactories.java  
\* /spring-security-core-5-4-10-sources-  
jar/org/springframework/security/authentication/ReactiveAuthenticationManager.java  
\*  
/spring-security-core-5-4-10-sources-jar/org/springframework/security/authorization/AuthorizationDecision.java  
\* /spring-security-core-5-4-10-sources-jar/org/springframework/security/core/AuthenticatedPrincipal.java  
\* /spring-security-core-5-4-10-sources-  
jar/org/springframework/security/authorization/AuthenticatedReactiveAuthorizationManager.java  
\* /spring-security-core-5-4-10-sources-  
jar/org/springframework/security/crypto/password/PasswordEncoderUtils.java  
\* /spring-security-core-5-4-10-sources-  
jar/org/springframework/security/core/context/ReactiveSecurityContextHolder.java  
\* /spring-security-core-5-4-10-sources-  
jar/org/springframework/security/authorization/ReactiveAuthorizationManager.java  
\* /spring-security-core-5-4-10-sources-jar/org/springframework/security/core/SpringSecurityCoreVersion.java  
\* /spring-security-core-5-4-10-sources-jar/org/springframework/security/crypto/password/Md4.java  
\* /spring-security-core-5-4-10-sources-jar/org/springframework/security/core/parameters/P.java  
\*  
/spring-security-core-5-4-10-sources-  
jar/org/springframework/security/core/userdetails/ReactiveUserDetailsService.java  
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\* limitations under the License.  
\*/  
/\*\*  
\* Determines if the { @link #getAuthentication() } has permission to access the target  
\* given the permission

```

* @param target the target domain object to check permission on
* @param permission the permission to check on the domain object (i.e. "read",
* "write", etc).
* @return true if permission
is granted to the { @link #getAuthentication()}, else
* false
*/

```

Found in path(s):

```

* /spring-security-core-5-4-10-sources-
jar/org/springframework/security/access/expression/SecurityExpressionOperations.java

```

# 1.384 pytest 4.6.3

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Adam Azarchs <adam.azarchs@10xgenomics.com>  
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Adam Eijdenberg <adam@continusec.com>  
Adam Harvey <aharvey@php.net>  
Adam Kisala <adam.kisala@gmail.com>  
Adam Langley <agl@golang.org>  
Adam Medzinski <adam.medzinski@gmail.com>  
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Adrien Delorme <adrien.delorme@icloud.com>  
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Aeneas Rekkas (arekkas) <aeneas@ory.am>  
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Andrew Bonventre <andybons@chromium.org>  
Andrew Braunstein <awbraunstein@gmail.com>  
Andrew Bursavich <abursavich@gmail.com>  
Andrew Ekstedt <andrew.ekstedt@gmail.com>  
Andrew Etter <andrew.etter@gmail.com>  
Andrew G. Morgan <agm@google.com>  
Andrew Gerrand <adg@golang.org>

Andrew Harding <andrew@spacemonkey.com>  
Andrew Jackura <ajackura@google.com>  
Andrew Louis <alouis@digitalocean.com>  
Andrew Lutomirski <andy@luto.us>  
Andrew Medvedev <andrew.y.medvedev@gmail.com>  
Andrew Pilloud <andrewpilloud@igneoussystems.com>  
Andrew  
Pogrebnoy <absourd.noise@gmail.com>  
Andrew Poydence <apoydence@pivotal.io>  
Andrew Pritchard <awpritchard@gmail.com>  
Andrew Radev <andrey.radev@gmail.com>  
Andrew Skiba <skibaa@gmail.com>  
Andrew Stormont <astormont@racktopsystems.com>  
Andrew Stribblehill <ads@wompom.org>  
Andrew Szeto <andrew@jabagawee.com>  
Andrew Todd <andrew.todd@wework.com>  
Andrew Werner <andrew@upthere.com> <awerner32@gmail.com>  
Andrew Wilkins <axwalk@gmail.com>  
Andrew Williams <williams.andrew@gmail.com>  
Andrew Z Allen <me@andrewzallen.com>  
Andrey Mirtchovski <mirtchovski@gmail.com>  
Andrey Petrov <andrey.petrov@shazow.net>  
Andrii Soldatenko <andrii.soldatenko@gmail.com>  
Andrii Soluk <isoluchok@gmail.com>  
Andriy Lytvynov <lytvynov.a.v@gmail.com>  
Andrzej eel <andrii.zhezhel@gmail.com>  
Andy Balholm <andy@balholm.com>  
Andy Davis <andy@bigandian.com>  
Andy Finkentadt <afinkentadt@zynga.com>  
Andy Lindeman <andy@lindeman.io>  
Andy Maloney <asmaloney@gmail.com>  
Andy Pan <panjf2000@gmail.com>  
Andy Walker  
<walkeraj@gmail.com>  
Andy Wang <cbeuw.andy@gmail.com>  
Andzej Maciusovic <andzej.maciusovic@gmail.com>  
Anfernee Yongkun Gui <anfernee.gui@gmail.com>  
Angelo Bulfone <mbulfone@gmail.com>  
Anh Hai Trinh <anh.hai.trinh@gmail.com>  
Anit Gandhi <anitgandhi@gmail.com>  
Ankit Goyal <ankit3goyal@gmail.com>  
Anmol Sethi <anmol@aubble.com>  
Annirudh Prasad <annirudh@wandb.com>  
Anschel Schaffer-Cohen <anschelsc@gmail.com>  
Anthony Alves <cvballa3g0@gmail.com>  
Anthony Canino <anthony.canino1@gmail.com>  
Anthony Eufemio <anthony.eufemio@gmail.com>  
Anthony Fok <foka@debian.org>

Anthony Martin <ality@pbrane.org>  
Anthony Sottile <asottile@umich.edu>  
Anthony Starks <ajstarks@gmail.com>  
Anthony Voutas <voutasaurus@gmail.com>  
Anthony Woods <awoods@raintank.io>  
Antoine GIRARD <sapk@sapk.fr>  
Antoine Martin <antoine97.martin@gmail.com>  
Anton Gyllenberg <anton@iki.fi>  
Anton Kuklin <anton.a.kuklin@gmail.com>  
Antonin Amand <antonin.amand@gmail.com>  
Antonio Antelo <aantelov87@gmail.com>  
Antonio Bibiano <antbbn@gmail.com>  
Antonio  
Huete Jimenez <tuxillo@quantummachine.net>  
Antonio Murdaca <runcom@redhat.com>  
Antonio Troina <thoeni@gmail.com>  
Anze Kolar <me@akolar.com>  
Aofei Sheng <aofei@aofeisheng.com>  
Apisak Darakananda <pongad@gmail.com>  
Aram Hvrneanu <aram@mgk.ro>  
Araragi Hokuto <kanseihonbucho@protonmail.com>  
Arash Bina <arash@arash.io>  
Arda Gl <ardaguclu@gmail.com>  
Areski Belaid <areski@gmail.com>  
Ariel Mashraki <ariel@mashraki.co.il>  
Arkadi Pyuro <arkadi@google.com>  
Arlo Breault <arlolra@gmail.com>  
Arnaud Ysmal <arnaud.ysmal@gmail.com>  
Arne Hormann <arnehormann@gmail.com>  
Arnout Engelen <arnout@bzzt.net>  
Aron Nopanen <aron.nopanen@gmail.com>  
Artem Alekseev <artem.alekseev@intel.com>  
Artem Kolin <artemkaxboy@gmail.com>  
Arthur Fabre <arthur@arthurfabre.com>  
Arthur Khashaev <arthur@khashaev.ru>  
Artyom Pervukhin <artyom.pervukhin@gmail.com>  
Arvinth Rajesh Tamilmani <art@a-30.net>  
Ashish Gandhi <ag@ashishgandhi.org>  
Asim Shankar <asimshankar@gmail.com>  
Atin Malaviya <amalaviy@akamai.com>  
Ato Araki  
<ato.araki@gmail.com>  
Audrey Lim <audreylh@gmail.com>  
Audrius Butkevicius <audrius.butkevicius@gmail.com>  
Augusto Roman <aroman@gmail.com>  
Aulus Egnatius Varialus <varialus@gmail.com>  
Aurlien Rainone <aurelien.rainone@gmail.com>  
Aurlio A. Heckert <aurium@gmail.com>

Austin Clements <austin@google.com> <aclements@csail.mit.edu>  
Avi Flax <avi@timehop.com>  
awaw fumin <awawfumin@gmail.com>  
Awn Umar <awn@cryptolosophy.io>  
Axel Wagner <axel.wagner.hh@googlemail.com>  
Ayan George <ayan@ayan.net>  
Ayanamist Yang <ayanamist@gmail.com>  
Ayke van Laethem <aykevanlaethem@gmail.com>  
Aymerick Jhanne <aymerick@jehanne.org>  
Azat Kaumov <kaumov.a.r@gmail.com>  
Baiju Muthukadan <baiju.m.mail@gmail.com>  
Balaram Makam <bmakam.qdt@qualcommdatacenter.com>  
Balazs Lecz <leczb@google.com>  
Baokun Lee <nototon@gmail.com>  
Barnaby Keene <accounts@southcla.ws>  
Bartosz Grzybowski <melkorm@gmail.com>  
Bartosz Oler <brtsz@google.com>  
Bastian Ike <bastian.ike@gmail.com>  
Ben Burkert <ben@benburkert.com>  
Ben Eitzen <eitzenb@golang.org>  
Ben  
Fried <ben.fried@gmail.com>  
Ben Haines <bhainesva@gmail.com>  
Ben Hoyt <benhoyt@gmail.com>  
Ben Laurie <ben@links.org> <benl@google.com>  
Ben Lubar <ben.lubar@gmail.com>  
Ben Lynn <benlynn@gmail.com>  
Ben Olive <sionide21@gmail.com>  
Ben Schwartz <bemasc@google.com>  
Ben Shi <powerman1st@163.com>  
Ben Toews <mastahyeti@gmail.com>  
Benjamin Black <b@b3k.us>  
Benjamin Cable <cable.benjamin@gmail.com>  
Benjamin Hsieh <tanookiben@users.noreply.github.com>  
Benjamin Peterson <benjamin@python.org>  
Benjamin Prosnitz <bprosnitz@google.com>  
Benjamin Wester <bwester@squareup.com>  
Benjamin Wuethrich <benjamin.wuethrich@gmail.com>  
Benny Siegert <bsiegert@gmail.com>  
Benoit Sigoure <tsunanet@gmail.com>  
Berengar Lehr <Berengar.Lehr@gmx.de>  
Berkant Ipek <41230766+0xbkt@users.noreply.github.com>  
Bharath Thiruveedula <tbharath91@gmail.com>  
Bhavin Gandhi <bhavin7392@gmail.com>  
Bill Neubauer <wcn@golang.org> <wcn@google.com> <bill.neubauer@gmail.com>  
Bill O'Farrell <billo@ca.ibm.com>  
Bill Prin <waprin@google.com>  
Bill

Thiede <couchmoney@gmail.com>  
Bill Zissimopoulos <billziss@navimatics.com>  
Billie Harold Cleek <bhcleek@gmail.com>  
Billy Lynch <wlynch@google.com>  
Billy Zaelani Malik <m.billyzaelani@gmail.com>  
Bjrn Erik Pedersen <bjorn.erik.pedersen@gmail.com>  
Bjorn Tillenius <bjorn@tillenius.me>  
Bjorn Tipling <bjorn.tipling@gmail.com>  
Blain Smith <rebelgeek@blainsmith.com>  
Blake Gentry <blakesgentry@gmail.com>  
Blake Mesdag <blakemesdag@gmail.com>  
Blake Mizerany <blake.mizerany@gmail.com>  
Blixt <me@blixt.nyc>  
Bob Briski <rbriski@gmail.com>  
Bob McNaughton <bobmcn@gmail.com>  
Bob Potter <bobby.potter@gmail.com>  
Bobby DeSimone <bobbydesimone@gmail.com>  
Bobby Powers <bobbypowers@gmail.com>  
Boqin Qin <bobbqqin@gmail.com>  
Boris Nagaev <nagaev@google.com>  
Borja Clemente <borja.clemente@gmail.com>  
Brad Burch <brad.burch@gmail.com>  
Brad Erickson <bderickson@gmail.com>  
Brad Fitzpatrick <bradfitz@golang.org> <bradfitz@gmail.com>  
Brad Garcia <bgarcia@golang.org>  
Brad Jones <rbrjones@google.com>  
Brad  
Morgan <brad@morgabra.com>  
Brad Whitaker <bwhitaker@fastly.com>  
Braden Bassingthwaite <bbassingthwaite@vendasta.com>  
Bradford Lamson-Scribner <brad.lamson@gmail.com>  
Bradley Falzon <brad@teambrad.net>  
Brady Catherman <brady@gmail.com>  
Brady Sullivan <brady@bsull.com>  
Brandon Bennett <bbennett@fb.com>  
Brandon Gilmore <varz@google.com>  
Brandon Philips <brandon@ifup.org>  
Brandon Ryan <bjryan19@gmail.com>  
Brayden Cloud <bcloud@google.com>  
Brendan Daniel Tracey <tracey.brendan@gmail.com>  
Brendan O'Dea <bod@golang.org>  
Brett Cannon <bcannon@gmail.com>  
Brett Merrill <brett.j.merrill94@gmail.com>  
Brian Dellisanti <briandellisanti@gmail.com>  
Brian Downs <brian.downs@gmail.com>  
Brian Falk <falk@logicparty.org>  
Brian G. Merrell <bgmerrell@gmail.com>  
Brian Gitonga Marete <marete@toshnix.com> <bgmarete@gmail.com> <bgm@google.com>

Brian Kennedy <btkennedy@gmail.com>  
Brian Kessler <brian.m.kessler@gmail.com>  
Brian Ketelsen <bketelsen@gmail.com>  
Brian Slesinsky <skybrian@google.com>  
Brian Smith <ohohvi@gmail.com>  
Brian  
Starke <brian.starke@gmail.com>  
Bryan Alexander <Kozical@msn.com>  
Bryan C. Mills <bcmills@google.com>  
Bryan Chan <bryan.chan@ca.ibm.com>  
Bryan Ford <brynosaurus@gmail.com>  
Bryan Heden <b.heden@gmail.com>  
Bulat Gaifullin <gaifullinbf@gmail.com>  
Burak Guven <bguven@gmail.com>  
Caine Tighe <arctanofyourface@gmail.com>  
Caio Marcelo de Oliveira Filho <caio.oliveira@intel.com>  
Caleb Martinez <accounts@calebmartinez.com>  
Caleb Spare <cespare@gmail.com>  
Carl Chatfield <carlchatfield@gmail.com>  
Carl Henrik Lunde <chlunde@ifi.uio.no>  
Carl Jackson <carl@stripe.com>  
Carl Johnson <me@carlmjohnson.net>  
Carl Mastrangelo <notcarl@google.com>  
Carl Shapiro <cshapiro@google.com> <cshapiro@golang.org>  
Carlisia Campos <carlisia@grokkingtech.io>  
Carlo Alberto Ferraris <cafxx@strayorange.com>  
Carlos Amedee <carlos@golang.org>  
Carlos Castillo <cookieo9@gmail.com>  
Carlos Cirello <uldericofilho@gmail.com>  
Carlos Eduardo <me@carlosedp.com>  
Carlos Eduardo Seo <cseo@linux.vnet.ibm.com>  
Carlos Iriarte  
<ciriarte@gmail.com>  
Carlos Souza <carloshrsouza@gmail.com>  
Carolyn Van Slyck <me@carolynvanslyck.com>  
Carrie Bynon <cbynon@gmail.com>  
Cary Hull <chull@google.com>  
Case Nelson <case.nelson@gmail.com>  
Casey Callendrello <squeed@gmail.com>  
Casey Marshall <casey.marshall@gmail.com>  
Catalin Nicutar <cnicutar@google.com>  
Catalin Patulea <catalinp@google.com>  
Cedric Staub <cs@squareup.com>  
Cezar S Espinola <cezarsa@gmail.com>  
Chad Rosier <mrosier.qdt@qualcommdatacenter.com>  
ChaiShushan <chaishushan@gmail.com>  
Changkun Ou <hi@changkun.us>  
Channing Kimble-Brown <channing@golang.org>

Chao Xu <xuchao@google.com>  
Charles Fenwick Elliott <Charles@FenwickElliott.io>  
Charles Kenney <charlesc.kenney@gmail.com>  
Charles L. Dorian <cldorian@gmail.com>  
Charles Lee <zombie.fml@gmail.com>  
Charles Weill <weill@google.com>  
Chauncy Cullitan <chauncyc@google.com>  
Chen Zhihan <energiehund@gmail.com>  
Cherry Zhang <cherryyz@google.com>  
Chew Choon Keat <choonkeat@gmail.com>  
Cholerae Hu <choleraehyq@gmail.com>  
Chotepud  
Teo <AlexRouSg@users.noreply.github.com>  
Chris Ball <chris@printf.net>  
Chris Biscardi <chris@christopherbiscardi.com>  
Chris Broadfoot <cbro@golang.org>  
Chris Dollin <ehog.hedge@gmail.com>  
Chris Farmiloe <chrisfarms@gmail.com>  
Chris Hines <chris.cs.guy@gmail.com>  
Chris Howey <howeyc@gmail.com>  
Chris Hundt <hundt@google.com>  
Chris Jones <chris@cjones.org> <chris.jones.yar@gmail.com>  
Chris Kastorff <encryptio@gmail.com>  
Chris Le Roy <brompwnie@users.noreply.github.com>  
Chris Lennert <calennert@gmail.com>  
Chris Liles <caveryliles@gmail.com>  
Chris Manghane <cmang@golang.org>  
Chris Marchesi <chrism@vanclueverttech.com>  
Chris McGee <sirnewton\_01@yahoo.ca> <newton688@gmail.com>  
Chris Raynor <raynor@google.com>  
Chris Roche <rodaine@gmail.com>  
Chris Smith <chrsmith@users.noreply.github.com>  
Chris Stockton <chrisstocktonaz@gmail.com>  
Chris Zou <chriszou@ca.ibm.com>  
Christian Alexander <christian@linux.com>  
Christian Couder <chriscool@tuxfamily.org>  
Christian Himpel <chressie@googlemail.com>  
<chressie@gmail.com>  
Christian Muehlhaeuser <muesli@gmail.com>  
Christian Pellegrin <chri@evolware.org>  
Christian R. Petrin <christianpetrin@gmail.com>  
Christine Hansmann <chhansmann@gmail.com>  
Christoffer Buchholz <christoffer.buchholz@gmail.com>  
Christoph Blecker <admin@toph.ca>  
Christoph Hack <christoph@tux21b.org>  
Christopher Cahoon <chris.cahoon@gmail.com>  
Christopher Guiney <chris@guiney.net>  
Christopher Henderson <chris@chenderson.org>

Christopher Koch <chrisko@google.com>  
Christopher Loessl <cloessl+github@gmail.com>  
Christopher Nelson <nadiasvertex@gmail.com>  
Christopher Nielsen <m4dh4tt3r@gmail.com>  
Christopher Redden <christopher.redden@gmail.com>  
Christopher Swenson <cswenson@google.com>  
Christopher Wedgwood <cw@f00f.org>  
Christos Zoulas <christos@zoulas.com> <zoulasc@gmail.com>  
Christy Perez <christy@linux.vnet.ibm.com>  
CL Sung <clsung@gmail.com> <cl\_sung@htc.com>  
Clment Chigot <clement.chigot@atos.net>  
Clement Skau <clementskau@gmail.com>  
Clint J. Edwards <clint.j.edwards@gmail.com>  
Cody  
Oss <the.cody.oss@gmail.com>  
Colby Ranger <cranger@google.com>  
Colin Arnott <colin@urandom.co.uk>  
Colin Cross <ccross@android.com>  
Colin Edwards <colin@recursivepenguin.com>  
Colin Kennedy <moshen.colin@gmail.com>  
Colin Nelson <colnnelson@google.com>  
Colin Rice <clr@google.com>  
Conrad Irwin <conrad.irwin@gmail.com>  
Conrad Meyer <cemeyer@cs.washington.edu>  
Conrado Gouvea <conradopl@gmail.com>  
Constantin Konstantinidis <constantinkonstantinidis@gmail.com>  
Corey Thomasson <cthom.lists@gmail.com>  
Corne van der Plas <vdplas@gmail.com>  
Cosmos Nicolaou <cnicolaou@google.com>  
Costin Chirvasuta <ctin@google.com>  
Craig Citro <craigcitro@google.com>  
Cristian Staretu <unclejacksons@gmail.com>  
Cuihtlauac ALVARADO <cuihtlauac.alvarado@orange.com>  
Cyrill Schumacher <cyrill@schumacher.fm>  
Daisuke Fujita <dtanshi45@gmail.com>  
Daisuke Suzuki <daisuzu@gmail.com>  
Daker Fernandes Pinheiro <daker.fernandes.pinheiro@intel.com>  
Damian Gryski <dgryski@gmail.com>  
Damien Lespiau <damien.lespiau@gmail.com>  
<damien.lespiau@intel.com>  
Damien Mathieu <42@dmathieu.com>  
Damien Neil <dneil@google.com>  
Damien Tournoud <damien@platform.sh>  
Dan Ballard <dan@mindstab.net>  
Dan Caddigan <goldcaddy77@gmail.com>  
Dan Callahan <dan.callahan@gmail.com>  
Dan Harrington <harringtond@google.com>  
Dan Jacques <dnj@google.com>



Dan Johnson <computerdruid@google.com>  
Dan Peterson <dpiddy@gmail.com>  
Dan Pupius <dan@medium.com>  
Dan Scales <danscales@google.com>  
Dan Sinclair <dan.sinclair@gmail.com>  
Daniel Cormier <danielc@knowbe4.com>  
Danil de Kok <me@danieldk.eu>  
Daniel Fleischman <danielfleischman@gmail.com>  
Daniel Ingram <ingramds@appstate.edu>  
Daniel Johansson <dajo2002@gmail.com>  
Daniel Kerwin <d.kerwin@gini.net>  
Daniel Krech <eikeon@eikeon.com>  
Daniel Kumor <rdkumor@gmail.com>  
Daniel Langner <s8572327@gmail.com>  
Daniel Lidn <daniel.liden.87@gmail.com>  
Daniel Lublin <daniel@lublin.se>  
Daniel Mangum <georgedanielmangum@gmail.com>  
Daniel Mart <mvdan@mvdan.cc>  
Daniel Morsing <daniel.morsing@gmail.com>  
Daniel  
Nadasi <dnadasi@google.com>  
Daniel Nephin <dnephin@gmail.com>  
Daniel Ortiz Pereira da Silva <daniel.particular@gmail.com>  
Daniel Skinner <daniel@dasa.cc>  
Daniel Speichert <daniel@speichert.pl>  
Daniel Theophanes <kardianos@gmail.com>  
Daniel Upton <daniel@floppy.co>  
Daniela Petruzalek <daniela.petruszalek@gmail.com>  
Danish Dua <danishdua@google.com>  
Danish Prakash <grafitykoncept@gmail.com>  
Danny Rosseau <daniel.rosseau@gmail.com>  
Daria Kolistratova <daria.kolistratova@intel.com>  
Darien Raymond <admin@v2ray.com>  
Darren Elwood <darren@textnode.com>  
Darren Grant <darren.e.grant@gmail.com>  
Darren McCleary <darren.rmc@gmail.com>  
Darshan Parajuli <parajulidarshan@gmail.com>  
Datong Sun <dndx@idndx.com>  
Dave Borowitz <dborowitz@google.com>  
Dave Bort <dbort@golang.org>  
Dave Cheney <dave@cheney.net>  
Dave Day <djd@golang.org>  
Dave Grijalva <dgrijalva@ngmoco.com>  
Dave MacFarlane <driusan@gmail.com>  
Dave Russell <forfuncsake@gmail.com>  
David Anderson <danderson@google.com>  
David Barnett <dbarnett@google.com>  
David

Benjamin <davidben@google.com>  
David Bond <davidsbond93@gmail.com>  
David Brophy <dave@brophy.uk>  
David Brgin <676c7473@gmail.com>  
David Calavera <david.calavera@gmail.com>  
David Carlier <devnexen@gmail.com>  
David Carter <fresco.raja@gmail.com>  
David Chase <drchase@google.com>  
David Covert <davidhcovert@gmail.com>  
David Crawshaw <david.crawshaw@zentus.com> <crawshaw@google.com> <crawshaw@golang.org>  
David du Colombier <0intro@gmail.com>  
David Finkel <david.finkel@gmail.com>  
David Forsythe <dforsythe@gmail.com>  
David G. Andersen <dave.andersen@gmail.com>  
David Glasser <glasser@meteor.com>  
David Golden <david@autopragmatic.com>  
David Heuschmann <heuschmann.d@gmail.com>  
David Howden <dhowden@gmail.com>  
David Hubbard <dsp@google.com>  
David Jakob Fritz <david.jakob.fritz@gmail.com>  
David Jones <dxjones@gmail.com>  
David Lazar <lazard@golang.org>  
David Leon Gil <coruus@gmail.com>  
David McLeish <davemc@google.com>  
David Ndungu <dnjuguna@gmail.com>  
David NewHamlet <david@newhamlet.com>  
David  
Presotto <presotto@gmail.com>  
David R. Jenni <david.r.jenni@gmail.com>  
David Sansome <me@davidsansome.com>  
David Stainton <dstainton415@gmail.com>  
David Symonds <dsymonds@golang.org>  
David Thomas <davidthomas426@gmail.com>  
David Timm <dtimm@pivotal.io>  
David Titarenco <david.titarenco@gmail.com>  
David Tolpin <david.tolpin@gmail.com>  
David Url <david@urld.io>  
David Volquartz Lebech <david@lebech.info>  
David Wimmer <davidlwimmer@gmail.com>  
Davies Liu <davies.liu@gmail.com>  
Davor Kapsa <davor.kapsa@gmail.com>  
Dean Eigenmann <7621705+decanus@users.noreply.github.com>  
Dean Prichard <dean.prichard@gmail.com>  
Deepak Jois <deepak.jois@gmail.com>  
Denis Bernard <db047h@gmail.com>  
Denis Brandolini <denis.brandolini@gmail.com>  
Denis Isaev <idenx@yandex.com>  
Denis Nagorny <denis.nagorny@intel.com>

Dennis Kuhnert <mail.kuhnert@gmail.com>  
Denys Honsiorovskiy <honsiorovskiy@gmail.com>  
Denys Smirnov <denis.smirnov.91@gmail.com>  
Derek Buitenhuis <derek.buitenhuis@gmail.com>  
Derek  
Che <drc@yahoo-inc.com>  
Derek McGowan <derek@mcgstyle.net>  
Derek Parker <parkerderek86@gmail.com>  
Derek Phan <derekphan94@gmail.com>  
Derek Shockey <derek.shockey@gmail.com>  
Dev Ojha <dojha12@gmail.com>  
Dev Zhoujun <dev.zhoujun@gmail.com>  
Devon H. O'Dell <devon.odell@gmail.com>  
Dhaivat Pandit <dhaivatpandit@gmail.com>  
Dhananjay Nakrani <dhananjayn@google.com>  
Dhiru Kholia <dhiru.kholia@gmail.com>  
Dhruvdudd Jadhav <dhrvdudd.jadhav@gmail.com>  
Di Xiao <dixiao@google.com>  
Didier Spezia <didier.06@gmail.com>  
Diego Siqueira <diego9889@gmail.com>  
Dieter Plaetinck <dieter@raintank.io>  
Dimitri Sokolyuk <sokolyuk@gmail.com>  
Dimitri Tcaciuc <dtcaciuc@gmail.com>  
Dina Garmash <dgrmsh@gmail.com>  
Diogo Pinela <diogoid7400@gmail.com>  
Dirk Gadsden <dirk@esherido.com>  
Diwaker Gupta <diwakergupta@gmail.com>  
Dmitri Goutnik <dgoutnik@gmail.com>  
Dmitri Popov <operator@cv.dp-net.com>  
Dmitri Shuralyov <dmitshur@golang.org> <dmitri@shuralyov.com>  
Dmitriy Cherchenko <dcherchenko@gmail.com>  
Dmitriy Dudkin <dudkin.dmitriy@gmail.com>  
Dmitriy  
Shelenin <deemok@googlemail.com> <deemok@gmail.com>  
Dmitriy Vyukov <dvyukov@google.com>  
Dmitry Chestnykh <dchest@gmail.com>  
Dmitry Doroginin <doroginin@gmail.com>  
Dmitry Mottl <dmitry.mottl@gmail.com>  
Dmitry Neverov <dmitry.neverov@gmail.com>  
Dmitry Savintsev <dsavints@gmail.com>  
Dmitry Yakunin <nonamezeil@gmail.com>  
Doga Fincan <doga@icloud.com>  
Domas Tamauskas <puerdomus@gmail.com>  
Domen Ipavec <domen@ipavec.net>  
Dominic Green <dominicgreen1@gmail.com>  
Dominik Honnef <dominik.honnef@gmail.com>  
Dominik Vogt <vogt@linux.vnet.ibm.com>  
Don Byington <don@dbyington.com>

Donald Huang <don.hcd@gmail.com>  
Dong-hee Na <donghee.na92@gmail.com>  
Donovan Hide <donovanhide@gmail.com>  
Doug Anderson <douga@google.com>  
Doug Fawley <dfawley@google.com>  
Douglas Danger Manley <doug.manley@gmail.com>  
Drew Flower <drewvanstone@gmail.com>  
Drew Hintz <adhintz@google.com>  
Duco van Amstel <duco.vanamstel@gmail.com>  
Duncan Holm <mail@frou.org>  
Dustin Carlino <dcarlino@google.com>  
Dustin  
Herbison <djherbis@gmail.com>  
Dustin Long <dustmop@gmail.com>  
Dustin Sallings <dsallings@gmail.com>  
Dustin Shields-Cloues <dcloues@gmail.com>  
Dvir Volk <dvir@everything.me> <dvirsky@gmail.com>  
Dylan Waits <dylan@waits.io>  
Ed Schouten <ed@nuxi.nl>  
Edan Bedrik <3d4nb3@gmail.com>  
Eddie Scholtz <escholtz@google.com>  
Eden Li <eden.li@gmail.com>  
Eduard Urbach <e.urbach@gmail.com>  
Eduardo Ramalho <eduardo.ramalho@gmail.com>  
Eduardo Villaseor <evillasrmx@gmail.com>  
Edward Muller <edwardam@interlix.com>  
Egon Elbre <egonelbre@gmail.com>  
Ehren Kret <ehren.kret@gmail.com>  
Eitan Adler <lists@eitanadler.com>  
Eivind Uggedal <eivind@uggedal.com>  
Elbert Fliek <efliek@gmail.com>  
Eldar Rakhimberdin <ibeono@gmail.com>  
Elena Grahovac <elena@grahovac.me>  
Eli Bendersky <eliben@google.com>  
Elias Naur <mail@eliasnaur.com> <elias.naur@gmail.com>  
Elliot Morrison-Reed <elliottmr@gmail.com>  
Ellison Leao <ellisonleao@gmail.com>  
Emerson Lin <linyintor@gmail.com>  
Emil Hessman <emil@hessman.se>  
Emil Mursalimov <mursalimovemeel@gmail.com>  
Emilien  
Kenler <hello@emilienkenler.com>  
Emmanuel Odeke <emm.odeke@gmail.com> <odeke@ualberta.ca>  
Emreacan Bati <emreacanbati@gmail.com>  
Eno Compton <enocom@google.com>  
Eoghan Sherry <ejsherry@gmail.com>  
Eric Biggers <ebiggers@google.com>  
Eric Brown <browne@vmware.com>

Eric Chiang <eric.chiang.m@gmail.com>  
Eric Clark <zerohp@gmail.com>  
Eric Daniels <eric@erdaniels.com>  
Eric Engestrom <eric@engestrom.ch>  
Eric Garrido <ekg@google.com>  
Eric Koleda <ekoleda+devrel@google.com>  
Eric Lagergren <ericscottlagergren@gmail.com>  
Eric Milliken <emilliken@gmail.com>  
Eric Pauley <eric@pauley.me>  
Eric Ponce <tricokun@gmail.com>  
Eric Rescorla <ekr@rtfm.com>  
Eric Roshan-Eisner <eric.d.eisner@gmail.com>  
Eric Rutherford <erutherford@gmail.com>  
Eric Rykwalder <e.rykwalder@gmail.com>  
Erick Tryzelaar <etryzelaar@google.com>  
Erik Aigner <aigner.erik@gmail.com>  
Erik Dubbelboer <erik@dubbelboer.com>  
Erik St. Martin <alakriti@gmail.com>  
Erik Staab <estaab@google.com>  
Erik Westrup <erik.westrup@gmail.com>  
Erin  
Masatsugu <erin.masatsugu@gmail.com>  
Ernest Chiang <ernest\_chiang@htc.com>  
Erwin Oegema <blablaechthema@hotmail.com>  
Esko Luontola <esko.luontola@gmail.com>  
Ethan Burns <eaburns@google.com>  
Ethan Miller <eamiller@us.ibm.com>  
Euan Kemp <euank@euank.com>  
Eugene Formanenko <mo4islona@gmail.com>  
Eugene Kalinin <e.v.kalinin@gmail.com>  
Evan Broder <evan@stripe.com>  
Evan Brown <evanbrown@google.com>  
Evan Digby <evandigby@gmail.com>  
Evan Hicks <evan.hicks2@gmail.com>  
Evan Jones <ej@evanjones.ca>  
Evan Klitzke <evan@eklitzke.org>  
Evan Kroske <evankroske@google.com>  
Evan Martin <evan.martin@gmail.com>  
Evan Phoenix <evan@phx.io>  
Evan Shaw <chickencha@gmail.com>  
Evgeniy Kulikov <tuxuls@gmail.com>  
Evgeniy Polyakov <zbr@ioremap.net>  
Ewan Chou <coocood@gmail.com>  
Ewan Valentine <ewan.valentine89@gmail.com>  
Eyal Posener <posener@gmail.com>  
Fabian Wickborn <fabian@wickborn.net>  
Fabian Zaremba <fabian@youremail.eu>  
Fabrizio Milo <mistobaan@gmail.com>

Faiyaz Ahmed <ahmedf@vmware.com>  
Fan  
Hongjian <fan.howard@gmail.com>  
Fangming Fang <fangming.fang@arm.com>  
Fannie Zhang <fannie.zhang@arm.com>  
Fatih Arslan <fatih@arslan.io>  
Fazal Majid <majid@apsalar.com>  
Fazlul Shahriar <fshahriar@gmail.com>  
Federico Bond <federicobond@gmail.com>  
Federico Simoncelli <fsimonce@redhat.com>  
Fedor Indutny <fedor@indutny.com>  
Fedor Korotkiy <dartslon@gmail.com>  
Felipe Oliveira <felipeweb.programador@gmail.com>  
Felix Bnemann <Felix.Buenemann@gmail.com>  
Felix Cornelius <9767036+fcornelius@users.noreply.github.com>  
Felix Geisendrfer <haimuiba@gmail.com>  
Felix Kollmann <fk@konsorten.de>  
Ferenc Szabo <frncmx@gmail.com>  
Filip Gruszczyski <gruszczy@gmail.com>  
Filip Haglund <drathier@users.noreply.github.com>  
Filip Stanis <fstanis@google.com>  
Filippo Valsorda <filippo@golang.org> <filippo@cloudflare.com> <hi@filippo.io>  
Firmansyah Adiputra <frm.adiputra@gmail.com>  
Florian Forster <octo@google.com>  
Florian Uekermann <florian@uekermann-online.de> <f1@uekermann-online.de>  
Florian Weimer <fw@deneb.enyo.de>  
Florin  
Patan <florinpatan@gmail.com>  
Folke Behrens <folke@google.com>  
Ford Hurley <ford.hurley@gmail.com>  
Francesc Campoy <campoy@golang.org>  
Francesco Renzi <rentziass@gmail.com>  
Francisco Claude <fclaude@recoded.cl>  
Francisco Rojas <francisco.rojas.gallegos@gmail.com>  
Francisco Souza <franciscossouza@gmail.com>  
Frank Schroeder <frank.schroeder@gmail.com>  
Frank Somers <fsomers@arista.com>  
Frederic Guillot <frederic.guillot@gmail.com>  
Frederick Kelly Mayle III <frederickmayle@gmail.com>  
Frederik Ring <frederik.ring@gmail.com>  
Frederik Zipp <fzipp@gmx.de>  
Fredrik Enestad <fredrik.enestad@soundtrackyourbrand.com>  
Fredrik Forsmo <fredrik.forsmo@gmail.com>  
Fredrik Wallgren <fredrik.wallgren@gmail.com>  
Frew Schmidt <github@frew.co>  
Frithjof Schulze <schulze@math.uni-hannover.de> <sfrithjof@gmail.com>  
Frits van Bommel <fvbommel@gmail.com>  
Fujimoto Kyosuke <kyoro.f@gmail.com>

Fumitoshi Ukai <ukai@google.com>  
G. Hussain Chinoy <ghchinoy@gmail.com>  
Gaal Yahas <gaal@google.com>  
Gabrel  
Arthr Ptursson <gabriel@system.is>  
Gabriel Aszalos <gabriel.aszalos@gmail.com>  
Gabriel Guzman <gabe.guzman@gmail.com>  
Gabriel Nelle <tehsphinx@web.de>  
Gabriel Nicolas Avellaneda <avellaneda.gabriel@gmail.com>  
Gabriel Rosenhouse <rosenhouse@gmail.com>  
Gabriel Russell <gabriel.russell@gmail.com>  
Gareth Paul Jones <gpj@foursquare.com>  
Garret Kelly <gdk@google.com>  
Garrick Evans <garrick@google.com>  
Gary Burd <gary@beagledreams.com> <gary.burd@gmail.com>  
Gary Elliott <garyelliott@google.com>  
Gaurish Sharma <contact@aurishsharma.com>  
Gautham Thambidorai <gautham.dorai@gmail.com>  
Gauthier Jolly <gauthier.jolly@gmail.com>  
Gawen Arab <gawen.arab@c.zen.ly>  
Geert-Johan Riemer <gjr19912@gmail.com>  
Genevieve Luyt <genevieve.luyt@gmail.com>  
Gengliang Wang <ltnwgl@gmail.com>  
Geoff Berry <gberry.qdt@qualcommdatacenter.com>  
Geoffroy Lorieux <lorieux.g@gmail.com>  
Geon Kim <geon0250@gmail.com>  
Georg Reinke <guelfey@gmail.com>  
George Gkirtsou <ggirtsou@gmail.com>  
George Hartzell <hartzell@alerce.com>  
George  
Shammas <george@shamm.as> <georgyo@gmail.com>  
Gerasimos (Makis) Maropoulos <kataras2006@hotmail.com>  
Gerasimos Dimitriadis <gedimitr@gmail.com>  
Gergely Brautigam <skarls0777@gmail.com>  
Gernot Vormayr <gvormayr@gmail.com>  
Gert Cuykens <gert.cuykens@gmail.com>  
Getulio Snchez <valentin2507@gmail.com>  
Ghazni Nattarshah <ghazni.nattarshah@gmail.com>  
Gianguido Sora` <g.sora4@gmail.com>  
Gideon Jan-Wessel Redelinghuys <gjredelinghuys@gmail.com>  
Giles Lean <giles.lean@pobox.com>  
Giovanni Bajo <rasky@develer.com>  
GitHub User @aca (50316549) <acadx0@gmail.com>  
GitHub User @ajnirp (1688456) <ajnirp@users.noreply.github.com>  
GitHub User @ajz01 (4744634) <ajzdenek@gmail.com>  
GitHub User @alkesh26 (1019076) <alkesh26@gmail.com>  
GitHub User @andig (184815) <cpuidle@gmx.de>  
GitHub User @andrius4669 (4699695) <andrius4669@gmail.com>

GitHub User @as (8127015) <as.utf8@gmail.com>  
GitHub User @bakape (7851952) <bakape@gmail.com>  
GitHub User @bgadrian (830001) <aditza8@gmail.com>  
GitHub User @bontequero  
(2674999) <bontequero@gmail.com>  
GitHub User @cch123 (384546) <buaa.cch@gmail.com>  
GitHub User @chainhelen (7046329) <chainhelen@gmail.com>  
GitHub User @chanxuehong (3416908) <chanxuehong@gmail.com>  
GitHub User @cncal (23520240) <flycalvin@qq.com>  
GitHub User @DQNEO (188741) <dqneo@gmail.com>  
GitHub User @Dreamacro (8615343) <chuainian@gmail.com>  
GitHub User @dupoxy (1143957) <dupoxy@users.noreply.github.com>  
GitHub User @erifan (31343225) <eric.fang@arm.com>  
GitHub User @esell (9735165) <eujon.sellers@gmail.com>  
GitHub User @fatedier (7346661) <fatedier@gmail.com>  
GitHub User @frennkie (6499251) <mail@rhab.de>  
GitHub User @geedchin (11672310) <geedchin@gmail.com>  
GitHub User @GrigoriyMikhalkin (3637857) <grigoriymikhalkin@gmail.com>  
GitHub User @hengwu0 (41297446) <41297446+hengwu0@users.noreply.github.com>  
GitHub User @itchyny (375258) <itchyny@hatena.ne.jp>  
GitHub User @jinmiaoluo (39730824) <jinmiaoluo@icloud.com>  
GitHub User @jobbrown (6345470) <msshane2008@gmail.com>  
GitHub User  
@kazysshr (30496953) <kazysshr0301@gmail.com>  
GitHub User @kc1212 (1093806) <kc1212@users.noreply.github.com>  
GitHub User @Kropekk (13366453) <kamilkropiewnicki@gmail.com>  
GitHub User @linguohua (3434367) <lghchinaidea@gmail.com>  
GitHub User @LotusFenn (13775899) <fenn.lotus@gmail.com>  
GitHub User @ly303550688 (11519839) <yang.liu636@gmail.com>  
GitHub User @madiganz (18340029) <zacharywmadigan@gmail.com>  
GitHub User @maltalex (10195391) <code@bit48.net>  
GitHub User @Matt966 (28551465) <Matt966@users.noreply.github.com>  
GitHub User @micnncim (21333876) <micnncim@gmail.com>  
GitHub User @mkishere (224617) <224617+mkishere@users.noreply.github.com>  
GitHub User @nu50218 (40682920) <nu\_ll@icloud.com>  
GitHub User @OlgaVIPetrova (44112727) <OVPpetrova@gmail.com>  
GitHub User @pityonline (438222) <pityonline@gmail.com>  
GitHub User @po3rin (29445112) <abctail30@gmail.com>  
GitHub User @pokutuna (57545) <popopopokutuna@gmail.com>  
GitHub User @pytimer (17105586) <lixin20101023@gmail.com>  
GitHub  
User @ramenjuniti (32011829) <ramenjuniti@gmail.com>  
GitHub User @saitarunreddy (21041941) <saitarunreddypalla@gmail.com>  
GitHub User @shogo-ma (9860598) <Choroma194@gmail.com>  
GitHub User @skanehira (7888591) <sho19921005@gmail.com>  
GitHub User @tatsumack (4510569) <tatsu.mack@gmail.com>  
GitHub User @tell-k (26263) <ffk2005@gmail.com>  
GitHub User @tennashi (10219626) <tennashio@gmail.com>



GitHub User @uhei (2116845) <uhei@users.noreply.github.com>  
GitHub User @uropek (39370426) <uropek@gmail.com>  
GitHub User @utkarsh-extc (53217283) <utkarsh.extc@gmail.com>  
GitHub User @witchard (4994659) <witchard@hotmail.co.uk>  
GitHub User @yah01 (12216890) <kagaminehuan@gmail.com>  
GitHub User @yuanhh (1298735) <yuan415030@gmail.com>  
GitHub User @zikaeroh (48577114) <zikaeroh@gmail.com>  
GitHub User @ZZMarquis (7624583) <zhonglingjian3821@163.com>  
Giulio Iotti <dullgiulio@gmail.com>  
Giulio Micheloni <giulio.micheloni@gmail.com>  
Giuseppe Valente <gvalente@arista.com>  
Gleb Stepanov <glebstepanov1992@gmail.com>  
Glenn  
Brown <glennb@google.com>  
Glenn Lewis <gmlewis@google.com>  
Gordon Klaus <gordon.klaus@gmail.com>  
Gordon Tyler <gordon@doxxx.net>  
Graham King <graham4king@gmail.com>  
Graham Miller <graham.miller@gmail.com>  
Grant Griffiths <ggp493@gmail.com>  
Greg Poirier <greg.istehbest@gmail.com>  
Greg Steuck <gneздо+github@google.com>  
Greg Thelen <gthelen@google.com>  
Greg Ward <greg@gerg.ca>  
Grgoire Delattre <gregoire.delattre@gmail.com>  
Gregory Man <man.gregory@gmail.com>  
Gregory Petrosyan <gregory.petrosyan@gmail.com>  
Guilherme Caruso <gui.martinscaruso@gmail.com>  
Guilherme Garnier <guilherme.garnier@gmail.com>  
Guilherme Goncalves <guilhermeaugustosg@gmail.com>  
Guilherme Rezende <guilhermebr@gmail.com>  
Guillaume J. Charmes <guillaume@charmes.net>  
Gnther Noack <gnoack@google.com>  
Guobiao Mei <meiguobiao@gmail.com>  
Guoliang Wang <iamwgliang@gmail.com>  
Gustav Paul <gustav.paul@gmail.com>  
Gustav Westling <gustav@westling.xyz>  
Gustavo Franco <gustavorfranco@gmail.com>  
Gustavo Niemeyer <gustavo@niemeyer.net>  
<n13m3y3r@gmail.com>  
Gwenael Treguier <gwenn.kahz@gmail.com>  
Gyu-Ho Lee <gyuhox@gmail.com>  
H. brahim Gngr <igungor@gmail.com>  
Hajime Hoshi <hajimehoshi@gmail.com>  
Hallgrimur Gunnarsson <halg@google.com>  
HAMANO Tsukasa <hamano@osstech.co.jp>  
Han-Wen Nienhuys <hanwen@google.com>  
Hang Qian <hangqian90@gmail.com>

Hanjun Kim <hallazzang@gmail.com>  
Haosdent Huang <haosdent@gmail.com>  
Harald Nordgren <haraldnordgren@gmail.com>  
Hari haran <hariharan.uno@gmail.com>  
Hariharan Srinath <srinathh@gmail.com>  
Harley Laue <losinggeneration@gmail.com>  
Harry Moreno <morenoh149@gmail.com>  
Harshavardhana <hrshvardhana@gmail.com>  
Hasan Ozgan <hasan@ozgan.net>  
Hasit Bhatt <hasit.p.bhatt@gmail.com>  
Hauke Lffler <hloeffler@users.noreply.github.com>  
Hvard Haugen <havard.haugen@gmail.com>  
He Liu <liulonnie@gmail.com>  
Hector Chu <hectorchu@gmail.com>  
Hector Martin Cantero <hector@marcansoft.com>  
Henning Schmiedehausen <henning@schmiedehausen.org>  
Henrik Edwards <henrik.edwards@gmail.com>  
Henrik  
Hodne <henrik@hodne.io>  
Henry Adi Sumarto <henry.adisumarto@gmail.com>  
Henry Bubert <google@mindeco.de>  
Henry Chang <mr.changyuheng@gmail.com>  
Henry Clifford <h.a.clifford@gmail.com>  
Henry Wong <liushuai.wang@elastic.co>  
Herbert Georg Fischer <herbert.fischer@gmail.com>  
Herbie Ong <herbie@google.com>  
Heschi Kreinick <heschi@google.com>  
Hidetatsu Yaginuma <ygnmhdt@gmail.com>  
Hilko Bengen <bengen@hilluzination.de>  
Hiroaki Nakamura <hnakamur@gmail.com>  
Hiromichi Ema <ema.hiro@gmail.com>  
Hironao OTSUBO <motemen@gmail.com>  
Hiroshi Ioka <hirochachacha@gmail.com>  
Hitoshi Mitake <mitake.hitoshi@gmail.com>  
Holden Huang <ttyh061@gmail.com>  
Hong Ruiqi <hongruiqi@gmail.com>  
Hongfei Tan <feilengcui008@gmail.com>  
Horacio Duran <horacio.duran@gmail.com>  
Horst Rutter <hhrutter@gmail.com>  
Hossein Sheikh Attar <hattar@google.com>  
Howard Zhang <howard.zhang@arm.com>  
Hsin Tsao <tsao@google.com>  
Hsin-Ho Yeh <yhh92u@gmail.com>  
Hu Keping <hukeping@huawei.com>  
Huan Du <i@huandu.me>  
Hugues Bruant <hugues.bruant@gmail.com>  
Huy

Le <huy.dinh.le.89@gmail.com>  
Hyang-Ah Hana Kim <hakim@google.com> <hyangah@gmail.com>  
Hyoyoung Chang <hyoyoung@gmail.com>  
Ian Cottrell <iancottrell@google.com>  
Ian Davis <nospam@iandavis.com>  
Ian Gudger <ian@loosescr.ws>  
Ian Haken <ihaken@netflix.com>  
Ian Kent <iankent85@gmail.com>  
Ian Lance Taylor <iant@golang.org>  
Ian Leue <ian@appboy.com>  
Ian Zapolsky <ianzapolsky@gmail.com>  
Ibrahim AshShohail <ibra.sho@gmail.com>  
Icarus Sparry <golang@icarus.freeuk.com>  
Iccha Sethi <icchasethi@gmail.com>  
Idora Shinatose <idora.shinatose@gmail.com>  
Ignacio Hagopian <jsign.uy@gmail.com>  
Igor Bernstein <igorbernstein@google.com>  
Igor Dolzhikov <bluesriverz@gmail.com>  
Igor Vashyst <ivashyst@gmail.com>  
Igor Zhilianin <igor.zhilianin@gmail.com>  
Illya Yalovyy <yalovoy@gmail.com>  
Ilya Sinelnikov <sidhmangh@gmail.com>  
Ilya Tocar <ilya.tocar@intel.com>  
INADA Naoki <songofacandy@gmail.com>  
Inanc Gumus <m@inanc.io>  
Ingo Gottwald <in.gottwald@gmail.com>  
Ingo Krabbe <ikrabbe.ask@gmail.com>  
Ingo  
Oeser <nightlyone@googlemail.com> <nightlyone@gmail.com>  
Ioannis Georgoulas <geototti21@hotmail.com>  
Irbe Krumina <irbekrm@gmail.com>  
Irfan Sharif <irfanmahmoudsharif@gmail.com>  
Irieda Noboru <irieda@gmail.com>  
Isaac Ardis <isaac.ardis@gmail.com>  
Isaac Wagner <ibw@isaacwagner.me>  
Isfan Azhabil <isfanazhabil@gmail.com>  
Iskander Sharipov <iskander.sharipov@intel.com> <quasilyte@gmail.com>  
Issac Trotts <issactrotts@google.com>  
Ivan Babrou <ivan@cloudflare.com>  
Ivan Bertona <ivan.bertona@gmail.com>  
Ivan Krasin <krasin@golang.org>  
Ivan Kutuzov <arbrix@gmail.com>  
Ivan Markin <sw@nogoegst.net>  
Ivan Moscoso <moscoso@gmail.com>  
Ivan Osadchiy <ivan.osadchii@gmail.com>  
Ivan Sharavuev <shpiwan@gmail.com>  
Ivan Trubach <mr.trubach@icloud.com>  
Ivan Ukhov <ivan.ukhov@gmail.com>

Ivy Evans <ivy@ivyevans.net>  
Jaana Burcu Dogan <jbd@google.com> <jbd@golang.org> <burcujdogan@gmail.com>  
Jaap Aarts <jaap.aarts1@gmail.com>  
Jack Britton <jackxbritton@gmail.com>  
Jack Lindamood <jlindamo@justin.tv>  
Jacob Baskin  
<jbaskin@google.com>  
Jacob Blain Christen <dweomer5@gmail.com>  
Jacob H. Haven <jacob@cloudflare.com>  
Jacob Hoffman-Andrews <github@hoffman-andrews.com>  
Jacob Walker <jacobwalker0814@gmail.com>  
Jae Kwon <jae@tendermint.com>  
Jake B <doogie1012@gmail.com>  
Jakob Borg <jakob@nym.se>  
Jakob Weisblat <jakobw@mit.edu>  
Jakub ajka <jcajka@redhat.com>  
Jakub Kaczmarzyk <jakubk@mit.edu>  
Jakub Ryszard Czarnowicz <j.czarnowicz@gmail.com>  
Jamal Carvalho <jamal.a.carvalho@gmail.com>  
James Aguilar <jaguilar@google.com>  
James Bardin <j.bardin@gmail.com>  
James Chacon <jchacon@google.com>  
James Clarke <jrtc27@jrtc27.com>  
James Cowgill <James.Cowgill@imgtec.com>  
James Craig Burley <james-github@burleyarch.com>  
James David Chalfant <james.chalfant@gmail.com>  
James Eady <jmeady@google.com>  
James Fysh <james.fysh@gmail.com>  
James Gray <james@james4k.com>  
James Hartig <fastest963@gmail.com>  
James Lawrence <jljatone@gmail.com>  
James Meneghello <rawrz0r@gmail.com>  
James Myers <jfmyers9@gmail.com>  
James Neve <jamesoneve@gmail.com>  
James  
Nugent <james@jen20.com>  
James P. Cooper <jamespcooper@gmail.com>  
James Robinson <jamesr@google.com> <jamesr.gatech@gmail.com>  
James Schofield <james@shoeboxapp.com>  
James Smith <jrs1995@icloud.com>  
James Sweet <james.sweet88@googlemail.com>  
James Toy <nil@opensesame.st>  
James Treanor <jtreanor3@gmail.com>  
James Tucker <raggi@google.com>  
James Whitehead <jnwhiteh@gmail.com>  
Jamie Beverly <jamie.r.beverly@gmail.com>  
Jamie Gennis <jgennis@google.com> <jgennis@gmail.com>  
Jamie Kerr <jkerr113@googlemail.com>

Jamie Liu <jameliu@google.com>  
Jamie Stackhouse <contin673@gmail.com>  
Jamie Turner <jamwt@dropbox.com>  
Jamie Wilkinson <jaq@spacepants.org>  
Jamil Djadala <djadala@gmail.com>  
Jan Bertold <jan@bertold.co>  
Jan H. Hosang <jan.hosang@gmail.com>  
Jan Kratochvil <jan.kratochvil@redhat.com>  
Jan Lehnardt <jan@apache.org>  
Jan Mercl <0xjnml@gmail.com> <befelemepeseveze@gmail.com>  
Jan Newmarch <jan.newmarch@gmail.com>  
Jan Pilzer <jan.pilzer@gmx.de>  
Jan Steinke <jan.steinke@gmail.com>  
Jan  
Ziak <0xe2.0x9a.0x9b@gmail.com>  
Jani Monoses <jani.monoses@ubuntu.com> <jani.monoses@gmail.com>  
Jannis Andrija Schnitzer <jannis@schnitzer.im>  
Jared Allard <jaredallard@users.noreply.github.com>  
Jared Culp <jculp14@gmail.com>  
Jaroslav Poepko <jp@webmaster.ms>  
Jason A. Donenfeld <Jason@zx2c4.com>  
Jason Baker <jason-baker@users.noreply.github.com>  
Jason Barnett <jason.w.barnett@gmail.com>  
Jason Buberel <jbuberel@google.com>  
Jason Chu <jasonchujc@gmail.com>  
Jason Del Ponte <delpontej@gmail.com>  
Jason Hall <jasonhall@google.com>  
Jason Keene <jasonkeene@gmail.com>  
Jason LeBrun <jblebrun@gmail.com>  
Jason Smale <jsmale@zendesk.com>  
Jason Travis <infomaniac7@gmail.com>  
Jason Wangsadinata <jwangsadinata@gmail.com>  
Javier Kohen <jkohen@google.com>  
Javier Revillas <jrevillas@massivedynamic.io>  
Javier Segura <javism@gmail.com>  
Jay Conrod <jayconrod@google.com>  
Jay Taylor <outtatime@gmail.com>  
Jay Weisskopf <jay@jayschwa.net>  
Jean de Klerk <deklerk@google.com>  
Jean-Andr Santoni  
<jean.andre.santoni@gmail.com>  
Jean-Franois Bustarret <jf@bustarret.com>  
Jean-Francois Cantin <jfcantin@gmail.com>  
Jean-Marc Eurin <jmeurin@google.com>  
Jean-Nicolas Moal <jn.moal@gmail.com>  
Jed Denlea <jed@fastly.com>  
Jdrzej Szczepaniak <jbszczepaniak@gmail.com>  
Jeet Parekh <jeetparekh96@gmail.com>

Jeevanandam M <jeeva@myjeeva.com>  
Jeff (Zhefu) Jiang <jeffjiang@google.com>  
Jeff Craig <jeffcraig@google.com>  
Jeff Dupont <jeff.dupont@gmail.com>  
Jeff Hodges <jeff@somethingsimilar.com>  
Jeff Johnson <jrjohnson@google.com>  
Jeff R. Allen <jra@nella.org> <jeff.allen@gmail.com>  
Jeff Sickel <jas@corpus-callosum.com>  
Jeff Wendling <jeff@spacemonkey.com>  
Jeffrey H <jeffreyh192@gmail.com>  
Jelte Fennema <github-tech@jeltef.nl>  
Jens Frederich <jfrederich@gmail.com>  
Jeremiah Harmsen <jeremiah@google.com>  
Jeremy Banks <\_@jeremy.ca>  
Jeremy Canady <jcanady@gmail.com>  
Jeremy Faller <jeremy@golang.org>  
Jeremy Jackins <jeremyjackins@gmail.com>  
Jeremy Jay <jeremy@pbnjay.com>  
Jeremy Schlatter <jeremy.schlatter@gmail.com>  
Jeroen  
Bobbeldijk <jrbob92@gmail.com>  
Jeroen Simonetti <jeroen@simonetti.nl>  
Jerrin Shaji George <jerrinsg@gmail.com>  
Jess Frazelle <me@jessfraz.com>  
Jesse Szwedko <jesse.szwedko@gmail.com>  
Jess Espino <jespinog@gmail.com>  
Jia Zhan <jzhan@uber.com>  
Jiacai Liu <jiacai2050@gmail.com>  
Jianing Yu <jnyu@google.com>  
Jianqiao Li <jianqiaoli@google.com>  
Jie Ma <jienius@outlook.com>  
Jihyun Yu <yjh0502@gmail.com>  
Jim Cote <jfcote87@gmail.com>  
Jim Kingdon <jim@bolt.me>  
Jim McGrath <jimmc2@gmail.com>  
Jim Minter <jminter@redhat.com>  
Jimmy Frasche <soapboxcicero@gmail.com>  
Jimmy Zelinskie <jimmyzelinskie@gmail.com>  
Jin-wook Jeong <jeweljar@hanmail.net>  
Jingcheng Zhang <diogin@gmail.com>  
Jingguo Yao <yaojingguo@gmail.com>  
Jingnan Si <jingnan.si@gmail.com>  
Jinkun Zhang <franksnolf@gmail.com>  
Jiong Du <londevil@gmail.com>  
Jirka Dank <dnk@mail.muni.cz>  
Jiulong Wang <jiulongw@gmail.com>  
Joakim Sernbrant <serbaut@gmail.com>  
Joe Bowbeer <joe.bowbeer@gmail.com>

Joe Cortopassi <joe@joecortopassi.com>  
Joe  
Farrell <joe2farrell@gmail.com>  
Joe Harrison <joehazzers@gmail.com>  
Joe Henke <joed.henke@gmail.com>  
Joe Kyo <xunianzu@gmail.com>  
Joe Poirier <jdpoirier@gmail.com>  
Joe Richey <joerichey@google.com>  
Joe Shaw <joe@joeshaw.org>  
Joe Sylve <joe.sylve@gmail.com>  
Joe Tsai <joetsai@digital-static.net>  
Joel Sing <joel@sing.id.au> <jsing@google.com>  
Jol Stemmer <jstemmer@google.com>  
Joel Stemmer <stemmertech@gmail.com>  
Joey Geiger <jgeiger@users.noreply.github.com>  
Johan Brandhorst <johan.brandhorst@gmail.com>  
Johan Euphrosine <propy@google.com>  
Johan Jansson <johan.jansson@iki.fi>  
Johan Sageryd <j@1616.se>  
John Asmuth <jasmuth@gmail.com>  
John Beisley <huin@google.com>  
John C Barstow <jbowtie@amathaine.com>  
John DeNero <denero@google.com>  
John Dethridge <jcd@golang.org>  
John Gibb <johngibb@gmail.com>  
John Gilik <john@jgilik.com>  
John Graham-Cumming <jgc@jgc.org> <jgrahamc@gmail.com>  
John Howard Palevich <jack.palevich@gmail.com>  
John Jeffery <jjeffery@sp.com.au>  
John Jenkins <twodopeshaggy@gmail.com>  
John  
Leidegren <john.leidegren@gmail.com>  
John McCabe <john@johnmccabe.net>  
John Moore <johnkenneth.moore@gmail.com>  
John Newlin <jnewlin@google.com>  
John Papandriopoulos <jpap.code@gmail.com>  
John Potocny <johnp@vividcortex.com>  
John R. Lenton <jlenton@gmail.com>  
John Schnake <schnake.john@gmail.com>  
John Shahid <jvshahid@gmail.com>  
John Tuley <john@tuley.org>  
John Weldon <johnweldon4@gmail.com>  
Johnny Luo <johnnyluo1980@gmail.com>  
Jon Chen <jchen@justin.tv>  
Jon Johnson <jonjohnson@google.com>  
Jonas Bernoulli <jonas@bernoul.li>  
Jonathan Allie <jonallie@google.com>  
Jonathan Amsterdam <jba@google.com>

Jonathan Boule <jonathanboule@gmail.com>  
Jonathan Chen <dijonkitchen@users.noreply.github.com>  
Jonathan Feinberg <feinberg@google.com>  
Jonathan Gold <jgold.bg@gmail.com>  
Jonathan Hseu <jhseu@google.com>  
Jonathan Mark <jhmark@xenops.com> <jhmark000@gmail.com>  
Jonathan Nieder <jrn@google.com>  
Jonathan Pentecost <pentecostjonathan@gmail.com>  
Jonathan Pittman <jmpittman@google.com>  
<jonathan.mark.pittman@gmail.com>  
Jonathan Rudenberg <jonathan@titanous.com>  
Jonathan Stacks <jonstacks13@gmail.com>  
Jonathan Wills <runningwild@gmail.com>  
Jonathon Lacher <jonathon.lacher@gmail.com>  
Jongmin Kim <atomaths@gmail.com>  
Joonas Kuorilehto <joneskoo@derbian.fi>  
Joop Kiefte <ikojba@gmail.com> <joop@kiefte.net>  
Jordan Christiansen <xordspar0@gmail.com>  
Jordan Krage <jmank88@gmail.com>  
Jordan Lewis <jordanthelewis@gmail.com>  
Jordan Liggitt <liggitt@google.com>  
Jordan Rhee <jordanrh@microsoft.com>  
Jordi Martin <jordimartin@gmail.com>  
Jorge Araya <jorgejavieran@yahoo.com.mx>  
Jorge L. Fatta <jorge.fatta@auth0.com>  
Jos Visser <josv@google.com>  
Josa Gesell <josa@gesell.me>  
Jose Luis Vzquez Gonzlez <josvazg@gmail.com>  
Joseph Bonneau <jcb@google.com>  
Joseph Holsten <joseph@josephholsten.com>  
Josh Baum <joshbaum@google.com>  
Josh Bleecher Snyder <josharian@gmail.com>  
Josh Chorlton <jchorlton@gmail.com>  
Josh Deprez <josh.deprez@gmail.com>  
Josh Goebel <dreamer3@gmail.com>  
Josh Hoak  
<jhoak@google.com>  
Josh Holland <jrh@joshh.co.uk>  
Josh Roppo <joshroppo@gmail.com>  
Josh Varga <josh.varga@gmail.com>  
Joshua Bezaleel Abednego <joshua.bezaleel@gmail.com>  
Joshua Boelter <joshua.boelter@intel.com>  
Joshua Chase <jcjosuachase@gmail.com>  
Joshua Crowgey <jcrowgey@uw.edu>  
Joshua M. Clulow <josh.clulow@joyent.com>  
Joshua Rubin <joshua@rubixconsulting.com>  
Josselin Costanzi <josselin@costanzi.fr>  
Jostein Stuhau <js@solidsystem.no>



JP Sugarbroad <jpsugar@google.com>  
JT Olds <jtolds@xnet5.com>  
JT Olio <hello@jtolio.com>  
Juan Carlos <juanjcsr@gmail.com>  
Juan Pablo Civile <elementohb@gmail.com>  
Jude Pereira <judebpereira@gmail.com>  
Jukka-Pekka Kekkonen <karatepekka@gmail.com>  
Julia Hansbrough <flowerhack@google.com>  
Julian Kornberger <jk+github@digineo.de>  
Julian Pastarmov <pastarmovj@google.com>  
Julian Phillips <julian@quantumfyre.co.uk>  
Julian Tibble <julian.tibble@gmail.com>  
Julie Qiu <julie@golang.org>  
Julien Kauffmann <julien.kauffmann@freelan.org>  
Julien Salleyron <julien.salleyron@gmail.com>  
Julien  
Schmidt <google@julienschmidt.com>  
Julio Montes <julio.montes@intel.com>  
Jun Zhang <jim.zoumo@gmail.com>  
Junda Liu <junda@celer.network>  
Jungho Ahn <jhahn@google.com>  
Junya Hayashi <ledmonster@gmail.com>  
Juraj Sukop <sukop@users.noreply.github.com>  
Jure Ham <jure.ham@zemanta.com>  
Justin Gracenin <jgracenin@gmail.com>  
Justin Li <git@justinli.net>  
Justin Nu <nuss.justin@gmail.com>  
Justyn Temme <justyntemme@gmail.com>  
Kai Backman <kaib@golang.org>  
Kai Dong <dokia2357@gmail.com>  
Kai Trukenmller <ktye78@gmail.com>  
Kale Blankenship <kale@lemnisis.com>  
Kaleb Elwert <kelwert@atlassian.com>  
Kalman Bekesi <kalmanb@google.com>  
Kamal Aboul-Hosn <aboulhosn@google.com>  
Kamil Chmielewski <kamil.chm@gmail.com>  
Kamil Kisiel <kamil@kamilkisiel.net> <kamil.kisiel@gmail.com>  
Kamil Rytarowski <krytarowski@users.noreply.github.com>  
Kang Hu <hukangustc@gmail.com>  
Kanta Ebihara <kantaebihara@gmail.com>  
Karan Dhiman <karandhi@ca.ibm.com>  
Karel Pazdera <pazderak@gmail.com>  
Karoly  
Negyesi <chx1975@gmail.com>  
Karsten Khler <karsten.koehler95@gmail.com>  
Karthik Nayak <karthik.188@gmail.com>  
Kashav Madan <kshvmdn@gmail.com>  
Kate Manson <kate.manson@izettle.com>

Katharine Berry <ktbry@google.com>  
Katie Hockman <katie@golang.org>  
Kato Kazuyoshi <kato.kazuyoshi@gmail.com>  
Katrina Owen <katrina.owen@gmail.com>  
Kaviraj Kanagaraj <kavirajkanagaraj@gmail.com>  
Kay Zhu <kayzhu@google.com>  
Kazuhiro Sera <seratch@gmail.com>  
KB Sriram <kbsriram@google.com>  
Keegan Carruthers-Smith <keegan.csmith@gmail.com>  
Kei Son <hey.calmdown@gmail.com>  
Keiji Yoshida <keijiyoshida.mail@gmail.com>  
Keisuke Kishimoto <keisuke.kishimoto@gmail.com>  
Keith Ball <inflatablewoman@gmail.com>  
Keith Randall <KHR@golang.org>  
Keith Rarick <kr@xph.us>  
Kelly Heller <pestophagous@gmail.com>  
Kelsey Hightower <kelsey.hightower@gmail.com>  
Kelvin Foo Chuan Lyi <vmirage@gmail.com>  
Ken Friedenbach <kenliz@cruzio.com>  
Ken Rockot <ken@oz.gs> <ken.rockot@gmail.com>  
Ken Sedgwick <ken@bonsai.com>  
Ken Thompson <ken@golang.org>  
Kenichi  
Tsunokawa <kenichi.tsunokawa@gmail.com>  
Kenji Kaneda <kenji.kaneda@gmail.com>  
Kenji Yano <kenji.yano@gmail.com>  
Kenneth Shaw <kenshaw@gmail.com>  
Kenny Grant <kennygrant@gmail.com>  
Kenta Mori <zoncoen@gmail.com>  
Kerollos Magdy <kerollos@yahoo.com>  
Ketan Parmar <ketanbparmar@gmail.com>  
Kevan Swanberg <kevswanberg@gmail.com>  
Kevin Ballard <kevin@sb.org>  
Kevin Burke <kev@inburke.com>  
Kvin Dunglas <dunglas@gmail.com>  
Kevin Gillette <extemporalgenome@gmail.com>  
Kevin Kirsche <kev.kirsche@gmail.com>  
Kevin Klues <klueska@gmail.com> <klueska@google.com>  
Kevin Malachowski <chowski@google.com>  
Kevin Ruffin <kruffin@gmail.com>  
Kevin Vu <kevin.m.vu@gmail.com>  
Kevin Zita <bleedgreenandgold@gmail.com>  
Keyan Pishdadian <kpishdadian@gmail.com>  
Kezhu Wang <kezhuw@gmail.com>  
Khosrow Moossavi <khos2ow@gmail.com>  
Kieran Colford <kieran@kcolford.com>  
Kim Shrier <kshrier@racktopsystems.com>  
Kim Yongbin <kybinz@gmail.com>

Kir Kolyshkin <kolyshkin@gmail.com>  
Kirill Korotaev <kirillx@gmail.com>  
Kirill  
Motkov <Motkov.Kirill@gmail.com>  
Kirill Smelkov <kirr@nexedi.com>  
Kirill Tatchihin <kirabsuir@gmail.com>  
Kirk Han <kirk91.han@gmail.com>  
Kirklin McDonald <kirklin.mcdonald@gmail.com>  
Klaus Post <klauspost@gmail.com>  
Kodie Goodwin <kodiegoodwin@gmail.com>  
Koichi Shiraishi <zchee.io@gmail.com>  
Koki Ide <niconegoto@yahoo.co.jp>  
Koki Tomoshige <tomocy.dev@gmail.com>  
Komu Wairagu <komuw05@gmail.com>  
Konstantin <konstantin8105@gmail.com>  
Konstantin Shaposhnikov <k.shaposhnikov@gmail.com>  
Koya IWAMURA <kiwamura0314@gmail.com>  
Kris Kwiatkowski <kris@cloudflare.com>  
Kris Nova <kris@nivenly.com>  
Kris Rousey <krousey@google.com>  
Kristopher Watts <traetox@gmail.com>  
Kshitij Saraogi <kshitij.saraogi@gmail.com>  
Kun Li <likunarmstrong@gmail.com>  
Kunpei Sakai <namusyaka@gmail.com>  
Kuntal Majumder <hellozee@disroot.org>  
Kush Patel <kush.patel@hootsuite.com>  
Kyle Consalus <consalus@gmail.com>  
Kyle Isom <kyle@gokyle.net>  
Kyle Jones <kyle@kyledj.com>  
Kyle Lemons <kyle@kylelemons.net> <kevlar@google.com>  
Kyle  
Nusbaum <kyle@datadog.com>  
Kyle Shannon <kyle@pobox.com>  
Kyle Spiers <eiais@google.com>  
Kyle Wood <kyle@kylewood.cc>  
Kyohei Kadota <lufia@lufia.org>  
Kyrylo Silin <silin@kyrylo.org>  
L Campbell <unpantso@gmail.com>  
Lai Jiangshan <eag0628@gmail.com>  
Lajos Papp <lalyos@yahoo.com>  
Lakshay Garg <lakshay.garg.1996@gmail.com>  
Lann Martin <lanm@google.com>  
Lanre Adelowo <yo@lanre.wtf>  
Larry Clapp <larry@theclapp.org>  
Larry Hosken <lahosken@golang.org>  
Lars Jeppesen <jeppesen.lars@gmail.com>  
Lars Lehtonen <lars.lehtonen@gmail.com>  
Lars Wiegman <lars@namsral.com>

Larz Conwell <larzconwell@gmail.com>  
Laurent Voisin <lpvoisin@gmail.com>  
Laurie Clark-Michalek <laurie@qubit.com>  
LE Manh Cuong <cuong.manhle.vn@gmail.com>  
Lee Hinman <hinman@gmail.com>  
Lee Packham <lpackham@gmail.com>  
Lehner Florian <dev@der-flo.net>  
Leigh McCulloch <leighmcc@gmail.com>  
Leo Antunes <leo@costela.net>  
Leo Rudberg <ljr@google.com>  
Leon Klingele <git@leonklingele.de>  
Leonardo Comelli <leonardo.comelli@gmail.com>  
Leonel  
Quinteros <leonel.quinteros@gmail.com>  
Lev Shamardin <shamardin@gmail.com>  
Lewin Bormann <lewin.bormann@gmail.com>  
Liam Haworth <liam@haworth.id.au>  
Lily Chung <lilithkchung@gmail.com>  
Lion Yang <lion@aosc.xyz>  
Liz Rice <liz@lizrice.com>  
Lloyd Dewolf <foolswisdom@gmail.com>  
Lorenz Bauer <lmb@cloudflare.com>  
Lorenz Brun <lorenz@brun.one>  
Lorenz Nickel <mail@lorenznickel.de>  
Lorenzo Masini <rugginoso@develer.com>  
Lorenzo Stoakes <lstoakes@gmail.com>  
Louis Kruger <louisk@google.com>  
Luan Santos <cfcluan@gmail.com>  
Lubomir I. Ivanov <neolit123@gmail.com>  
Luca Bruno <luca.bruno@coreos.com>  
Luca Greco <luca.greco@alcacoop.it>  
Lucas Bremgartner <lucas.bremgartner@gmail.com>  
Lucas Clemente <lclemente@google.com>  
Lucien Stuker <lucien.stuker@gmail.com>  
Lucio De Re <lucio.dere@gmail.com>  
Ludi Rehak <ludi317@gmail.com>  
Luigi Riefolo <luigi.riefolo@gmail.com>  
Luit van Drongelen <luitvd@gmail.com>  
Luka Zakrajek <tr00.g33k@gmail.com>  
Luka Zitnik <luka.zitnik@gmail.com>  
Lukasz Milewski <lmmilewski@gmail.com>  
Luke  
Champine <luke.champine@gmail.com>  
Luke Curley <qpingu@gmail.com>  
Luke Granger-Brown <git@lukegb.com>  
Luke Young <bored-engineer@users.noreply.github.com>  
Luna Duclos <luna.duclos@palmstonegames.com>  
Luuk van Dijk <lvd@golang.org> <lvd@google.com>

Lyle Franklin <lylejfranklin@gmail.com>  
Lynn Boger <laboger@linux.vnet.ibm.com>  
Ma Peiqi <mapei2017@gmail.com>  
Maarten Bezemer <maarten.bezemer@gmail.com>  
Maciej Dbski <maciejd@google.com>  
Madhu Rajanna <madhupr007@gmail.com>  
Magnus Hiie <magnus.hiie@gmail.com>  
Maicon Costa <maiconscosta@gmail.com>  
Mak Kolybabi <mak@kolybabi.com>  
Maksym Trykur <maksym.trykur@gmail.com>  
Mal Curtis <mal@mal.co.nz>  
Manfred Touron <m@42.am>  
Manigandan Dharmalingam <manigandan.jeff@gmail.com>  
Manish Goregaokar <manishsmail@gmail.com>  
Manoj Dayaram <platform-dev@moovweb.com> <manoj.dayaram@moovweb.com>  
Mansour Rahimi <rahimi.mnr@gmail.com>  
Manu Garg <manugarg@google.com>  
Manu S Ajith <neo@codingarena.in>  
Manuel Mendez <mmendez534@gmail.com>  
Marat  
Khabibullin <marat.khabibullin@jetbrains.com>  
Marc Sanmiquel <marcsanmiquel@gmail.com>  
Marc Weistroff <marc@weistroff.net>  
Marc-Antoine Ruel <maruel@chromium.org>  
Marcel Edmund Franke <marcel.edmund.franke@gmail.com>  
Marcel van Lohuizen <mpvl@golang.org>  
Marcelo Cantos <marcelo.cantos@gmail.com>  
Marcelo E. Magallon <marcelo.magallon@gmail.com>  
Marco Hennings <marco.hennings@freiheit.com>  
Marcus Weiner <marcus.weiner@gmail.com>  
Marcus Willock <crazcalm@gmail.com>  
Marga Manterola <marga@google.com>  
Mariano Cano <mariano@smallstep.com>  
Marin Bai <marin.basic02@gmail.com>  
Mario Arranz <marioarranzr@gmail.com>  
Marius A. Eriksen <marius@grailbio.com>  
Marius Nuennerich <mnu@google.com>  
Mark Adams <mark@markadams.me>  
Mark Bucciarelli <mkbucc@gmail.com>  
Mark Glines <mark@glines.org>  
Mark Harrison <marhar@google.com>  
Mark Percival <m@mdp.im>  
Mark Pulford <mark@kyne.com.au>  
Mark Rushakoff <mark.rushakoff@gmail.com>  
Mark Ryan <mark.d.ryan@intel.com>  
Mark Severson <miquella@gmail.com>  
Mark Theunissen

<mark.theunissen@gmail.com>  
Mark Villacampa <m@markvillacampa.com>  
Mark Wolfe <mark@wolfe.id.au>  
Mark Zavislak <zavislak@google.com>  
Marko Juhani Silokunnas <marko.silokunnas@gmail.com>  
Marko Kevac <marko@kevac.org>  
Marko Kungla <marko.kungla@gmail.com>  
Marko Mikulicic <mkm@google.com>  
Marko Mudrinic <mudrinic.mare@gmail.com>  
Marko Tiikkaja <marko@joh.to>  
Markus Duft <markus.duft@salomon.at>  
Markus Sonderegger <marraison@gmail.com>  
Markus Zimmermann <zimmski@gmail.com>  
Marten Seemann <martenseemann@gmail.com>  
Martin Asquino <martin.asquino@gmail.com>  
Martin Bertschler <mbertschler@gmail.com>  
Martin Garton <garton@gmail.com>  
Martin Habbecke <marhab@google.com>  
Martin Hamrle <martin.hamrle@gmail.com>  
Martin Hoefling <martin.hoefling@gmx.de>  
Martin Kreichgauer <martinkr@google.com>  
Martin Kunc <martinkunc@users.noreply.github.com>  
Martin Lindhe <martin.j.lindhe@gmail.com>  
Martin Mohrmann <moehrmann@google.com> <martisch@uos.de>  
Martin Neubauer <m.ne@gmx.net>  
Martin Olsen <github.com@martinolsen.net>  
Martin  
Olsson <martin@minimum.se>  
Martin Probst <martin@probst.io>  
Martin Sucha <anty.sk+git@gmail.com>  
Martin Tournoij <martin@arp242.net>  
Martins Sipenko <martins.sipenko@gmail.com>  
Martynas Budrinas <mabu@google.com>  
Marvin Stenger <marvin.stenger94@gmail.com>  
Marwan Sulaiman <marwan.sulaiman@work.co>  
Maryan Hratson <gmarik@gmail.com>  
Masahiro Furudate <masahiro.furudate@gmail.com>  
Masahiro Wakame <vvakame@gmail.com>  
Masaki Yoshida <yoshida.masaki@gmail.com>  
Masaya Watanabe <sfbgwm30@gmail.com>  
Mat Byczkowski <mbyczkowski@gmail.com>  
Mat Ryer <thatmatryer@gmail.com>  
Mt Gulys <mgulyas86@gmail.com>  
Matej Bao <matejbaco@gmail.com>  
Mateus Amin <mateus.amin@gmail.com>  
Mateusz Czapliski <czapkofan@gmail.com>  
Mathias Beke <git@denbeke.be>  
Mathias Hall-Andersen <mathias@hall-andersen.dk>

Mathias Leppich <mleppich@muhqu.de>  
Mathieu Lonjaret <mathieu.lonjaret@gmail.com>  
Mats Lidell <mats.lidell@cag.se> <mats.lidell@gmail.com>  
Matt Aimonetti <mattaimonetti@gmail.com>  
Matt Blair  
<me@matthewblair.net>  
Matt Bostock <matt@mattbostock.com>  
Matt Brown <mbrown@google.com>  
Matt Dee <mdee@hioscar.com>  
Matt Drollette <matt@drollette.com>  
Matt Harden <matt.harden@gmail.com>  
Matt Jibson <matt.jibson@gmail.com>  
Matt Joiner <anacrolix@gmail.com>  
Matt Jones <mrjones@google.com>  
Matt Juran <thepciet@gmail.com>  
Matt Layher <mdlayher@gmail.com>  
Matt Reiferson <mreiferson@gmail.com>  
Matt Robenolt <matt@ydekproductions.com>  
Matt Strong <mstrong1341@gmail.com>  
Matt T. Proud <matt.proud@gmail.com>  
Matt Williams <gh@mattyw.net> <mattyjwilliams@gmail.com>  
Matthew Brennan <matty.brennan@gmail.com>  
Matthew Broberg <matthewbbroberg@gmail.com>  
Matthew Cottingham <mattcottingham@gmail.com>  
Matthew Dempsky <mdempsky@google.com>  
Matthew Denton <mdenton@skyportsystems.com>  
Matthew Holt <Matthew.Holt+git@gmail.com>  
Matthew Horsnell <matthew.horsnell@gmail.com>  
Matthew Waters <mwwaters@gmail.com>  
Matthieu Hauglustaine <matt.hauglustaine@gmail.com>  
Matthieu Olivier <olivier.matthieu@gmail.com>  
Matthijs  
Kooijman <matthijs@stdin.nl>  
Max Riveiro <kavu13@gmail.com>  
Max Schmitt <max@schmitt.mx>  
Max Semenik <maxsem.wiki@gmail.com>  
Max Ushakov <ushmax@gmail.com>  
Maxim Eryomenko <moeryomenko@gmail.com>  
Maxim Khitrov <max@mxcrypt.com>  
Maxim Pimenov <mpimenov@google.com>  
Maxim Pugachev <pugachev.mm@gmail.com>  
Maxim Ushakov <ushakov@google.com>  
Maxime de Roucy <maxime.deroucy@gmail.com>  
Mximo Cuadros Ortiz <mcuadros@gmail.com>  
Maxwell Krohn <themax@gmail.com>  
Maya Rashish <maya@NetBSD.org>  
Mayank Kumar <krmayankk@gmail.com>  
Meir Fischer <meirfischer@gmail.com>

Meng Zhuo <mengzhuo1203@gmail.com> <mzh@golangcn.org>  
Mhd Sulhan <m.shulhan@gmail.com>  
Micah Stetson <micah.stetson@gmail.com>  
Michael Anthony Knyszek <mknyszek@google.com>  
Michael Brandenburg <mbrandenburg@bolste.com>  
Michael Chaten <mchaten@gmail.com>  
Michael Cook <code@mdcook.net>  
Michael Darakananda <pongad@google.com>  
Michael Dorner <mail@michaeldorner.de>  
Michael Edwards <medwards@walledcity.ca>  
Michael Elkins <michael.elkins@gmail.com>  
Michael  
Ellis <micellis@justin.tv>  
Michael Fraenkel <michael.fraenkel@gmail.com>  
Michael Fromberger <michael.j.fromberger@gmail.com>  
Michael Gehring <mg@ebfe.org> <gnirheg.leahcim@gmail.com>  
Michael Henderson <mdhender@users.noreply.github.com>  
Michael Hendricks <michael@ndrix.org>  
Michael Hoisie <hoisie@gmail.com>  
Michael Hudson-Doyle <michael.hudson@linaro.org>  
Michael Kasch <michael.kasch@gmail.com>  
Michael Kufl <golang@c.michael-kaeufl.de>  
Michael Kelly <mjk@google.com>  
Michael Lewis <mikelikespie@gmail.com>  
Michael MacInnis <Michael.P.MacInnis@gmail.com>  
Michael Marineau <michael.marineau@coreos.com>  
Michael Matloob <matloob@google.com>  
Michael McConville <momccconville@gmail.com>  
Michael McGreevy <mcgreevy@golang.org>  
Michael McLoughlin <mmcloughlin@gmail.com>  
Michael Munday <mike.munday@ibm.com>  
Michael Pearson <mipearson@gmail.com>  
Michael Piatek <piatek@google.com>  
Michael Pratt <mpratt@google.com>  
Michael Schaller <michael@5challer.de>  
Michael Schurter <michael.schurter@gmail.com>  
Michael  
Shields <mshields@google.com>  
Michael Stapelberg <michael@stapelberg.de> <mstplbrg@googlemail.com>  
Michael Steinert <mike.steinert@gmail.com>  
Michael T. Jones <mtj@google.com> <michael.jones@gmail.com>  
Michael Teichgrber <mteichgraeber@gmx.de> <mt4swm@googlemail.com>  
Michael Traver <mtraver@google.com>  
Michael Vetter <g.bluehut@gmail.com>  
Michael Vogt <mvo@ubuntu.com>  
Michal Bohuslvek <mbohuslvek@gmail.com>  
Michal Cierniak <cierniak@google.com>  
Micha Derkacz <ziutek@lnet.pl>



Michal Franc <lam.michal.franc@gmail.com>  
Micha owicki <mlowicki@gmail.com>  
Michal Pristas <michal.pristas@gmail.com>  
Michal Rostecki <mrostecki@suse.de>  
Michalis Kargakis <michaliskargakis@gmail.com>  
Michel Lespinasse <>walken@google.com>  
Mickael Kerjean <mickael.kerjean@gmail.com>  
Mickey Reiss <mickeyreiss@gmail.com>  
Miek Gieben <miek@miek.nl> <remigius.gieben@gmail.com>  
Miguel Acero <acero@google.com>  
Miguel Mendez <stxmendez@gmail.com>  
Miguel Molina <hi@mvader.me>  
Mihai Borobocea  
<MihaiBorobocea@gmail.com>  
Mihai Moldovan <ionic@ionic.de>  
Mihai Todor <todormihai@gmail.com>  
Mihail Minaev <minaev.mike@gmail.com>  
Mikael Tillenius <mikti42@gmail.com>  
Mike Andrews <mra@xoba.com>  
Mike Appleby <mike@app.leby.org>  
Mike Danese <mikedanese@google.com>  
Mike Houston <mike@kothar.net>  
Mike Kabischev <kabischev@gmail.com>  
Mike Rosset <mike.rosset@gmail.com>  
Mike Samuel <mikesamuel@gmail.com>  
Mike Solomon <msolo@gmail.com>  
Mike Strosaker <strosake@us.ibm.com>  
Mike Tsao <mike@sowbug.com>  
Mike Wiacek <mjwiacek@google.com>  
Mikhail Fesenko <proggga@gmail.com>  
Mikhail Gusarov <dottedmag@dottedmag.net>  
Mikhail Panchenko <m@mihasya.com>  
Miki Tebeka <miki.tebeka@gmail.com>  
Mikio Hara <mikioh.mikioh@gmail.com>  
Mikkel Krautz <mikkel@krautz.dk> <krautz@gmail.com>  
Mikoaj Baranowski <mikolajb@gmail.com>  
Milan Knezevic <milan.knezevic@mips.com>  
Milan Patel <bicelot3@gmail.com>  
Milutin Jovanovic <jovanovic.milutin@gmail.com>  
MinJae Kwon <mingrammer@gmail.com>  
Miquel Sabat Sol <mikisabate@gmail.com>  
Mirko  
Hansen <baaazen@gmail.com>  
Miroslav Genov <mgenov@gmail.com>  
Misty De Meo <mistydemeo@gmail.com>  
Mohit Agarwal <mohit@sdf.org>  
Mohit kumar Bajoria <mohitbajo36@gmail.com>  
Mohit Verma <vmohit.93@gmail.com>

Momchil Velikov <momchil.velikov@gmail.com>  
Monis Khan <mkhan@redhat.com>  
Monty Taylor <mordred@inaugust.com>  
Moritz Fain <moritz@fain.io>  
Moriyoshi Koizumi <mozo@mozo.jp>  
Morten Siebuhr <sbhr@sbhr.dk>  
Mshe van der Sterre <moshevds@gmail.com>  
Mostyn Bramley-Moore <mostyn@antipode.se>  
Mrunal Patel <mrunalp@gmail.com>  
Muhammad Falak R Wani <falakreyaz@gmail.com>  
Muhammed Uluyol <uluyol0@gmail.com>  
Muir Manders <muir@mnd.rs>  
Mukesh Sharma <sharma.mukesh439@gmail.com>  
Mura Li <mura\_li@castech.com.tw>  
Mykhailo Lesyk <mikhail@lesyk.org>  
Naman Aggarwal <aggarwal.nam@gmail.com>  
Nan Deng <monnand@gmail.com>  
Nao Yonashiro <owan.orisano@gmail.com>  
Naoki Kanatani <k12naoki@gmail.com>  
Nate Wilkinson <nathanwilk7@gmail.com>  
Nathan Cantelmo <n.cantelmo@gmail.com>  
Nathan Caza <mastercactus@gmail.com>  
Nathan  
Dias <nathan.dias@orijtech.com>  
Nathan Fiscaletti <nathan.fiscaletti@vrazo.com>  
Nathan Humphreys <nkhumphreys@gmail.com>  
Nathan John Youngman <nj@nathany.com>  
Nathan Otterness <otterness@cs.unc.edu>  
Nathan P Finch <nate.finch@gmail.com>  
Nathan VanBenschoten <nvanbenschoten@gmail.com>  
Nathan Youngman <git@nathany.com>  
Nathan(yinian) Hu <nathanhu@google.com>  
Nathaniel Cook <nvcook42@gmail.com>  
Naveen Kumar Sangi <naveenkumarsangi@protonmail.com>  
Neeilan Selvalingam <neeilan96@gmail.com>  
Neelesh Chandola <neelesh.c98@gmail.com>  
Neil Lyons <nwjlyons@googlemail.com>  
Neuman Vong <neuman.vong@gmail.com>  
Neven Sajko <nsajko@gmail.com>  
Nevins Bartolomeo <nevins.bartolomeo@gmail.com>  
Niall Sheridan <nsheridan@gmail.com>  
Nic Day <nic.day@me.com>  
Nicholas Katsaros <nick@nickkatsaros.com>  
Nicholas Maniscalco <nicholas@maniscalco.com>  
Nicholas Ng <nickng@nickng.io>  
Nicholas Presta <nick@nickpresta.ca> <nick1presta@gmail.com>  
Nicholas Sullivan <nicholas.sullivan@gmail.com>  
Nicholas

Waples <nwaples@gmail.com>  
Nick Anthony <Liberatys@outlook.com>  
Nick Cooper <nmvc@google.com>  
Nick Craig-Wood <nick@craig-wood.com> <nickcw@gmail.com>  
Nick Harper <nharper@google.com>  
Nick Kubala <nkubala@google.com>  
Nick Leli <nicholasleli@gmail.com>  
Nick Miyake <nmiyake@users.noreply.github.com>  
Nick Patavalis <nick.patavalis@gmail.com>  
Nick Petroni <npetroni@cs.umd.edu>  
Nick Robinson <nrobinson13@gmail.com>  
Nick Smolin <nick27surgut@gmail.com>  
Nicolas BRULEZ <n.brulez@gmail.com>  
Nicolas Kaiser <nikai@nikai.net>  
Nicolas Owens <mischief@offblast.org>  
Nicolas S. Dade <nic.dade@gmail.com>  
Niek Sanders <niek.sanders@gmail.com>  
Niels Widger <niels.widger@gmail.com>  
Nigel Kerr <nigel.kerr@gmail.com>  
Nigel Tao <nigeltao@golang.org>  
Nik Nyby <nnyby@columbia.edu>  
Nikhil Benesch <nikhil.benesch@gmail.com>  
Nikita Gillmann <nikita@n0.is> <ng0@n0.is>  
Nikita Kryuchkov <nkryuchkov10@gmail.com>  
Nikita Vanyasin <nikita.vanyasin@gmail.com>  
Niklas Schnelle <niklas.schnelle@gmail.com>  
Niko Dziemba  
<niko@dziemba.com>  
Nikolay Turpitko <nikolay@turpitko.com>  
Nikson Kanti Paul <nikson.sust@gmail.com>  
Nils Larsgrd <nilsmagnus@gmail.com>  
Nir Soffer <nirsof@gmail.com>  
Niranjan Godbole <niranjan8192@gmail.com>  
Nishanth Shanmugham <nishanth.gerrard@gmail.com>  
Noah Campbell <noahcampbell@gmail.com>  
Noah Goldman <noahg34@gmail.com>  
Noble Johnson <noblepoly@gmail.com>  
Nodir Turakulov <nodir@google.com>  
Noel Georgi <git@frezbo.com>  
Norberto Lopes <nlopes.ml@gmail.com>  
Norman B. Lancaster <qbradq@gmail.com>  
Nuno Cruces <ncruces@users.noreply.github.com>  
Obeyda Djefal <djefobey@gmail.com>  
Odin Ugedal <odin@ugedal.com>  
Oleg Bulatov <dmage@yandex-team.ru>  
Oleg Vakheta <helginet@gmail.com>  
Oleku Konko <oleku.konko@gmail.com>  
Oling Cat <olingcat@gmail.com>

Oliver Hookins <ohookins@gmail.com>  
Oliver Powell <oliverpowell84@gmail.com>  
Oliver Stenbom <ostenbom@pivotal.io>  
Oliver Tonnhofer <olt@bogosoftware.com>  
Olivier Antoine <olivier.antoine@gmail.com>  
Olivier Duperray <duperray.olivier@gmail.com>  
Olivier  
Poitrey <rs@daily motion.com>  
Olivier Saingre <osaingre@gmail.com>  
Omar Jarjur <ojarjur@google.com>  
Oryan Moshe <iamoryanmoshe@gmail.com>  
Osamu TONOMORI <osamingo@gmail.com>  
zgr Kesim <oec-go@kesim.org>  
Pablo Caderno <kaderno@gmail.com>  
Pablo Lalloni <plalloni@gmail.com>  
Pablo Rozas Larraondo <pablo.larraondo@anu.edu.au>  
Pablo Santiago Blum de Aguiar <scorplus@gmail.com>  
Padraig Kitterick <padraigkitterick@gmail.com>  
Pallat Anchaleechamaikorn <yod.pallat@gmail.com>  
Panos Georgiadis <pgeorgiadis@suse.de>  
Pantelis Sampaziotis <psampaz@gmail.com>  
Paolo Giarrusso <p.giarrusso@gmail.com>  
Paolo Martini <mrtnpaolo@gmail.com>  
Parker Moore <parkrmoore@gmail.com>  
Parminder Singh <parmsingh101@gmail.com>  
Pascal Dierich <pascal@pascaldierich.com>  
Pascal S. de Kloe <pascal@quies.net>  
Paschalis Tsilias <paschalis.tsilias@gmail.com>  
Pasi Thkp <pasi.tahkapaa@gmail.com>  
Pat Moroney <pat@pat.email>  
Patrick Barker <barkerp@vmware.com>  
Patrick Crosby <patrick@stathat.com>  
Patrick Gavlin <pgavlin@gmail.com>  
Patrick  
Higgins <patrick.allen.higgins@gmail.com>  
Patrick Lee <pattyshack101@gmail.com>  
Patrick Mzard <patrick@mezard.eu>  
Patrick Mylund Nielsen <patrick@patrickmn.com>  
Patrick Pelletier <pp.pelletier@gmail.com>  
Patrick Riley <pfr@google.com>  
Patrick Smith <pat42smith@gmail.com>  
Patrik Lundin <patrik@sigterm.se>  
Paul A Querna <paul.querna@gmail.com>  
Paul Borman <borman@google.com>  
Paul Boyd <boyd.paul2@gmail.com>  
Paul Chang <paulchang@google.com>  
Paul D. Weber <x0bdev@gmail.com>  
Paul Hammond <paul@paulhammond.org>

Paul Hankin <paulhankin@google.com>  
Paul Jolly <paul@myitcv.org.uk>  
Paul Lalonde <paul.a.lalonde@gmail.com>  
Paul M Furley <paul@paulfurley.com>  
Paul Marks <pmarks@google.com>  
Paul Meyer <paul.meyer@microsoft.com>  
Paul Nasrat <pnasrat@google.com>  
Paul PISCUC <paul.piscuc@gmail.com>  
Paul Querna <pquerna@apache.org>  
Paul Rosania <paul.rosania@gmail.com>  
Paul Ruest <pruest@gmail.com>  
Paul Sbarra <Sbarra.Paul@gmail.com>  
Paul Smith <paulsmith@pobox.com> <paulsmith@gmail.com>  
Paul  
Tyng <paul@paultyng.net>  
Paul van Brouwershaven <paul@vanbrouwershaven.com>  
Paul Wankadia <junyer@google.com>  
Paulo Casaretto <pcasaretto@gmail.com>  
Paulo Flabiano Smorigo <pfsmorigo@linux.vnet.ibm.com>  
Paulo Gomes <paulo.gomes.uk@gmail.com>  
Pavel Paulau <pavel.paulau@gmail.com>  
Pavel Zinovkin <pavel.zinovkin@gmail.com>  
Pavlo Sumkin <ymkins@gmail.com>  
Pawel Knap <pawelknap88@gmail.com>  
Pawel Szczur <filemon@google.com>  
Pei Xian Chee <luciolas1991@gmail.com>  
Percy Wegmann <ox.to.a.cart@gmail.com>  
Perry Abbott <perry.j.abbott@gmail.com>  
Petar Dambovaliev <petar.atanasov.1987@gmail.com>  
Petar Maymounkov <petarm@gmail.com>  
Peter Armitage <peter.armitage@gmail.com>  
Peter Bourgon <peter@bourgon.org>  
Peter Collingbourne <pcc@google.com>  
Peter Conerly <pconerly@gmail.com>  
Peter Dotchev <dotchev@gmail.com>  
Peter Froehlich <peter.hans.froehlich@gmail.com>  
Peter Gonda <pgonda@google.com>  
Peter Hoyes <pahoyes@gmail.com>  
Peter Kleiweg <pkleiweg@xs4all.nl>  
Peter McKenzie <petermck@google.com>  
Peter  
Moody <pmoody@uber.com>  
Peter Morjan <pmorjan@gmail.com>  
Peter Mundy <go.peter.90@gmail.com>  
Peter Nguyen <peter@mictis.com>  
Pter Surnyi <speter.go1@gmail.com>  
Pter Szab <pts@google.com>  
Pter Szilgyi <peterke@gmail.com>

Peter Teichman <pteichman@fastly.com>  
Peter Tseng <ptseng@squareup.com>  
Peter Waldschmidt <peter@waldschmidt.com>  
Peter Waller <peter.waller@gmail.com>  
Peter Weinberger <pjw@golang.org>  
Peter Williams <pwil3058@gmail.com>  
Peter Wu <pwu@cloudflare.com>  
Peter Zhang <i@ddatsh.com>  
Petr Jedin <petr.jediny@gmail.com>  
Petrica Voicu <pvoicu@paypal.com>  
Phil Pearl <philip.j.r.pearl@gmail.com>  
Phil Pennock <pdp@golang.org>  
Philip Brgesen <philip.borgesen@gmail.com>  
Philip Brown <phil@bolthole.com>  
Philip Hofer <phofer@umich.edu>  
Philip K. Warren <pkwarren@gmail.com>  
Philip Nelson <me@pnelson.ca>  
Philipp Stephani <phst@google.com>  
Pierre Carru <pierre.carru@eshard.com>  
Pierre Durand <pierredurand@gmail.com>  
Pierre Prinetti <pierreprinetti@gmail.com>  
Pierre Roullon <pierre.roullon@gmail.com>  
Piers  
<google@heloopers.pro>  
Pieter Droogendijk <pieter@binky.org.uk>  
Pietro Gagliardi <pietro10@mac.com>  
Piyush Mishra <piyush@codeitout.com>  
Plekhanov Maxim <kishtatix@gmail.com>  
Polina Osadcha <polliosa@google.com>  
Pontus Leitzler <leitzler@gmail.com>  
Povilas Versockas <p.versockas@gmail.com>  
Prasanga Siripala <pj@pjebs.com.au>  
Prasanna Swaminathan <prasanna@mediamath.com>  
Prashant Agrawal <prashant.a.vjti@gmail.com>  
Prashant Varanasi <prashant@prashantv.com>  
Praveen Kumar <praveen+git@kumar.in>  
Pravendra Singh <hackpravj@gmail.com>  
Preetam Jinka <pj@preet.am>  
Pure White <wu.purewhite@gmail.com>  
Qais Patankar <qaisjp@gmail.com>  
Qiuxuan Zhu <ilsh1022@gmail.com>  
Quan Tran <qeed.quan@gmail.com>  
Quan Yong Zhai <qyzhai@gmail.com>  
Quentin Perez <qperez@ocs.online.net>  
Quentin Renard <contact@asticode.com>  
Quentin Smith <quentin@golang.org>  
Quey-Liang Kao <s101062801@m101.nthu.edu.tw>  
Quinn Slack <sqs@sourcegraph.com>

Quinten Yearsley <qyearsley@chromium.org>  
Quoc-Viet Nguyen  
<afelion@gmail.com>  
Radek Sohlich <sohlich@gmail.com>  
Radu Berinde <radu@cockroachlabs.com>  
Rafal Jeczalik <rjeczalik@gmail.com>  
Raghavendra Nagaraj <jamdagni86@gmail.com>  
Rahul Chaudhry <rahulchaudhry@chromium.org>  
Raif S. Naffah <go@naffah-raif.name>  
Rajat Goel <rajat.goel2010@gmail.com>  
Rajath Agasthya <rajathagasthya@gmail.com>  
Rajender Reddy Kompally <rajenderreddykompally@gmail.com>  
Ralph Corderoy <ralph@inputplus.co.uk>  
Ramazan AYYILDIZ <rayyildiz@gmail.com>  
Ramesh Dharan <dharan@google.com>  
Raph Levien <raph@google.com>  
Raphael Geronimi <raphael.geronimi@gmail.com>  
Raul Silvera <rsilvera@google.com>  
Ravil Bikbulatov <weeellz12@gmail.com>  
RaviTeja Pothana <ravi.tezu@gmail.com>  
Ray Tung <rtung@thoughtworks.com>  
Raymond Kazlauskas <raima220@gmail.com>  
Rebecca Stambler <rstambler@golang.org>  
Reilly Watson <reillywatson@gmail.com>  
Reinaldo de Souza Jr <juniorz@gmail.com>  
Remi Gillig <remigillig@gmail.com>  
Rmy Oudompheng <oudomphe@phare.normalesup.org> <remyoudompheng@gmail.com>  
Ren  
Ogaki <re.yuz77777@gmail.com>  
Rens Rikkerink <Ikkerens@users.noreply.github.com>  
Rhys Hiltner <rhys@justin.tv>  
Ricardo Padilha <ricardospadilha@gmail.com>  
Ricardo Seriani <ricardo.seriani@gmail.com>  
Richard Barnes <rlb@ipv.sx>  
Richard Crowley <r@rcrowley.org>  
Richard Dingwall <rdingwall@gmail.com>  
Richard Eric Gavaletz <gavaletz@gmail.com>  
Richard Gibson <richard.gibson@gmail.com>  
Richard Miller <miller.research@gmail.com>  
Richard Musiol <mail@richard-musiol.de> <neelance@gmail.com>  
Richard Ulmer <codesoap@mailbox.org>  
Richard Wilkes <wilkes@me.com>  
Rick Arnold <rickarnoldjr@gmail.com>  
Rick Hudson <rlh@golang.org>  
Rick Sayre <whorfin@gmail.com>  
Rijnard van Tonder <rvantonder@gmail.com>  
Riku Voipio <riku.voipio@linaro.org>  
Risto Jaakko Saarelm <rsaarelm@gmail.com>

Rob Earhart <earhart@google.com>  
Rob Findley <rfindley@google.com>  
Rob Norman <rob.norman@infinitycloud.com>  
Rob Phoenix <rob@robphoenix.com>  
Rob Pike <r@golang.org>  
Robert Ayrapetyan <robert.ayrapetyan@gmail.com>  
Robert  
Daniel Kortschak <dan.kortschak@adelaide.edu.au> <dan@kortschak.io>  
Robert Dinu <r@varp.se>  
Robert Figueiredo <robfig@gmail.com>  
Robert Griesemer <gri@golang.org>  
Robert Hencke <robert.hencke@gmail.com>  
Robert Iannucci <iannucci@google.com>  
Robert Kuska <rkuska@gmail.com>  
Robert Obryk <robryk@gmail.com>  
Robert Sesek <rsesek@google.com>  
Robert Snedegar <roberts@google.com>  
Robert Stepanek <robert.stepanek@gmail.com>  
Robert van Gent <rvangent@google.com>  
Robert-Andr Mauchin <zebob.m@gmail.com>  
Roberto Clapis <robclap8@gmail.com>  
Roberto Selbach <roberto@selbach.ca>  
Robin Eklind <r.eklind.87@gmail.com>  
Robin Zhong <robin@robinzhong.co>  
Rodolfo Carvalho <rhcarvalho@gmail.com>  
Rodolfo Rodriguez <rodolfobgibson@gmail.com>  
Rodrigo Moraes de Oliveira <rodrigo.moraes@gmail.com>  
Rodrigo Rafael Monti Kochenburger <divoxx@gmail.com>  
Roger Pau Monn <royger@gmail.com>  
Roger Peppe <rogpeppe@gmail.com>  
Rohan Challa <rohan@golang.org>  
Rohan Verma <rohanverma2004@gmail.com>  
Rohith Ravi <entombedvirus@gmail.com>  
Roland  
Illig <roland.illig@gmx.de>  
Roland Shoemaker <rolandshoemaker@gmail.com>  
Romain Bague <romain.bague@elwinar.com>  
Roman Budnikov <romanyx90@yandex.ru>  
Roman Kollr <roman.kollar.0@gmail.com>  
Roman Shchekin <mrqtros@gmail.com>  
Ron Hashimoto <mail@h2so5.net>  
Ron Minnich <rminnich@gmail.com>  
Ross Chater <rdchater@gmail.com>  
Ross Kinsey <rossikinsey@gmail.com>  
Ross Light <light@google.com> <rlight2@gmail.com>  
Ross Smith II <ross@smithii.com>  
Rowan Marshall <rowanajmarshall@gmail.com>  
Rowan Worth <sqweek@gmail.com>



Rudi Kramer <rudi.kramer@gmail.com>  
Rui Ueyama <ruiui@google.com>  
Ruixin Bao <ruixin.bao@ibm.com>  
Ruslan Nigmatullin <elessar@dropbox.com>  
Russ Cox <rsc@golang.org>  
Russell Haering <russellhaering@gmail.com>  
Ryan Bagwell <ryanbagwell@outlook.com>  
Ryan Barrett <ryanb@google.com>  
Ryan Boehning <ryan.boehning@apcera.com>  
Ryan Brown <ribrdb@google.com>  
Ryan Canty <jrcanty@gmail.com>  
Ryan Dahl <ry@tinyclouds.org>  
Ryan Hitchman <hitchmanr@gmail.com>  
Ryan Lower <rpjlower@gmail.com>  
Ryan  
Rodén-Corrent <ryan@rcorre.net>  
Ryan Seys <ryan@ryanseys.com>  
Ryan Slade <ryanslade@gmail.com>  
Ryan Zhang <ryan.zhang@docker.com>  
Ryoichi KATO <ryo1kato@gmail.com>  
Ryuji Iwata <qt.luigi@gmail.com>  
Ryuma Yoshida <ryuma.y1117@gmail.com>  
Ryuzo Yamamoto <ryuzo.yamamoto@gmail.com>  
S.alar Onur <caglar@10ur.org>  
Sabin Mihai Rapan <sabin.rapan@gmail.com>  
Sad Pencil <qh06@qq.com>  
Sai Cheemalapati <saicheems@google.com>  
Sakeven Jiang <jc5930@sina.cn>  
Salmn Aljammz <s@0x65.net>  
Sam Arnold <sarnold64@bloomberg.net>  
Sam Boyer <tech@samboyer.org>  
Sam Chen <chenxsan@gmail.com>  
Sam Cross <samgcdev@gmail.com>  
Sam Ding <samding@ca.ibm.com>  
Sam Hug <samuel.b.hug@gmail.com>  
Sam Thorogood <thorogood@google.com> <sam.thorogood@gmail.com>  
Sam Whited <sam@samwhited.com>  
Sameer Ajmani <sameer@golang.org> <ajmani@gmail.com>  
Sami Commerot <samic@google.com>  
Sami Pnknen <sami.ponkanen@gmail.com>  
Samuel Kelemen <SCKelemen@users.noreply.github.com>  
Samuel Tan <samueltan@google.com>  
Samuele Pedroni  
<pedronis@lucediurna.net>  
Sander van Harmelen <sander@vanharmelen.nl>  
Sanjay Menakuru <balasanjay@gmail.com>  
Santhosh Kumar Tekuri <santhosh.tekuri@gmail.com>  
Sarah Adams <shadams@google.com>

Sardorbek Pulatov <sardorbek.pulatov@outlook.com>  
Sascha Brawer <sascha@brawer.ch>  
Sasha Lionheart <lionhearts@google.com>  
Sasha Sobol <sasha@scaledinference.com>  
Scott Barron <scott.barron@github.com>  
Scott Bell <scott@sctsm.com>  
Scott Crunkleton <crunk1@gmail.com>  
Scott Ferguson <scottwferg@gmail.com>  
Scott Lawrence <bytbody@gmail.com>  
Scott Mansfield <smansfield@netflix.com>  
Scott Ragan <ragansa@fb.com>  
Scott Schwartz <scotts@golang.org>  
Scott Van Woudenberg <scottvw@google.com>  
Sean Burford <sburford@google.com>  
Sean Chen <oohcode@gmail.com>  
Sean Chittenden <seanc@joyent.com>  
Sean Christopherson <sean.j.christopherson@intel.com>  
Sean Dolphin <Sean.Dolphin@kpcompass.com>  
Sean Harger <sharger@google.com>  
Sean Liao <seankhliao@gmail.com>  
Sean Rees <sean@erifax.org>  
Sebastiaan van Stijn <github@gone.nl>  
Sebastian  
Chlopecki <sebsebmc@gmail.com>  
Sebastian Kinne <skinne@google.com>  
Sebastian Schmidt <yath@google.com>  
Sebastien Binet <seb.binet@gmail.com>  
Sbastien Paolacci <sebastien.paolacci@gmail.com>  
Sebastien Williams-Wynn <sebastien@cytora.com>  
Segev Finer <segev208@gmail.com>  
Seiji Takahashi <timaki.st@gmail.com>  
Sergei Lemeshkin <sergeilem@gmail.com>  
Sergei Skorobogatov <skorobo@rambler.ru>  
Sergei Zagurskii <gvozdoder@gmail.com>  
Sergey 'Snake' Gromov <snake.scaly@gmail.com>  
Sergey Arseev <sergey.arseev@intel.com>  
Sergey Dobrodey <sergey.dobrodey@synesis.ru>  
Sergey Frolov <sfrolov@google.com>  
Sergey Glushchenko <gs serge@gmail.com>  
Sergey Ivanov <ser1325@gmail.com>  
Sergey Lukjanov <me@slukjanov.name>  
Sergey Mishin <sergeymishine@gmail.com>  
Sergey Mudrik <sergey.mudrik@gmail.com>  
Sergey Semin <gray12511@gmail.com>  
Sergey Yanykin <syanykin@ozon.ru>  
Sergio Luis O. B. Correia <sergio@correia.cc>  
Sergiusz Bazanski <bazanski@gmail.com>  
Serhat Giydiren <serhatgiydiren@gmail.com>

Serhii

Aheienko <serhii.aheienko@gmail.com>  
Seth Hoenig <seth.a.hoenig@gmail.com>  
Seth Vargo <sethvargo@gmail.com>  
Shahar Kohanim <skohanim@gmail.com>  
Shamil Garatuev <garatuev@gmail.com>  
Shane Hansen <shanemhansen@gmail.com>  
Shang Jian Ding <sdng3@ncsu.edu>  
Shaozhen Ding <dsz0111@gmail.com>  
Shaquille Wyan Que <shaqqywyang@gmail.com>  
Shaun Dunning <shaun.dunning@uservoice.com>  
Shawn Elliott <selliot@microsoft.com>  
Shawn Ledbetter <sledbetter@google.com>  
Shawn Smith <shawn.p.smith@gmail.com>  
Shawn Walker-Salas <shawn.walker@oracle.com>  
Shenghou Ma <minux@golang.org> <minux.ma@gmail.com>  
Shengjing Zhu <zsj950618@gmail.com>  
Shengyu Zhang <shengyu.zhang@chaitin.com>  
Shi Han Ng <shihanng@gmail.com>  
Shijie Hao <haormj@gmail.com>  
Shinji Tanaka <shinji.tanaka@gmail.com>  
Shintaro Kaneko <kaneshin0120@gmail.com>  
Shivakumar GN <shivakumar.gn@gmail.com>  
Shivani Singhal <shivani.singhal2804@gmail.com>  
Shivansh Rai <shivansh@freebsd.org>  
Shivashis Padhi <shivashispadhi@gmail.com>  
Shubham Sharma <shubham.sha12@gmail.com>  
Shun  
Fan <sfan@google.com>  
Silvan Jegen <s.jegen@gmail.com>  
Simarpreet Singh <simar@linux.com>  
Simon Drake <simondrake1990@gmail.com>  
Simon Ferquel <simon.ferquel@docker.com>  
Simon Jefford <simon.jefford@gmail.com>  
Simon Rawet <simon@rawet.se>  
Simon Rozman <simon@rozman.si>  
Simon Thulbourn <simon+github@thulbourn.com>  
Simon Whitehead <chemnova@gmail.com>  
Sina Siadat <siadat@gmail.com>  
Sjoerd Siebinga <sjoerd.siebinga@gmail.com>  
Sokolov Yura <funny.falcon@gmail.com>  
Song Gao <song@gao.io>  
Soojin Nam <jsunam@gmail.com>  
Sren L. Hansen <soren@linux2go.dk>  
Spencer Kocot <spencerkocot@gmail.com>  
Spencer Nelson <s@spenczar.com>  
Spencer Tung <spencertung@google.com>  
Spring Mc <heresy.mc@gmail.com>

Srdjan Petrovic <spetrovic@google.com>  
Sridhar Venkatakrishnan <sridhar@laddoo.net>  
Srinidhi Kaushik <shrindhi.kaushik@gmail.com>  
StalkR <stalkr@stalkr.net>  
Stan Schwertly <stan@schwertly.com>  
Stanislav Afanasev <php.progger@gmail.com>  
Steeve Morin <steeve.morin@gmail.com>  
Stefan Baebler  
<sbaebler@outbrain.com>  
Stefan Nilsson <snilsson@nada.kth.se> <trolleriprofessorn@gmail.com>  
Stepan Shabalin <neverliberty@gmail.com>  
Stephan Renatus <srenatus@chef.io>  
Stephan Zuercher <zuercher@gmail.com>  
Stphane Travostino <stephane.travostino@gmail.com>  
Stephen Lewis <stephen@sock.org.uk>  
Stephen Lu <steuhs@users.noreply.github.com>  
Stephen Ma <stephenm@golang.org>  
Stephen McQuay <stephen@mcquay.me>  
Stephen Searles <stephens2424@gmail.com>  
Stephen Weinberg <stephen@q5comm.com>  
Steve Francia <spf@golang.org>  
Steve Gilbert <stevegilbert23@gmail.com>  
Steve LoFurno <slofurno@gmail.com>  
Steve McCoy <mccoyst@gmail.com>  
Steve Mynott <steve.mynott@gmail.com>  
Steve Newman <snewman@google.com>  
Steve Phillips <elimistev@gmail.com>  
Steve Streeting <steve@stevestreeting.com>  
Steven Buss <sbuss@google.com>  
Steven Elliot Harris <seharris@gmail.com>  
Steven Erenst <stevenerenst@gmail.com>  
Steven Hartland <steven.hartland@multiplay.co.uk>  
Steven Littlebrant <imgroxx@gmail.com>  
Steven Wilkin  
<stevenwilkin@gmail.com>  
Stuart Jansen <sjansen@buscaluz.org>  
Sue Spence <virtuallysue@gmail.com>  
Sugu Sougoumarane <ssougou@gmail.com>  
Suharsh Sivakumar <suharshs@google.com>  
Sukrit Handa <sukrit.handa@utoronto.ca>  
Sunny <me@darkowlzz.space>  
Suriyaa Sundararuban <suriyaasundararuban@gmail.com>  
Suyash <dextrous93@gmail.com>  
Suzy Mueller <suzmue@golang.org>  
Sven Almgren <sven@tras.se>  
Sven Blumenstein <svbl@google.com>  
Sven Taute <sven.taute@gmail.com>  
Sylvain Zimmer <sylvain@sylvainzimmer.com>

Syohei YOSHIDA <syohex@gmail.com>  
Szabolcs Nagy <nsz@port70.net>  
Taavi Kivisik <taavi.kivisik@gmail.com>  
Tad Fisher <tadfisher@gmail.com>  
Tad Glines <tad.glines@gmail.com>  
Tadas Valiukas <tadovas@gmail.com>  
Tadeo Kondrak <me@tadeo.ca>  
Taesu Pyo <pyotaesu@gmail.com>  
Tai Le <letientai299@gmail.com>  
Taj Khattrra <taj.khattrra@gmail.com>  
Takashi Matsuo <tmatsuo@google.com>  
Takayoshi Nishida <takayoshi.nishida@gmail.com>  
Takeshi YAMANASHI <9.nashi@gmail.com>  
Takuto Ikuta <tikuta@google.com>  
Takuya Ueda  
<uedatakuya@gmail.com>  
Tal Shprecher <tshprecher@gmail.com>  
Tams Gulcsi <tgulacsi78@gmail.com>  
Tamir Duberstein <tamird@gmail.com>  
Tao Qingyun <qingyunha@gmail.com>  
Tao Shen <shentaoskyking@gmail.com>  
Tao Wang <twang2218@gmail.com>  
Tarmigan Casebolt <tarmigan@gmail.com>  
Taro Aoki <aizu.s1230022@gmail.com>  
Taru Karttunen <taruti@taruti.net>  
Tatsuhiko Tsujikawa <tatsuhiko.t@gmail.com>  
Tatsuya Kaneko <m.ddotx.f@gmail.com>  
Taufiq Rahman <taufiqrx8@gmail.com>  
Teague Cole <tnc1443@gmail.com>  
Ted Kornish <golang@tedkornish.com>  
Tejasvi Nareddy <tejunareddy@gmail.com>  
Terin Stock <terinjokes@gmail.com>  
Terrel Shumway <gopher@shumway.us>  
Tetsuo Kiso <tetsuokiso9@gmail.com>  
Than McIntosh <thanm@google.com>  
Thanabodee Charoenpiriyakij <wingyminus@gmail.com>  
Thanatat Tamtan <acoshift@gmail.com>  
The Hatsune Daishi <nao20010128@gmail.com>  
Thiago Avelino <t@avelino.xxx>  
Thiago Fransosi Farina <thiago.farina@gmail.com> <tfarina@chromium.org>  
Thomas Alan Copeland <talán.copeland@gmail.com>  
Thomas Bonfort  
<thomas.bonfort@gmail.com>  
Thomas Bouldin <inlined@google.com>  
Thomas Bruyelle <thomas.bruyelle@gmail.com>  
Thomas Bushnell, BSG <tbushnell@google.com>  
Thomas de Zeeuw <thomasdezeeuw@gmail.com>  
Thomas Desrosiers <thomasdesr@gmail.com>

Thomas Habets <habets@google.com>  
Thomas Kappler <tkappler@gmail.com>  
Thomas Meson <zllak@hycik.org>  
Thomas Symborski <thomas.symborski@gmail.com>  
Thomas Wanielista <tomwans@gmail.com>  
Thorben Krueger <thorben.krueger@gmail.com>  
Thordur Bjornsson <thorduri@secnorth.net>  
Tiago Queiroz <contato@tiago.eti.br>  
Tianji Wu <the729@gmail.com>  
Tianon Gravi <admwiggin@gmail.com>  
Tilman Dilo <tilman.dilo@gmail.com>  
Tim Cooijmans <timcooijmans@gmail.com>  
Tim Cooper <tim.cooper@layeh.com>  
Tim Ebringer <tim.ebringer@gmail.com>  
Tim Heckman <t@heckman.io>  
Tim Henderson <tim.tadh@gmail.com>  
Tim Hockin <thockin@google.com>  
Tim Mhlmann <muhlemmer@gmail.com>  
Tim Swast <swast@google.com>  
Tim Wright <tenortim@gmail.com>  
Tim Xu <xiaoxubeii@gmail.com>  
Timmy Douglas <timmyd983@gmail.com>  
Timo  
Savola <timo.savola@gmail.com>  
Timo Truyts <alkaloid.btx@gmail.com>  
Timothy Studd <tim@timstudd.com>  
Tipp Moseley <tipp@google.com>  
Tobias Assarsson <tobias.assarsson@gmail.com>  
Tobias Columbus <tobias.columbus@gmail.com> <tobias.columbus@googlemail.com>  
Tobias Klauser <tklauser@distanz.ch>  
Toby Burress <kurin@google.com>  
Todd Kulesza <tkulesza@google.com>  
Todd Neal <todd@tneal.org>  
Todd Wang <toddwang@gmail.com>  
Tom Anthony <git@tomanthony.co.uk>  
Tom Bergan <tombergan@google.com>  
Tom Heng <zhm20070928@gmail.com>  
Tom Lanyon <tomlanyon@google.com>  
Tom Levy <tomlevy93@gmail.com>  
Tom Limoncelli <tal@whatexit.org>  
Tom Linfoord <tomlinfoord@gmail.com>  
Tom Parkin <tom.parkin@gmail.com>  
Tom Payne <twpayne@gmail.com>  
Tom Szymanski <tgs@google.com>  
Tom Thorogood <me+google@tomthorogood.co.uk>  
Tom Wilkie <tom@weave.works>  
Tomas Dabasinskas <tomas@dabasinskas.net>  
Tommy Schaefer <tommy.schaefer@teecom.com>

Tomohiro Kusumoto <zabio1192@gmail.com>  
Tomoya Ishizaki <zaq1tomo@gmail.com>  
Tonis  
Tiigi <tonistiigi@gmail.com>  
Tony Reix <tony.reix@bull.net>  
Tony Walker <walkert.uk@gmail.com>  
Tooru Takahashi <tooru.takahashi134@gmail.com>  
Tor Andersson <tor.andersson@gmail.com>  
Torben Schinke <torben.schinke@neotos.de>  
Tormod Erevik Lea <tormodlea@gmail.com>  
Toshihiro Shiino <shiino.toshihiro@gmail.com>  
Toshiki Shima <hayabusa1419@gmail.com>  
Totoro W <tw19881113@gmail.com>  
Travis Bischel <travis.bischel@gmail.com>  
Travis Cline <travis.cline@gmail.com>  
Trevor Strohman <trevor.strohman@gmail.com>  
Trey Lawrence <lawrence.trey@gmail.com>  
Trey Roessig <trey.roessig@gmail.com>  
Trey Tacon <ttacon@gmail.com>  
Tristan Amini <tamini01@ca.ibm.com>  
Tristan Colgate <tcolgate@gmail.com>  
Tristan Ooohry <ooohry@gmail.com>  
Tristan Rice <rice@fn.lc>  
Troels Thomsen <troels@thomsen.io>  
Trung Nguyen <trung.n.k@gmail.com>  
Tsuji Daishiro <dram.dt.shonan@gmail.com>  
Tudor Golubenco <tudor.g@gmail.com>  
Tugdual Saunier <tugdual.saunier@gmail.com>  
Tuo Shan <sturbo89@gmail.com> <shantuo@google.com>  
Tyler  
Bui-Palsulich <tpalsulich@google.com>  
Tyler Bunnell <tylerbunnell@gmail.com>  
Tyler Treat <ttreat31@gmail.com>  
Tyson Andre <tysonandre775@gmail.com>  
Tzach Shabtay <tzachshabtay@gmail.com>  
Tzu-Jung Lee <roylee17@currant.com>  
Udalov Max <re.udalov@gmail.com>  
Ugorji Nwoke <ugorji@gmail.com>  
Ulf Holm Nielsen <doktor@dyregod.dk>  
Ulrich Kunitz <uli.kunitz@gmail.com>  
Umang Parmar <umangjparmar@gmail.com>  
Uriel Mangado <uriel@berlinblue.org>  
Urvil Patel <patelurvil38@gmail.com>  
Uttam C Pawar <uttam.c.pawar@intel.com>  
Vadim Grek <vadimprog@gmail.com>  
Vadim Vygonets <unixdj@gmail.com>  
Val Polouchkine <vpolouch@justin.tv>  
Valentin Vidic <vvidic@valentin-vidic.from.hr>

Vee Zhang <veezhang@126.com> <vveezhang@gmail.com>  
Vega Garcia Luis Alfonso <vegacom@gmail.com>  
Venil Noronha <veniln@vmware.com>  
Veselkov Konstantin <kostozyb@gmail.com>  
Viacheslav Poturaev <vearutop@gmail.com>  
Victor Chudnovsky <vchudnov@google.com>  
Victor Vrantchan <vrancean+github@gmail.com>  
Vignesh Ramachandra <vickynamachandra@gmail.com>  
Vikas  
Kedia <vikask@google.com>  
Ville Skytt <ville.skytta@iki.fi>  
Vincent Ambo <tazjin@googlemail.com>  
Vincent Batts <vbatts@hashbangbash.com> <vbatts@gmail.com>  
Vincent Vanackere <vincent.vanackere@gmail.com>  
Vinu Rajashekhar <vinutheraj@gmail.com>  
Vish Subramanian <vish@google.com>  
Vishvananda Ishaya <vishvananda@gmail.com>  
Visweswara R <r.visweswara@gmail.com>  
Vitaly Zdanevich <zdanevich.vitaly@ya.ru>  
Vitor De Mario <vitordemario@gmail.com>  
Vivek Sekhar <vsekhar@google.com>  
Vivian Liang <vliang88@gmail.com>  
Vlad Krasnov <vlad@cloudflare.com>  
Vladimir Evgrafov <evgrafov.vladimir@gmail.com>  
Vladimir Kovpak <cn007b@gmail.com>  
Vladimir Kuzmin <vkuzmin@uber.com>  
Vladimir Mihailenco <vladimir.webdev@gmail.com>  
Vladimir Nikishenko <vova616@gmail.com>  
Vladimir Stefanovic <vladimir.stefanovic@imgtec.com>  
Vladimir Varankin <nek.narqo@gmail.com>  
Vojtech Bocek <vbocek@gmail.com>  
Volker Dobler <dr.volker.dobler@gmail.com>  
Volodymyr Paprotski <vpaprots@ca.ibm.com>  
W. Trevor King <wking@tremily.us>  
Wade  
Simmons <wade@wades.im>  
Wagner Riffel <wgrriffel@gmail.com>  
Walt Della <walt@javins.net>  
Walter Poupore <wpoupore@google.com>  
Wander Lairson Costa <wcosta@mozilla.com>  
Wang Xuerui <git@xen0n.name>  
Warren Fernandes <warren.f.fernandes@gmail.com>  
Wayne Ashley Berry <wayneashleyberry@gmail.com>  
Wedson Almeida Filho <wedsonaf@google.com>  
Weerasak Chongnguluam <singpor@gmail.com>  
Wi Cngru <crvv.mail@gmail.com>  
Wei Fu <fhfuwei@163.com>  
Wei Guangjing <vcc.163@gmail.com>



Wei Xiao <wei.xiao@arm.com>  
Wei Xikai <xykwei@gmail.com>  
Weichao Tang <tevic.tt@gmail.com>  
Wembley G. Leach, Jr <wembley.gl@gmail.com>  
Wenlei (Frank) He <wlhe@google.com>  
Wenzel Lowe <lowewenzel@gmail.com>  
Wil Selwood <wselwood@gmail.com>  
Wilfried Teiken <wteiken@google.com>  
Will Beason <willbeason@gmail.com>  
Will Chan <willchan@google.com>  
Will Faught <will.faught@gmail.com>  
Will Morrow <wmorrow.qdt@qualcommdatacenter.com>  
Will Norris <willnorris@google.com>  
Will Storey <will@summercat.com>  
Willem van der Schyff  
<willemvds@gmail.com>  
William Chan <willchan@chromium.org>  
William Chang <mr.williamchang@gmail.com>  
William Josephson <wjosephson@gmail.com>  
William Orr <will@worrbase.com> <ay1244@gmail.com>  
William Poussier <william.poussier@gmail.com>  
Wisdom Omuya <deafgoat@gmail.com>  
Wu Yunzhou <yunzhouwu@gmail.com>  
Xi Ruoyao <xry23333@gmail.com>  
Xia Bin <snyh@snyh.org>  
Xiangdong Ji <xiangdong.ji@arm.com>  
Xing Xing <mikespook@gmail.com>  
Xingqiang Bai <bxq2011hust@qq.com>  
Xu Fei <badgangkiller@gmail.com>  
Xudong Zhang <felixmelon@gmail.com>  
Xudong Zheng <7pkvm5aw@slicealias.com>  
Xuyang Kang <xuyangkang@gmail.com>  
Yamagishi Kazutoshi <ykzts@desire.sh>  
Yan Zou <yzou@google.com>  
Yang Hau <vulxj0j8j8@gmail.com>  
Yang Tian <linuxty@gmail.com>  
Yann Hodique <yhodique@google.com>  
Yann Kerherv <yann.kerherv@gmail.com>  
Yann Salan <yannsalaun1@gmail.com>  
Yannic Bonenberger <contact@yannic-bonenberger.com>  
Yao Zhang <lunaria21@gmail.com>  
Yaron de Leeuw <jarondl@google.com>  
Yaroslav Vorobiov <yar.vorobiov@gmail.com>  
Yasha  
Bubnov <girokompass@gmail.com>  
Yasser Abdolmaleki <yasser@yasser.ca>  
Yasuharu Goto <matope.ono@gmail.com>  
Yasuhiro Matsumoto <mattn.jp@gmail.com>

Yasuyuki Oka <yasuyk@gmail.com>  
Yazen Shunnar <yazen.shunnar@gmail.com>  
Yestin Sun <ylh@pdx.edu>  
Yesudeep Mangalapilly <yesudeep@google.com>  
Yissakhar Z. Beck <yissakhar.beck@gmail.com>  
Yo-An Lin <yoanlin93@gmail.com>  
Yohei Takeda <yo.tak0812@gmail.com>  
Yongjian Xu <i3dmaster@gmail.com>  
Yorman Arias <cixtords@gmail.com>  
Yoshiyuki Kanno <nekotaroh@gmail.com> <yoshiyuki.kanno@stoic.co.jp>  
Yoshiyuki Mineo <yoshiyuki.mineo@gmail.com>  
Yosuke Akatsuka <yosuke.akatsuka@gmail.com>  
Yu Heng Zhang <annita.zhang@cn.ibm.com>  
Yu Xuan Zhang <zyxsh@cn.ibm.com>  
Yuichi Kishimoto <yk2220s@gmail.com>  
Yuichi Nishiwaki <yuichi.nishiwaki@gmail.com>  
Yuji Yaginuma <yuuji.yaginuma@gmail.com>  
Yuki OKUSHI <huyuumi.dev@gmail.com>  
Yuki Yugui Sonoda <yugui@google.com>  
Yukihiro Nishinaka <6elpinal@gmail.com>  
Yury Smolsky <yury@smolsky.by>  
Yusuke Kagiwada <block.rxckin.beats@gmail.com>  
Yuusei  
Kuwana <kuwana@kumama.org>  
Yuval Pavel Zholkover <paulzhol@gmail.com>  
Yves Junqueira <yvesj@google.com> <yves.junqueira@gmail.com>  
Zac Bergquist <zbergquist99@gmail.com>  
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Zakatell Kanda <hi@zkanda.io>  
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Zev Goldstein <zev.goldstein@gmail.com>  
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Zheng Dayu <davidzheng23@gmail.com>  
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Zhengyu He <hzy@google.com>  
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Zhongtao Chen <chenzhongtao@126.com>  
Zhongwei Yao <zhongwei.yao@arm.com>  
Zhou Peng <p@ctruple.cn>  
Ziad Hatahet <hatahet@gmail.com>  
Ziheng Liu <lzhfromustc@gmail.com>  
Zorion Arrizabalaga <zorionk@gmail.com>  
<a.maksadbek@gmail.com>

<max.faceless.frei@gmail.com>

<hagen1778@gmail.com>

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<faxriddinjon@gmail.com>

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# An entry with multiple email addresses specifies that the  
# first address should be used in the submit logs and  
# that the other addresses should be recognized as the  
# same person when interacting with Gerrit.  
  
# Please keep the list sorted.

Aamir Khan <syst3m.w0rm@gmail.com>  
Aaron France <aaron.l.france@gmail.com>  
Aaron Jacobs <jacobsa@google.com>  
Aaron Kemp <kemp.aaron@gmail.com>  
Aaron Torres <tcboox@gmail.com>  
Aaron Zinman <aaron@azinman.com>  
Abe Haskins <abeisgreat@abeisgreat.com>  
Abhinav Gupta <abhinav.g90@gmail.com>  
Adam Langley <agl@golang.org>  
Adrian Nos <nos.adrian@gmail.com>  
Adrian O'Grady <elpollouk@gmail.com>  
Adrien Bustany <adrien-xx-google@bustany.org>  
Acio Jnior <aeciodantasjunior@gmail.com>  
Ahmed Waheed Moanes <oneofone@gmail.com>  
Ahmy Yulrizka <yulrizka@gmail.com>  
Aiden Scandella <ai@uber.com>  
Ainar  
Garipov <gugl.zadolbal@gmail.com>  
Akihiro Suda <suda.kyoto@gmail.com>  
Akshat Kumar <seed@mail.nanosouffle.net>  
Alan Donovan <adonovan@google.com>  
Alan Shreve <alan@inconshreveable.com>  
Albert Nigmatzianov <albertnigma@gmail.com>  
Albert Strasheim <fullung@gmail.com>  
Albert Yu <yukinying@gmail.com>  
Alberto Bertogli <albertito@blitiri.com.ar>  
Alberto Donizetti <alb.donizetti@gmail.com>  
Alberto Garca Hierro <alberto@garciahierro.com> <alberto.garcia.hierro@gmail.com>  
Aleksandar Dezelin <dezelin@gmail.com>  
Alessandro Arzilli <alessandro.arzilli@gmail.com>  
Alessandro Baffa <alessandro.baffa@gmail.com>  
Alex A Skinner <alex@lx.lc>  
Alex Brainman <alex.brainman@gmail.com>  
Alex Bramley <abramley@google.com>  
Alex Browne <stephenalexbrowne@gmail.com>  
Alex Carol <alex.carol.c@gmail.com>  
Alex Jin <toalexjin@gmail.com>  
Alex Plugaru <alex@plugaru.org> <alexandru.plugaru@gmail.com>



Alex Schroeder <alex@gnu.org>  
Alex Sergeyev <abc@alexsergeyev.com>  
Alex Vaghin <crhyme@google.com>  
Alexander  
Demakin <alexander.demakin@gmail.com>  
Alexander Dring <email@alex.d.ch>  
Alexander Larsson <alexander.larsson@gmail.com>  
Alexander Menzhinsky <amenzhinsky@gmail.com>  
Alexander Morozov <lk4d4math@gmail.com>  
Alexander Neumann <alexander@bumper.de>  
Alexander Orlov <alexander.orlov@loxal.net>  
Alexander Reece <awreece@gmail.com>  
Alexander Surma <surma@surmair.de>  
Alexander Zhavnerchik <alex.vizor@gmail.com>  
Alexander Zolotov <goldifit@gmail.com>  
Alexandre Cesaro <alexandre.cesaro@gmail.com>  
Alexandre Fiori <fiorix@gmail.com>  
Alexandre Normand <alexandre.normand@gmail.com>  
Alexandru Mooi <brtznr@gmail.com>  
Alexei Sholik <alcosholik@gmail.com>  
Alexey Borzenkov <snaury@gmail.com>  
Alexey Palazhchenko <alexey.palazhchenko@gmail.com>  
Alexis Imperial-Legrand <ail@google.com>  
Aliaksandr Valialkin <valyala@gmail.com>  
Alif Rachmawadi <subosito@gmail.com>  
Allan Simon <allan.simon@supinfo.com>  
Alok Menghrajani <alok.menghrajani@gmail.com>  
Amir Mohammad Saied <amir@gluegadget.com>  
Amrut Joshi <amrut.joshi@gmail.com>  
Andre  
Nathan <andrenth@gmail.com>  
Andrea Spadaccini <spadaccio@google.com>  
Andreas Auernhammer <aead@mail.de>  
Andreas Jellinghaus <andreas@ionisiert.de> <anj@google.com>  
Andreas Litt <andreas.litt@gmail.com>  
Andrei Korzhevskii <a.korzhevskiy@gmail.com>  
Andrei Vieru <euvieru@gmail.com>  
Andres Erbsen <andreser@google.com>  
Andrew Austin <andrewacht@gmail.com>  
Andrew Balholm <andybalholm@gmail.com>  
Andrew Bonventre <andybons@chromium.org>  
Andrew Bursavich <abursavich@gmail.com>  
Andrew Ekstedt <andrew.ekstedt@gmail.com>  
Andrew Etter <andrew.etter@gmail.com>  
Andrew Gerrand <adg@golang.org>  
Andrew Harding <andrew@spacemonkey.com>  
Andrew Lutomirski <andy@luto.us>  
Andrew Pilloud <andrewpilloud@igneoussystems.com>

Andrew Pogrebnoy <absourd.noise@gmail.com>  
Andrew Pritchard <awpritchard@gmail.com>  
Andrew Radev <andrey.radev@gmail.com>  
Andrew Skiba <skibaa@gmail.com>  
Andrew Szeto <andrew@jabagawee.com>  
Andrew Werner <andrew@upthere.com> <awerner32@gmail.com>  
Andrew Wilkins <axwalk@gmail.com>  
Andrew  
Williams <williams.andrew@gmail.com>  
Andrey Mirtchovski <mirtchovski@gmail.com>  
Andrey Petrov <andrey.petrov@shazow.net>  
Andriy Lytvynov <lytvynov.a.v@gmail.com>  
Andy Balholm <andy@balholm.com>  
Andy Davis <andy@bigandian.com>  
Andy Finkensadt <afinkensadt@zynga.com>  
Andy Maloney <asmaloney@gmail.com>  
Anfernee Yongkun Gui <anfernee.gui@gmail.com>  
Angelo Bulfone <mbulfone@gmail.com>  
Anh Hai Trinh <anh.hai.trinh@gmail.com>  
Anmol Sethi <anmol@aubble.com>  
Anschel Schaffer-Cohen <anschelsc@gmail.com>  
Anthony Canino <anthony.canino1@gmail.com>  
Anthony Eufemio <anthony.eufemio@gmail.com>  
Anthony Martin <ality@pbrane.org>  
Anthony Starks <ajstarks@gmail.com>  
Anthony Woods <awoods@raintank.io>  
Antonio Bibiano <antbbn@gmail.com>  
Antonio Murdaca <runcom@redhat.com>  
Apisak Darakananda <pongad@gmail.com>  
Aram Hvrneanu <aram@mgk.ro>  
Areski Belaid <areski@gmail.com>  
Arkadi Pyuro <arkadi@google.com>  
Arlo Breault <arlolra@gmail.com>  
Arnaud Ysmal <arnaud.ysmal@gmail.com>  
Arne Hormann <arnehormann@gmail.com>  
Arnout  
Engelen <arnout@bzzt.net>  
Aron Nopanen <aron.nopanen@gmail.com>  
Artyom Pervukhin <artyom.pervukhin@gmail.com>  
Arvinth Rajesh Tamilmani <art@a-30.net>  
Asim Shankar <asimshankar@gmail.com>  
Atin Malaviya <amalaviy@akamai.com>  
Ato Araki <ato.araki@gmail.com>  
Audrey Lim <audreylh@gmail.com>  
Augusto Roman <aroman@gmail.com>  
Aulus Egnatius Varialus <varialus@gmail.com>  
Austin Clements <austin@google.com> <aclements@csail.mit.edu>  
awaw fumin <awawfumin@gmail.com>

Ayanamist Yang <ayanamist@gmail.com>  
Aymerick Jhanne <aymerick@jehanne.org>  
Baiju Muthukadan <baiju.m.mail@gmail.com>  
Balazs Lecz <leczb@google.com>  
Ben Burkert <ben@benburkert.com>  
Ben Eitzen <eitzenb@golang.org>  
Ben Fried <ben.fried@gmail.com>  
Ben Lubar <ben.lubar@gmail.com>  
Ben Lynn <benlynn@gmail.com>  
Ben Olive <sionide21@gmail.com>  
Benjamin Black <b@b3k.us>  
Benjamin Prosnitz <bprosnitz@google.com>  
Benjamin Wester <bwester@squareup.com>  
Benny Siegert <bsiegert@gmail.com>  
Benoit Sigoure <tsunanet@gmail.com>  
Berengar  
Lehr <Berengar.Lehr@gmx.de>  
Bill Neubauer <wcn@golang.org> <wcn@google.com> <bill.neubauer@gmail.com>  
Bill O'Farrell <billo@ca.ibm.com>  
Bill Thiede <couchmoney@gmail.com>  
Billie Harold Cleek <bhcleek@gmail.com>  
Billy Lynch <wlynch@google.com>  
Bjorn Tillenius <bjorn@tillenius.me>  
Bjorn Tipling <bjorn.tipling@gmail.com>  
Blake Gentry <blakesgentry@gmail.com>  
Blake Mizerany <blake.mizerany@gmail.com>  
Blixt <me@blixt.nyc>  
Bobby Powers <bobbypowers@gmail.com>  
Boris Nagaev <nagaev@google.com>  
Brad Fitzpatrick <bradfitz@golang.org> <bradfitz@gmail.com>  
Brad Garcia <bgarcia@golang.org>  
Braden Bassingthwaite <bbassingthwaite@vendasta.com>  
Brady Catherman <brady@gmail.com>  
Brady Sullivan <brady@bsull.com>  
Brandon Gilmore <varz@google.com>  
Brendan Daniel Tracey <tracey.brendan@gmail.com>  
Brendan O'Dea <bod@golang.org>  
Brett Cannon <bcannon@gmail.com>  
Brian Dellisanti <briandellisanti@gmail.com>  
Brian G. Merrell <bgmerrell@gmail.com>  
Brian Gitonga Marete <marete@toshnix.com> <bgmarete@gmail.com>  
<bgm@google.com>  
Brian Kennedy <btkenedy@gmail.com>  
Brian Ketelsen <bketelsen@gmail.com>  
Brian Slesinsky <skybrian@google.com>  
Brian Smith <ohohvi@gmail.com>  
Bryan Alexander <Kozical@msn.com>  
Bryan C. Mills <bcmills@google.com>

Bryan Chan <bryan.chan@ca.ibm.com>  
Bryan Ford <brynosaurus@gmail.com>  
Caine Tighe <arctanofyourface@gmail.com>  
Caio Marcelo de Oliveira Filho <caio.oliveira@intel.com>  
Caleb Spare <cespare@gmail.com>  
Carl Chatfield <carlchatfield@gmail.com>  
Carl Jackson <carl@stripe.com>  
Carl Johnson <me@carlmjohnson.net>  
Carl Mastrangelo <notcarl@google.com>  
Carl Shapiro <cshapiro@google.com> <cshapiro@golang.org>  
Carlos Castillo <cookieo9@gmail.com>  
Carlos Cirello <uldericofilho@gmail.com>  
Carlos Eduardo Seo <cseo@linux.vnet.ibm.com>  
Cary Hull <chull@google.com>  
Case Nelson <case.nelson@gmail.com>  
Casey Marshall <casey.marshall@gmail.com>  
Catalin Nicutar <cnicutar@google.com>  
Catalin Patulea <catalinp@google.com>  
Cedric Staub <cs@squareup.com>  
Cezar S Espinola <cezarsa@gmail.com>  
ChaiShushan  
<chaishushan@gmail.com>  
Charles L. Dorian <cldorian@gmail.com>  
Charles Lee <zombie.fml@gmail.com>  
Charles Weill <weill@google.com>  
Cherry Zhang <cherryz@google.com>  
Chris Broadfoot <cbro@golang.org>  
Chris Dollin <ehog.hedge@gmail.com>  
Chris Farmiloe <chrisfarms@gmail.com>  
Chris Hines <chris.cs.guy@gmail.com>  
Chris Howey <howeyc@gmail.com>  
Chris Hundt <hundt@google.com>  
Chris Jones <chris@cjones.org> <chris.jones.yar@gmail.com>  
Chris Kastorff <encryptio@gmail.com>  
Chris Lennert <calennert@gmail.com>  
Chris Manghane <cmang@golang.org>  
Chris McGee <sirnewton\_01@yahoo.ca> <newton688@gmail.com>  
Chris Stockton <chrisstocktonaz@gmail.com>  
Chris Zou <chriszou@ca.ibm.com>  
Christian Couder <chriscool@tuxfamily.org>  
Christian Himpel <chressie@googlemail.com> <chressie@gmail.com>  
Christine Hansmann <chhansmann@gmail.com>  
Christoffer Buchholz <christoffer.buchholz@gmail.com>  
Christoph Hack <christoph@tux21b.org>  
Christopher Cahoon <chris.cahoon@gmail.com>  
Christopher Guiney  
<chris@guiney.net>  
Christopher Nelson <nadiasvertex@gmail.com>

Christopher Nielsen <m4dh4tt3r@gmail.com>  
Christopher Redden <christopher.redden@gmail.com>  
Christopher Swenson <cswenson@google.com>  
Christopher Wedgwood <cw@f00f.org>  
Christy Perez <christy@linux.vnet.ibm.com>  
CL Sung <clsung@gmail.com> <cl\_sung@htc.com>  
Clement Skau <clementskau@gmail.com>  
Colby Ranger <cranger@google.com>  
Colin Cross <ccross@android.com>  
Colin Edwards <colin@recursivepenguin.com>  
Colin Kennedy <moshen.colin@gmail.com>  
Conrad Irwin <conrad.irwin@gmail.com>  
Conrad Meyer <cemeyer@cs.washington.edu>  
Corey Thomasson <cthom.lists@gmail.com>  
Cosmos Nicolaou <cnicolaou@google.com>  
Cristian Staretu <unclejacksons@gmail.com>  
Cuihtlauac ALVARADO <cuihtlauac.alvarado@orange.com>  
Cyrill Schumacher <cyrill@schumacher.fm>  
Damian Gryski <dgryski@gmail.com>  
Damien Neil <dneil@google.com>  
Dan Caddigan <goldcaddy77@gmail.com>  
Dan Callahan <dan.callahan@gmail.com>  
Dan Harrington <harringtond@google.com>  
Dan Jacques <dnj@google.com>  
Dan  
Peterson <dpiddy@gmail.com>  
Dan Pupius <dan@medium.com>  
Dan Sinclair <dan.sinclair@gmail.com>  
Daniel Fleischman <danielfleischman@gmail.com>  
Daniel Johansson <dajo2002@gmail.com>  
Daniel Kerwin <d.kerwin@gini.net>  
Daniel Krech <eikeon@eikeon.com>  
Daniel Lidn <daniel.liden.87@gmail.com>  
Daniel Mart <mvdan@mvdan.cc>  
Daniel Morsing <daniel.morsing@gmail.com>  
Daniel Nadasi <dnadasi@google.com>  
Daniel Ortiz Pereira da Silva <daniel.particular@gmail.com>  
Daniel Skinner <daniel@dasa.cc>  
Daniel Speichert <daniel@speichert.pl>  
Daniel Theophanes <kardianos@gmail.com>  
Daria Kolistratova <daria.kolistratova@intel.com>  
Darren Elwood <darren@textnode.com>  
Datong Sun <dndx@idndx.com>  
Dave Borowitz <dborowitz@google.com>  
Dave Bort <dbort@golang.org>  
Dave Cheney <dave@cheney.net>  
Dave Day <djd@golang.org>  
Dave Grijalva <dgrijalva@ngmoco.com>

David Anderson <danderson@google.com>  
David Barnett <dbarnett@google.com>  
David Benjamin <davidben@google.com>  
David Brophy <dave@brophy.uk>  
David  
Brgin <676c7473@gmail.com>  
David Calavera <david.calavera@gmail.com>  
David Chase <drchase@google.com>  
David Covert <davidhcovert@gmail.com>  
David Crawshaw <david.crawshaw@zentus.com> <crawshaw@google.com> <crawshaw@golang.org>  
David du Colombier <0intro@gmail.com>  
David Forsythe <dforsythe@gmail.com>  
David G. Andersen <dave.andersen@gmail.com>  
David Glasser <glasser@meteor.com>  
David Howden <dhowden@gmail.com>  
David Hubbard <dsp@google.com>  
David Jakob Fritz <david.jakob.fritz@gmail.com>  
David Lazar <lazard@golang.org>  
David Leon Gil <coruus@gmail.com>  
David McLeish <davemc@google.com>  
David Presotto <presotto@gmail.com>  
David R. Jenni <david.r.jenni@gmail.com>  
David Sansome <me@davidsansome.com>  
David Stainton <dstainton415@gmail.com>  
David Symonds <dsymonds@golang.org>  
David Thomas <davidthomas426@gmail.com>  
David Titarenco <david.titarenco@gmail.com>  
Davies Liu <davies.liu@gmail.com>  
Dean Prichard <dean.prichard@gmail.com>  
Deepak Jois <deepak.jois@gmail.com>  
Denis Bernard <db047h@gmail.com>  
Denis  
Brandolini <denis.brandolini@gmail.com>  
Denis Nagorny <denis.nagorny@intel.com>  
Denys Honsiorovskiy <honsiorovskiy@gmail.com>  
Derek Buitenhuis <derek.buitenhuis@gmail.com>  
Derek Che <drc@yahoo-inc.com>  
Derek Parker <parkerderek86@gmail.com>  
Derek Shockey <derek.shockey@gmail.com>  
Devon H. O'Dell <devon.odell@gmail.com>  
Dhaivat Pandit <dhaivatpandit@gmail.com>  
Dhananjay Nakrani <dhananjayn@google.com>  
Dhiru Kholia <dhiru.kholia@gmail.com>  
Didier Spezia <didier.06@gmail.com>  
Dimitri Tcaciuc <dtcaciuc@gmail.com>  
Dirk Gadsden <dirk@esherido.com>  
Diwaker Gupta <diwakergupta@gmail.com>  
Dmitri Popov <operator@cv.dp-net.com>

Dmitri Shuralyov <shurcool@gmail.com>  
Dmitriy Dudkin <dudkin.dmitriy@gmail.com>  
Dmitriy Shelenin <deemok@googlemail.com> <deemok@gmail.com>  
Dmitriy Vyukov <dvyukov@google.com>  
Dmitry Chestnykh <dchest@gmail.com>  
Dmitry Savintsev <dsavints@gmail.com>  
Dmitry Yakunin <nonamezeil@gmail.com>  
Dominik Honnef <dominik.honnef@gmail.com>  
Dominik Vogt <vogt@linux.vnet.ibm.com>  
Donald  
Huang <don.hcd@gmail.com>  
Donovan Hide <donovanhide@gmail.com>  
Doug Anderson <douga@google.com>  
Drew Hintz <adhintz@google.com>  
Duncan Holm <mail@frou.org>  
Dustin Carlino <dcarlino@google.com>  
Dustin Herbison <djherbis@gmail.com>  
Dustin Long <dustmop@gmail.com>  
Dustin Sallings <dsallings@gmail.com>  
Dustin Shields-Cloues <dcloues@gmail.com>  
Dvir Volk <dvir@everything.me> <dvirsky@gmail.com>  
Eden Li <eden.li@gmail.com>  
Edward Muller <edwardam@interlix.com>  
Egon Elbre <egonelbre@gmail.com>  
Ehren Kret <ehren.kret@gmail.com>  
Eivind Uggedal <eivind@uggedal.com>  
Elias Naur <elias.naur@gmail.com>  
Elliot Morrison-Reed <elliottmr@gmail.com>  
Emil Hessman <c.emil.hessman@gmail.com> <emil@hessman.se>  
Emmanuel Odeke <emm.odeke@gmail.com> <odeke@ualberta.ca>  
Eoghan Sherry <ejsherry@gmail.com>  
Eric Clark <zerohp@gmail.com>  
Eric Engestrom <eric@engestrom.ch>  
Eric Garrido <ekg@google.com>  
Eric Koleda <ekoleda+devrel@google.com>  
Eric Lagergren <ericscottlagergren@gmail.com>  
Eric Milliken  
<emilliken@gmail.com>  
Eric Roshan-Eisner <eric.d.eisner@gmail.com>  
Erik Aigner <aigner.erik@gmail.com>  
Erik Dubbelboer <erik@dubbelboer.com>  
Erik St. Martin <alakriti@gmail.com>  
Erik Staab <estaab@google.com>  
Erik Westrup <erik.westrup@gmail.com>  
Ernest Chiang <ernest\_chiang@htc.com>  
Esko Luontola <esko.luontola@gmail.com>  
Ethan Burns <eaburns@google.com>  
Ethan Miller <eamiller@us.ibm.com>

Euan Kemp <euank@euank.com>  
Evan Broder <evan@stripe.com>  
Evan Brown <evanbrown@google.com>  
Evan Kroske <evankroske@google.com>  
Evan Martin <evan.martin@gmail.com>  
Evan Phoenix <evan@phx.io>  
Evan Shaw <chickencha@gmail.com>  
Ewan Chou <coocood@gmail.com>  
Fabian Wickborn <fabian@wickborn.net>  
Fabrizio Milo <mistobaan@gmail.com>  
Faiyaz Ahmed <ahmedf@vmware.com>  
Fan Hongjian <fan.howard@gmail.com>  
Fatih Arslan <fatih@arslan.io>  
Fazlul Shahriar <fshahriar@gmail.com>  
Federico Simoncelli <fsimonce@redhat.com>  
Fedor Indutny <fedor@indutny.com>  
Felix Geisendrfer <haimuiba@gmail.com>  
Filippo Valsorda <hi@filippo.io>  
Firmansyah  
Adiputra <frm.adiputra@gmail.com>  
Florian Uekermann <florian@uekermann-online.de> <f1@uekermann-online.de>  
Florian Weimer <fw@deneb.enyo.de>  
Florin Patan <florinpatan@gmail.com>  
Folke Behrens <folke@google.com>  
Ford Hurley <ford.hurley@gmail.com>  
Francesc Campoy <campoy@golang.org>  
Francisco Claude <fclaud@recoded.cl>  
Francisco Souza <franciscossouza@gmail.com>  
Frederick Kelly Mayle III <frederickmayle@gmail.com>  
Fredrik Enestad <fredrik.enestad@soundtrackyourbrand.com>  
Frithjof Schulze <schulze@math.uni-hannover.de> <sfrithjof@gmail.com>  
Frits van Bommel <fvbommel@gmail.com>  
Fumitoshi Ukai <ukai@google.com>  
Gaal Yahas <gaal@google.com>  
Gabriel Aszalos <gabriel.aszalos@gmail.com>  
Gabriel Russell <gabriel.russell@gmail.com>  
Gareth Paul Jones <gpj@foursquare.com>  
Garrick Evans <garrick@google.com>  
Gary Burd <gary@beagledreams.com> <gary.burd@gmail.com>  
Gary Elliott <garyelliott@google.com>  
Gaurish Sharma <contact@aurishsharma.com>  
Gautham Thambidorai <gautham.dorai@gmail.com>  
Geert-Johan  
Riemer <gjr19912@gmail.com>  
Geoffroy Lorieux <lorieux.g@gmail.com>  
Georg Reinke <guelfey@gmail.com>  
George Shammas <george@shamm.as> <georgyo@gmail.com>  
Gerasimos Dimitriadis <gedimitr@gmail.com>



Gideon Jan-Wessel Redelinghuys <gjredelinghuys@gmail.com>  
Giles Lean <giles.lean@pobox.com>  
Giovanni Bajo <rasky@develer.com>  
Giulio Iotti <dullgiulio@gmail.com>  
Gleb Stepanov <glebstepanov1992@gmail.com>  
Glenn Brown <glennb@google.com>  
Glenn Lewis <gmlewis@google.com>  
Gordon Klaus <gordon.klaus@gmail.com>  
Graham King <graham4king@gmail.com>  
Graham Miller <graham.miller@gmail.com>  
Greg Ward <greg@gerg.ca>  
Guillaume J. Charmes <guillaume@charmest.net>  
Guobiao Mei <meiguobiao@gmail.com>  
Gustav Paul <gustav.paul@gmail.com>  
Gustavo Franco <gustavorfranco@gmail.com>  
Gustavo Niemeyer <gustavo@niemeyer.net> <n13m3y3r@gmail.com>  
Gwenael Treguier <gwenn.kahz@gmail.com>  
Gyu-Ho Lee <gyuhox@gmail.com>  
H. brahim Gngr <igungor@gmail.com>  
Hajime Hoshi <hajimehoshi@gmail.com>  
Hallgrimur Gunnarsson  
<halg@google.com>  
Han-Wen Nienhuys <hanwen@google.com>  
Hari haran <hariharan.uno@gmail.com>  
Hariharan Srinath <srinathh@gmail.com>  
Harley Laue <losinggeneration@gmail.com>  
Harry Moreno <morenoh149@gmail.com>  
Harshavardhana <hrshvardhana@gmail.com>  
Hvard Haugen <havard.haugen@gmail.com>  
Hector Chu <hectorchu@gmail.com>  
Hector Martin Cantero <hector@marcansoft.com>  
Henning Schmiedehausen <henning@schmiedehausen.org>  
Henrik Edwards <henrik.edwards@gmail.com>  
Henrik Hodne <henrik@hodne.io>  
Herbert Georg Fischer <herbert.fischer@gmail.com>  
Hironao OTSUBO <motemen@gmail.com>  
Hiroshi Ioka <hirochachacha@gmail.com>  
Hitoshi Mitake <mitake.hitoshi@gmail.com>  
Holden Huang <ttyh061@gmail.com>  
Hong Ruiqi <hongruiqi@gmail.com>  
Hossein Sheikh Attar <hattar@google.com>  
Hsin-Ho Yeh <yhh92u@gmail.com>  
Hu Keping <hukeping@huawei.com>  
Hyang-Ah Hana Kim <hakim@google.com> <hyangah@gmail.com>  
Ian Gudger <ian@loosescrews>  
Ian Lance Taylor <iant@golang.org>  
Icarus Sparry <golang@icarus.freeuk.com>  
Idora

Shinatose <idora.shinatose@gmail.com>  
Igor Bernstein <igorbernstein@google.com>  
Igor Dolzhikov <bluesriverz@gmail.com>  
Ilya Tocar <ilya.tocar@intel.com>  
INADA Naoki <songofacandy@gmail.com>  
Ingo Krabbe <ikrabbe.ask@gmail.com>  
Ingo Oeser <nightlyone@googlemail.com> <nightlyone@gmail.com>  
Irieda Noboru <irieda@gmail.com>  
Isaac Wagner <ibw@isaacwagner.me>  
Ivan Babrou <ivan@cloudflare.com>  
Ivan Krasin <krasin@golang.org>  
Ivan Ukhov <ivan.ukhov@gmail.com>  
Jaana Burcu Dogan <jbd@google.com> <jbd@golang.org> <burcujdogan@gmail.com>  
Jack Lindamood <jlindamo@justin.tv>  
Jacob Baskin <jbaskin@google.com>  
Jacob H. Haven <jacob@cloudflare.com>  
Jacob Hoffman-Andrews <github@hoffman-andrews.com>  
Jae Kwon <jae@tendermint.com>  
Jakob Borg <jakob@nym.se>  
Jakub ajka <jcajka@redhat.com>  
Jakub Ryszard Czarnowicz <j.czarnowicz@gmail.com>  
James Aguilar <jaguilar@google.com>  
James Bardin <j.bardin@gmail.com>  
James Chacon <jchacon@google.com>  
James Clarke <jrtc27@jrtc27.com>  
James David Chalfant <james.chalfant@gmail.com>  
James  
Fysh <james.fysh@gmail.com>  
James Gray <james@james4k.com>  
James Meneghello <rawrz0r@gmail.com>  
James P. Cooper <jamespcooper@gmail.com>  
James Robinson <jamesr@google.com> <jamesr.gatech@gmail.com>  
James Schofield <james@shoeboxapp.com>  
James Sweet <james.sweet88@googlemail.com>  
James Toy <nil@opensesame.st>  
James Tucker <raggi@google.com>  
James Whitehead <jnwhiteh@gmail.com>  
Jamie Beverly <jamie.r.beverly@gmail.com>  
Jamie Gennis <jgennis@google.com> <jgennis@gmail.com>  
Jamie Turner <jamwt@dropbox.com>  
Jamie Wilkinson <jaq@spacepants.org>  
Jamil Djadala <djadala@gmail.com>  
Jan H. Hosang <jan.hosang@gmail.com>  
Jan Kratochvil <jan.kratochvil@redhat.com>  
Jan Mercl <0xjnml@gmail.com>  
Jan Mercl <befelemepeseveze@gmail.com>  
Jan Newmarch <jan.newmarch@gmail.com>  
Jan Ziak <0xe2.0x9a.0x9b@gmail.com>

Jani Monoses <jani.monoses@ubuntu.com> <jani.monoses@gmail.com>

Jaroslavas Poepko <jp@webmaster.ms>

Jason Barnett <jason.w.barnett@gmail.com>

Jason Buberel <jbuberel@google.com>

Jason

Del Ponte <delpontej@gmail.com>

Jason Hall <jasonhall@google.com>

Jason Smale <jsmale@zendesk.com>

Jason Travis <infomaniac7@gmail.com>

Jay Weisskopf <jay@jayschwa.net>

Jean-Marc Eurin <jmeurin@google.com>

Jean-Nicolas Moal <jn.moal@gmail.com>

Jed Denlea <jed@fastly.com>

Jeff Craig <jeffcraig@google.com>

Jeff Hodges <jeff@somethingsimilar.com>

Jeff R. Allen <jra@nella.org> <jeff.allen@gmail.com>

Jeff Sickel <jas@corpus-callosum.com>

Jeff Wendling <jeff@spacemonkey.com>

Jens Frederich <jfrederich@gmail.com>

Jeremiah Harmsen <jeremiah@google.com>

Jeremy Jackins <jeremyjackins@gmail.com>

Jeremy Schlatter <jeremy.schlatter@gmail.com>

Jeroen Bobbeldijk <jerbob92@gmail.com>

Jess Frazelle <me@jessfraz.com>

Jesse Szwedko <jesse.szwedko@gmail.com>

Jihyun Yu <yjh0502@gmail.com>

Jim Cote <jfcote87@gmail.com>

Jim Kingdon <jim@bolt.me>

Jim McGrath <jimmc2@gmail.com>

Jimmy Zelinskie <jimmyzelinskie@gmail.com>

Jingcheng Zhang <diogin@gmail.com>

Jingguo Yao <yaojingguo@gmail.com>

Jiong Du <londevil@gmail.com>

Jirka

Dank <dnk@mail.muni.cz>

Joakim Sernbrant <serbaut@gmail.com>

Joe Farrell <joe2farrell@gmail.com>

Joe Harrison <joehazzers@gmail.com>

Joe Henke <joed.henke@gmail.com>

Joe Poirier <jdpoirier@gmail.com>

Joe Shaw <joe@joeshaw.org>

Joe Sylve <joe.sylve@gmail.com>

Joe Tsai <joetsai@digital-static.net>

Joel Sing <jsing@google.com>

Joel Stemmer <stemmertech@gmail.com>

Johan Euphrosine <propy@google.com>

Johan Sageryd <j@1616.se>

John Asmuth <jasmuth@gmail.com>

John Beisley <huin@google.com>  
John C Barstow <jbowtie@amathaine.com>  
John DeNero <denero@google.com>  
John Dethridge <jcd@golang.org>  
John Graham-Cumming <jgc@jgc.org> <jgrahamc@gmail.com>  
John Howard Palevich <jack.palevich@gmail.com>  
John Jeffery <jjeffery@sp.com.au>  
John Jenkins <twodopeslaggy@gmail.com>  
John Newlin <jnewlin@google.com>  
John Potocny <johnp@vividcortex.com>  
John Schnake <schnake.john@gmail.com>  
John Shahid <jvshahid@gmail.com>  
John Tuley <john@tuley.org>  
Jon Chen <jchen@justin.tv>  
Jonathan Allie  
    <jonallie@google.com>  
Jonathan Amsterdam <jba@google.com>  
Jonathan Boule <jonathanboule@gmail.com>  
Jonathan Feinberg <feinberg@google.com>  
Jonathan Gold <jgold.bg@gmail.com>  
Jonathan Hseu <jhseu@google.com>  
Jonathan Mark <jhmark@xenops.com> <jhmark000@gmail.com>  
Jonathan Nieder <jrn@google.com>  
Jonathan Pittman <jmpittman@google.com> <jonathan.mark.pittman@gmail.com>  
Jonathan Rudenberg <jonathan@titanous.com>  
Jonathan Wills <runningwild@gmail.com>  
Jongmin Kim <atomaths@gmail.com>  
Joonas Kuorilehto <joneskoo@derbian.fi>  
Joop Kiefte <ikojba@gmail.com> <joop@kiefte.net>  
Jordan Lewis <jordanthelewis@gmail.com>  
Jos Visser <josv@google.com>  
Jose Luis Vazquez Gonzalez <josvazg@gmail.com>  
Joseph Bonneau <jcb@google.com>  
Joseph Holsten <joseph@josephholsten.com>  
Josh Bleacher Snyder <josharian@gmail.com>  
Josh Chorlton <jchorlton@gmail.com>  
Josh Goebel <dreamer3@gmail.com>  
Josh Hoak <jhoak@google.com>  
Josh Holland <jrh@joshh.co.uk>  
Joshua Boelter <joshua.boelter@intel.com>  
Joshua Chase <jcjosuachase@gmail.com>  
Jostein  
    Stuhaug <js@solidsystem.no>  
JP Sugarbroad <jpsugar@google.com>  
JT Olds <jtolds@xnet5.com>  
Jukka-Pekka Kekkonen <karatepekka@gmail.com>  
Julia Hansbrough <flowerhack@google.com>  
Julian Kornberger <jk+github@digineo.de>

Julian Phillips <julian@quantumfyre.co.uk>  
Julien Schmidt <google@julienschmidt.com>  
Jungho Ahn <jhahn@google.com>  
Jure Ham <jure.ham@zemanta.com>  
Justin Nu <nuss.justin@gmail.com>  
Justyn Temme <justyntemme@gmail.com>  
Kai Backman <kaib@golang.org>  
Kale Blankenship <kale@lemnisis.com>  
Kamal Aboul-Hosn <aboulhosn@google.com>  
Kamil Kisiel <kamil@kamilkisiel.net> <kamil.kisiel@gmail.com>  
Kang Hu <hukangustc@gmail.com>  
Karan Dhiman <karandhi@ca.ibm.com>  
Kato Kazuyoshi <kato.kazuyoshi@gmail.com>  
Katrina Owen <katrina.owen@gmail.com>  
Kaviraj Kanagaraj <kavirajkanagaraj@gmail.com>  
Kay Zhu <kayzhu@google.com>  
KB Sriram <kbsriram@google.com>  
Keegan Carruthers-Smith <keegan.csmith@gmail.com>  
Kei Son <hey.calmdown@gmail.com>  
Keith Ball <inflatablewoman@gmail.com>  
Keith  
Randall <KHR@golang.org>  
Keith Rarick <kr@xph.us>  
Kelsey Hightower <kelsey.hightower@gmail.com>  
Kelvin Foo Chuan Lyi <vmirage@gmail.com>  
Ken Friedenbach <kenliz@cruzio.com>  
Ken Rockot <ken@oz.gs> <ken.rockot@gmail.com>  
Ken Sedgwick <ken@bonsai.com>  
Ken Thompson <ken@golang.org>  
Kenji Kaneda <kenji.kaneda@gmail.com>  
Kenneth Shaw <kenshaw@gmail.com>  
Kenny Grant <kennygrant@gmail.com>  
Kevin Ballard <kevin@sb.org>  
Kevin Burke <kev@inburke.com>  
Kevin Kirsche <kev.kirsche@gmail.com>  
Kevin Klues <klueska@gmail.com> <klueska@google.com>  
Kevin Malachowski <chowski@google.com>  
Kevin Vu <kevin.m.vu@gmail.com>  
Kim Shrier <kshrier@racktopsystems.com>  
Kirklin McDonald <kirklin.mcdonald@gmail.com>  
Klaus Post <klauspost@gmail.com>  
Konstantin Shaposhnikov <k.shaposhnikov@gmail.com>  
Kris Rousey <krousey@google.com>  
Kristopher Watts <traetox@gmail.com>  
Kun Li <likunarmstrong@gmail.com>  
Kyle Consalus <consalus@gmail.com>  
Kyle Isom <kyle@gokyle.net>  
Kyle Lemons <kyle@kylelemons.net> <kevlar@google.com>

## L

Campbell <unpantso@gmail.com>  
Lai Jiangshan <eag0628@gmail.com>  
Larry Hosken <lahosken@golang.org>  
Larz Conwell <larzconwell@gmail.com>  
LE Manh Cuong <cuong.manhle.vn@gmail.com>  
Lee Hinman <hinman@gmail.com>  
Lee Packham <lpackham@gmail.com>  
Lewin Bormann <lewin.bormann@gmail.com>  
Lloyd Dewolf <foolswisdom@gmail.com>  
Lorenzo Stoakes <lstoakes@gmail.com>  
Louis Kruger <louisk@google.com>  
Luan Santos <cfcluan@gmail.com>  
Luca Greco <luca.greco@alcacoop.it>  
Lucien Stuker <lucien.stuker@gmail.com>  
Lucio De Re <lucio.dere@gmail.com>  
Luigi Riefolo <luigi.riefolo@gmail.com>  
Luit van Drongelen <luitvd@gmail.com>  
Luka Zakrajek <tr00.g33k@gmail.com>  
Luke Curley <qpingu@gmail.com>  
Luna Duclos <luna.duclos@palmstonegames.com>  
Luuk van Dijk <lvd@golang.org> <lvd@google.com>  
Lynn Boger <laboger@linux.vnet.ibm.com>  
Maksym Trykur <maksym.trykur@gmail.com>  
Mal Curtis <mal@mal.co.nz>  
Manfred Touron <m@42.am>  
Manoj Dayaram <platform-dev@moovweb.com> <manoj.dayaram@moovweb.com>  
Manu Garg <manugarg@google.com>  
Manu  
S Ajith <neo@codingarena.in>  
Manuel Mendez <mmendez534@gmail.com>  
Marc Weistroff <marc@weistroff.net>  
Marc-Antoine Ruel <maruel@chromium.org>  
Marcel Edmund Franke <marcel.edmund.franke@gmail.com>  
Marcel van Lohuizen <mpvl@golang.org>  
Marco Hennings <marco.hennings@freiheit.com>  
Marga Manterola <marga@google.com>  
Marin Bai <marin.basic02@gmail.com>  
Marius Nuennerich <mnu@google.com>  
Mark Bucciarelli <mkbucc@gmail.com>  
Mark Severson <miquella@gmail.com>  
Mark Theunissen <mark.theunissen@gmail.com>  
Mark Zavislak <zavislak@google.com>  
Marko Juhani Silokunnas <marko.silokunnas@gmail.com>  
Marko Mikulicic <mkm@google.com>  
Marko Tiikkaja <marko@joh.to>  
Markus Duft <markus.duft@salomon.at>  
Markus Sonderegger <marraison@gmail.com>

Markus Zimmermann <zimmski@gmail.com>  
Martin Bertschler <mbertschler@gmail.com>  
Martin Garton <garton@gmail.com>  
Martin Hamrle <martin.hamrle@gmail.com>  
Martin Kreichgauer <martinkr@google.com>  
Martin Mohrmann <moehrmann@google.com> <martisch@uos.de>  
Martin  
Neubauer <m.ne@gmx.net>  
Martin Olsson <martin@minimum.se>  
Marvin Stenger <marvin.stenger94@gmail.com>  
Mateusz Czapliski <czapkofan@gmail.com>  
Mathias Beke <git@denbeke.be>  
Mathias Leppich <mleppich@muqu.de>  
Mathieu Lonjaret <mathieu.lonjaret@gmail.com>  
Mats Lidell <mats.lidell@cag.se> <mats.lidell@gmail.com>  
Matt Aimonetti <mattaimonetti@gmail.com>  
Matt Bostock <matt@mattbostock.com>  
Matt Brown <mbrown@google.com>  
Matt Drollette <matt@drollette.com>  
Matt Jibson <matt.jibson@gmail.com>  
Matt Joiner <anacrolix@gmail.com>  
Matt Jones <mrjones@google.com>  
Matt Layher <mdlayher@gmail.com>  
Matt Reiferson <mreiferson@gmail.com>  
Matt Robenolt <matt@ydekproductions.com>  
Matt T. Proud <matt.proud@gmail.com>  
Matt Williams <gh@mattyw.net> <mattyjwilliams@gmail.com>  
Matthew Brennan <matty.brennan@gmail.com>  
Matthew Cottingham <mattcottingham@gmail.com>  
Matthew Dempsey <mdempsey@google.com>  
Matthew Denton <mdenton@skyportsystems.com>  
Matthew Holt <Matthew.Holt+git@gmail.com>  
Matthew Horsnell <matthew.horsnell@gmail.com>  
Matthieu  
Hauglustaine <matt.hauglustaine@gmail.com>  
Matthieu Olivier <olivier.matthieu@gmail.com>  
Max Riveiro <kavu13@gmail.com>  
Maxim Khitrov <max@mxcrypt.com>  
Maxim Pimenov <mpimenov@google.com>  
Maxim Ushakov <ushakov@google.com>  
Maxwell Krohn <themax@gmail.com>  
Meir Fischer <meirfischer@gmail.com>  
Meng Zhuo <mengzhuo1203@gmail.com>  
Mhd Sulhan <m.shulhan@gmail.com>  
Micah Stetson <micah.stetson@gmail.com>  
Michael Chaten <mchaten@gmail.com>  
Michael Darakananda <pongad@google.com>  
Michael Elkins <michael.elkins@gmail.com>

Michael Fraenkel <michael.fraenkel@gmail.com>  
Michael Gehring <mg@ebfe.org> <gnirheg.leahcim@gmail.com>  
Michael Hoisie <hoisie@gmail.com>  
Michael Hudson-Doyle <michael.hudson@linaro.org>  
Michael Kufl <golang@c.michael-kaeufl.de>  
Michael Kelly <mjk@google.com>  
Michael Lewis <mikelikespie@gmail.com>  
Michael MacInnis <Michael.P.MacInnis@gmail.com>  
Michael Marineau <michael.marineau@coreos.com>  
Michael Matloob <matloob@google.com>  
Michael McConville  
<momconville@gmail.com>  
Michael McGreevy <mcgreevy@golang.org>  
Michael Munday <munday@ca.ibm.com>  
Michael Pearson <mipearson@gmail.com>  
Michael Piatek <piatek@google.com>  
Michael Pratt <mpratt@google.com>  
Michael Schaller <michael@5challer.de>  
Michael Shields <mshields@google.com>  
Michael Stapelberg <michael@stapelberg.de> <mstplbrg@googlemail.com>  
Michael T. Jones <mtj@google.com> <michael.jones@gmail.com>  
Michael Teichgrber <mteichgraeber@gmx.de> <mt4swm@googlemail.com>  
Michael Vetter <g.bluehut@gmail.com>  
Michal Bohuslvek <mbohuslvek@gmail.com>  
Michal Cierniak <cierniak@google.com>  
Micha Derkacz <ziutek@lnet.pl>  
Michalis Kargakis <michaliskargakis@gmail.com>  
Michel Lespinasse <>walken@google.com>  
Miek Gieben <miek@miek.nl> <remigius.gieben@gmail.com>  
Miguel Mendez <stxmendez@gmail.com>  
Mihai Borobocea <MihaiBorobocea@gmail.com>  
Mikael Tillenius <mikti42@gmail.com>  
Mike Andrews <mra@xoba.com>  
Mike Appleby <mike@app.leby.org>  
Mike Danese <mikedanese@google.com>  
Mike Houston <mike@kothar.net>  
Mike  
Rosset <mike.rosset@gmail.com>  
Mike Samuel <mikesamuel@gmail.com>  
Mike Solomon <msolo@gmail.com>  
Mike Strosaker <strosake@us.ibm.com>  
Mikhail Gusarov <dottedmag@dottedmag.net>  
Mikhail Panchenko <m@mihasya.com>  
Miki Tebeka <miki.tebeka@gmail.com>  
Mikio Hara <mikioh.mikioh@gmail.com>  
Mikkel Krautz <mikkel@krautz.dk> <krautz@gmail.com>  
Miquel Sabat Sol <mikisabate@gmail.com>  
Miroslav Genov <mgenov@gmail.com>



Mohit Agarwal <mohit@sdf.org>  
Momchil Velikov <momchil.velikov@gmail.com>  
Monty Taylor <mordred@inaugust.com>  
Moriyoshi Koizumi <mozo@mozo.jp>  
Morten Siebuhr <sbhr@sbhr.dk>  
Mshe van der Sterre <moshevds@gmail.com>  
Mrunal Patel <mrunalp@gmail.com>  
Muhammed Uluyol <uluyol0@gmail.com>  
Nan Deng <monnand@gmail.com>  
Nathan John Youngman <nj@nathany.com>  
Nathan Otterness <otternes@cs.unc.edu>  
Nathan P Finch <nate.finch@gmail.com>  
Nathan VanBenschoten <nvanbenschoten@gmail.com>  
Nathan Youngman <git@nathany.com>  
Nathan(yinian) Hu <nathanhu@google.com>  
Neelesh Chandola <neelesh.c98@gmail.com>  
Nevins  
Bartolomeo <nevins.bartolomeo@gmail.com>  
Niall Sheridan <nsheridan@gmail.com>  
Nic Day <nic.day@me.com>  
Nicholas Katsaros <nick@nickkatsaros.com>  
Nicholas Presta <nick@nickpresta.ca> <nick1presta@gmail.com>  
Nicholas Sullivan <nicholas.sullivan@gmail.com>  
Nicholas Waples <nwaples@gmail.com>  
Nick Cooper <nmvc@google.com>  
Nick Craig-Wood <nick@craig-wood.com> <nickcw@gmail.com>  
Nick Harper <nharper@google.com>  
Nick Leli <nicholasleli@gmail.com>  
Nick Patavalis <nick.patavalis@gmail.com>  
Nick Petroni <npetroni@cs.umd.edu>  
Nicolas Kaiser <nikai@nikai.net>  
Nicolas Owens <mischief@offblast.org>  
Nicolas S. Dade <nic.dade@gmail.com>  
Niels Widger <niels.widger@gmail.com>  
Nigel Kerr <nigel.kerr@gmail.com>  
Nigel Tao <nigeltao@golang.org>  
Nik Nyby <nnyby@columbia.edu>  
Niko Dziemba <niko@dziemba.com>  
Nikolay Turpitko <nikolay@turpitko.com>  
Noah Campbell <noahcampbell@gmail.com>  
Nodir Turakulov <nodir@google.com>  
Norberto Lopes <nlopes.ml@gmail.com>  
Odin Ugedal <odin@ugedal.com>  
Oleg  
Vakheta <helginet@gmail.com>  
Oleku Konko <oleku.konko@gmail.com>  
Oling Cat <olingcat@gmail.com>  
Oliver Hookins <ohookins@gmail.com>

Olivier Antoine <olivier.antoine@gmail.com>  
Olivier Duperray <duperray.olivier@gmail.com>  
Olivier Poitrey <rs@dailymotion.com>  
Olivier Saingre <osaingre@gmail.com>  
Omar Jarjur <ojarjur@google.com>  
zgr Kesim <oec-go@kesim.org>  
Padraig Kitterick <padraigkitterick@gmail.com>  
Paolo Giarrusso <p.giarrusso@gmail.com>  
Paolo Martini <mrtnpaolo@gmail.com>  
Parker Moore <parkrmoore@gmail.com>  
Pascal S. de Kloe <pascal@quies.net>  
Patrick Crosby <patrick@stathat.com>  
Patrick Gavlin <pgavlin@gmail.com>  
Patrick Higgins <patrick.allen.higgins@gmail.com>  
Patrick Lee <pattyshack101@gmail.com>  
Patrick Mzard <patrick@mezard.eu>  
Patrick Mylund Nielsen <patrick@patrickmn.com>  
Patrick Riley <pfr@google.com>  
Patrick Smith <pat42smith@gmail.com>  
Paul A Querna <paul.querna@gmail.com>  
Paul Borman <borman@google.com>  
Paul Chang <paulchang@google.com>  
Paul Hammond <paul@paulhammond.org>  
Paul  
Hankin <paulhankin@google.com>  
Paul Lalonde <paul.a.lalonde@gmail.com>  
Paul Marks <pmarks@google.com>  
Paul Meyer <paul.meyer@microsoft.com>  
Paul Nasrat <pnasrat@google.com>  
Paul Rosania <paul.rosania@gmail.com>  
Paul Sbarra <Sbarra.Paul@gmail.com>  
Paul Smith <paulsmith@pobox.com> <paulsmith@gmail.com>  
Paul van Brouwershaven <paul@vanbrouwershaven.com>  
Paul Wankadia <junyer@google.com>  
Paulo Casaretto <pcasaretto@gmail.com>  
Pavel Paulau <pavel.paulau@gmail.com>  
Pavel Zinovkin <pavel.zinovkin@gmail.com>  
Pawel Knap <pawelknap88@gmail.com>  
Pawel Szczur <filemon@google.com>  
Percy Wegmann <ox.to.a.cart@gmail.com>  
Perry Abbott <perry.j.abbott@gmail.com>  
Petar Maymoukov <petarm@gmail.com>  
Peter Armitage <peter.armitage@gmail.com>  
Peter Collingbourne <pcc@google.com>  
Peter Froehlich <peter.hans.froehlich@gmail.com>  
Peter Gonda <pgonda@google.com>  
Peter Kleiweg <pkleiweg@xs4all.nl>  
Peter McKenzie <petermck@google.com>

Peter Moody <pmoody@uber.com>  
Peter Mundy <go.peter.90@gmail.com>  
Pter  
Surnyi <speter.gol@gmail.com>  
Pter Szab <pts@google.com>  
Pter Szilgyi <peterke@gmail.com>  
Peter Tseng <ptseng@squareup.com>  
Peter Waldschmidt <peter@waldschmidt.com>  
Peter Waller <peter.waller@gmail.com>  
Peter Weinberger <pjw@golang.org>  
Peter Williams <pwil3058@gmail.com>  
Phil Pennock <pdp@golang.org>  
Philip Brgesen <philip.borgesen@gmail.com>  
Philip Hofer <phofer@umich.edu>  
Philip K. Warren <pkwarren@gmail.com>  
Pierre Durand <pierredurand@gmail.com>  
Pierre Roullon <pierre.roullon@gmail.com>  
Pieter Droogendijk <pieter@binky.org.uk>  
Pietro Gagliardi <pietro10@mac.com>  
Prasanna Swaminathan <prasanna@mediamath.com>  
Prashant Varanasi <prashant@prashantv.com>  
Preetam Jinka <pj@preet.am>  
Quan Tran <qeed.quan@gmail.com>  
Quan Yong Zhai <qyzhai@gmail.com>  
Quentin Perez <qperez@ocs.online.net>  
Quentin Smith <quentin@golang.org>  
Quinn Slack <sqs@sourcegraph.com>  
Quoc-Viet Nguyen <afelion@gmail.com>  
Radu Berinde <radu@cockroachlabs.com>  
Rafal Jeczalik <rjeczalik@gmail.com>  
Rahul Chaudhry <rahulchaudhry@chromium.org>  
Raif  
S. Naffah <go@naffah-raif.name>  
Rajat Goel <rajat.goel2010@gmail.com>  
Ralph Corderoy <ralph@inputplus.co.uk>  
Ramesh Dharan <dharan@google.com>  
Raph Levien <raph@google.com>  
Raphael Geronimi <raphael.geronimi@gmail.com>  
Raul Silvera <rsilvera@google.com>  
Rebecca Stambler <rstambler@golang.org>  
Reinaldo de Souza Jr <juniorz@gmail.com>  
Rmy Oudompheng <oudomphe@phare.normalesup.org> <remyoudompheng@gmail.com>  
Rhys Hiltner <rhys@justin.tv>  
Ricardo Padilha <ricardospadilha@gmail.com>  
Richard Barnes <rlb@ipv.sx>  
Richard Crowley <r@rcrowley.org>  
Richard Eric Gavaletz <gavaletz@gmail.com>  
Richard Gibson <richard.gibson@gmail.com>

Richard Miller <miller.research@gmail.com>  
Richard Musiol <mail@richard-musiol.de> <neelance@gmail.com>  
Rick Arnold <rickarnoldjr@gmail.com>  
Rick Hudson <rlh@golang.org>  
Riku Voipio <riku.voipio@linaro.org>  
Risto Jaakko Saarelmä <rsaarelm@gmail.com>  
Rob Earhart <earhart@google.com>  
Rob Norman <rob.norman@infinitycloud.com>  
Rob Pike <r@golang.org>  
Robert  
Daniel Kortschak <dan.kortschak@adelaide.edu.au>  
Robert Dinu <r@varp.se>  
Robert Figueiredo <robfig@gmail.com>  
Robert Griesemer <gri@golang.org>  
Robert Hencke <robert.hencke@gmail.com>  
Robert Iannucci <iannucci@google.com>  
Robert Obryk <robryk@gmail.com>  
Robert Sesek <rsesek@google.com>  
Robert Snedegar <roberts@google.com>  
Robert Stepanek <robert.stepanek@gmail.com>  
Robin Eklind <r.eklind.87@gmail.com>  
Rodrigo Moraes de Oliveira <rodrigo.moraes@gmail.com>  
Rodrigo Rafael Monti Kochenburger <divoxx@gmail.com>  
Roger Pau Monn <royger@gmail.com>  
Roger Peppe <rogpeppe@gmail.com>  
Roland Shoemaker <rolandshoemaker@gmail.com>  
Ron Hashimoto <mail@h2so5.net>  
Ron Minnich <rminnich@gmail.com>  
Ross Light <light@google.com> <rlight2@gmail.com>  
Rowan Worth <sqweek@gmail.com>  
Rui Ueyama <ruiui@google.com>  
Russ Cox <rsc@golang.org>  
Russell Haering <russellhaering@gmail.com>  
Ryan Bagwell <ryanbagwell@outlook.com>  
Ryan Barrett <ryanb@google.com>  
Ryan Brown <ribldb@google.com>  
Ryan Hitchman  
<hitchmanr@gmail.com>  
Ryan Lower <rpjlower@gmail.com>  
Ryan Seys <ryan@ryanseys.com>  
Ryan Slade <ryanslade@gmail.com>  
Ryuzo Yamamoto <ryuzo.yamamoto@gmail.com>  
S.alar Onur <caglar@10ur.org>  
Sai Cheemalapati <saicheems@google.com>  
Salim Aljammz <s@0x65.net>  
Sam Ding <samding@ca.ibm.com>  
Sam Hug <samuel.b.hug@gmail.com>  
Sam Thorogood <thorogood@google.com> <sam.thorogood@gmail.com>

Sam Whited <sam@samwhited.com>  
Sameer Ajmani <sameer@golang.org> <ajmani@gmail.com>  
Sami Commerot <samic@google.com>  
Samuel Tan <samueltan@google.com>  
Samuele Pedroni <pedronis@lucediurna.net>  
Sanjay Menakuru <balasanjay@gmail.com>  
Sarah Adams <shadams@google.com>  
Sasha Lionheart <lionhearts@google.com>  
Sasha Sobol <sasha@scaledinference.com>  
Scott Barron <scott.barron@github.com>  
Scott Bell <scott@sctsm.com>  
Scott Ferguson <scottwferg@gmail.com>  
Scott Lawrence <bytbox@gmail.com>  
Scott Mansfield <smansfield@netflix.com>  
Scott Schwartz <scotts@golang.org>  
Scott Van Woudenberg <scottvw@google.com>  
Sean Burford <sburford@google.com>  
Sean  
Dolphin <Sean.Dolphin@kpcompass.com>  
Sean Harger <sharger@google.com>  
Sean Rees <sean@erifax.org>  
Sebastien Binet <seb.binet@gmail.com>  
Sbastien Paolacci <sebastien.paolacci@gmail.com>  
Sergei Skorobogatov <skorobo@rambler.ru>  
Sergey 'Snake' Gromov <snake.scaly@gmail.com>  
Sergey Arseev <sergey.arseev@intel.com>  
Sergio Luis O. B. Correia <sergio@correia.cc>  
Seth Hoenig <seth.a.hoenig@gmail.com>  
Seth Vargo <sethvargo@gmail.com>  
Shahar Kohanim <skohanim@gmail.com>  
Shane Hansen <shanemhansen@gmail.com>  
Shaozhen Ding <dsz0111@gmail.com>  
Shawn Ledbetter <sledbetter@google.com>  
Shawn Smith <shawn.p.smith@gmail.com>  
Shawn Walker-Salas <shawn.walker@oracle.com>  
Shenghou Ma <minux@golang.org> <minux.ma@gmail.com>  
Shinji Tanaka <shinji.tanaka@gmail.com>  
Shivakumar GN <shivakumar.gn@gmail.com>  
Shun Fan <sfan@google.com>  
Silvan Jegen <s.jegen@gmail.com>  
Simon Jefford <simon.jefford@gmail.com>  
Simon Rawet <simon@rawet.se>  
Simon Thulbourn <simon+github@thulbourn.com>  
Simon Whitehead  
<chemnova@gmail.com>  
Sina Siadat <siadat@gmail.com>  
Sokolov Yura <funny.falcon@gmail.com>  
Song Gao <song@gao.io>

Spencer Nelson <s@spenczar.com>  
Spring Mc <heresy.mc@gmail.com>  
Srdjan Petrovic <spetrovic@google.com>  
Sridhar Venkatakrishnan <sridhar@laddoo.net>  
StalkR <stalkr@stalkr.net>  
Stan Schwertly <stan@schwertly.com>  
Stefan Nilsson <snilsson@nada.kth.se> <trolleriprofessorn@gmail.com>  
Stphane Travostino <stephane.travostino@gmail.com>  
Stephen Ma <stephenm@golang.org>  
Stephen McQuay <stephen@mcquay.me>  
Stephen Weinberg <stephen@q5comm.com>  
Steve Francia <spf@golang.org>  
Steve McCoy <mccoyst@gmail.com>  
Steve Newman <snewman@google.com>  
Steve Phillips <elimistev@gmail.com>  
Steve Streeting <steve@stevestreeting.com>  
Steven Elliot Harris <seharris@gmail.com>  
Steven Hartland <steven.hartland@multiplay.co.uk>  
Sugu Sougoumarane <ssougou@gmail.com>  
Suharsh Sivakumar <suharshs@google.com>  
Suyash <dextrous93@gmail.com>  
Sven Almgren <sven@tras.se>  
Sven Blumenstein <svbl@google.com>  
Syohai  
YOSHIDA <syohex@gmail.com>  
Szabolcs Nagy <nsz@port70.net>  
Tad Glines <tad.glines@gmail.com>  
Taj Khattri <taj.khattri@gmail.com>  
Takashi Matsuo <tmatsuo@google.com>  
Takeshi YAMANASHI <9.nashi@gmail.com>  
Takuya Ueda <uedatakuya@gmail.com>  
Tal Shprecher <tshprecher@gmail.com>  
Tamir Duberstein <tamird@gmail.com>  
Tarmigan Casebolt <tarmigan@gmail.com>  
Taru Karttunen <taruti@taruti.net>  
Tatsuhiro Tsujikawa <tatsuhiro.t@gmail.com>  
Terrel Shumway <gopher@shumway.us>  
Tetsuo Kiso <tetsuokiso9@gmail.com>  
Than McIntosh <thanm@google.com>  
Thiago Fransosi Farina <thiago.farina@gmail.com> <tfarina@chromium.org>  
Thomas Alan Copeland <talán.copeland@gmail.com>  
Thomas de Zeeuw <thomasdezeuw@gmail.com>  
Thomas Desrosiers <thomasdesr@gmail.com>  
Thomas Habets <habets@google.com>  
Thomas Kappler <tkappler@gmail.com>  
Thorben Krueger <thorben.krueger@gmail.com>  
Thordur Bjornsson <thorduri@secnorth.net>  
Tilman Dilo <tilman.dilo@gmail.com>

Tim Cooijmans <timcooijmans@gmail.com>  
Tim Ebringer <tim.ebringer@gmail.com>  
Tim  
Henderson <tim.tadh@gmail.com>  
Tim Hockin <thockin@google.com>  
Tim Swast <swast@google.com>  
Timo Savola <timo.savola@gmail.com>  
Timo Truys <alkaloid.btx@gmail.com>  
Timothy Studd <tim@timstudd.com>  
Tipp Moseley <tipp@google.com>  
Tobias Columbus <tobias.columbus@gmail.com> <tobias.columbus@googlemail.com>  
Toby Burrell <kurin@google.com>  
Todd Neal <todd@tneal.org>  
Todd Wang <toddwang@gmail.com>  
Tom Bergan <tombergan@google.com>  
Tom Heng <zhm20070928@gmail.com>  
Tom Linfoot <tomlinfoot@gmail.com>  
Tom Szymanski <tgs@google.com>  
Tom Wilkie <tom@weave.works>  
Tommy Schaefer <tommy.schaefer@teecom.com>  
Tor Andersson <tor.andersson@gmail.com>  
Tormod Erevik Lea <tormodlea@gmail.com>  
Totoro W <tw19881113@gmail.com>  
Travis Cline <travis.cline@gmail.com>  
Trevor Strohman <trevor.strohman@gmail.com>  
Trey Lawrence <lawrence.trey@gmail.com>  
Trey Tacon <ttacon@gmail.com>  
Tristan Amini <tamini01@ca.ibm.com>  
Tristan Colgate <tcolgate@gmail.com>  
Tristan Oohry <ooohry@gmail.com>  
Tudor Golubenco  
<tudor.g@gmail.com>  
Tuo Shan <sturbo89@gmail.com> <shantuo@google.com>  
Tyler Bunnell <tylerbunnell@gmail.com>  
Tyler Treat <ttreat31@gmail.com>  
Tzu-Jung Lee <roylee17@currant.com>  
Ugorji Nwoke <ugorji@gmail.com>  
Ulf Holm Nielsen <doktor@dyregod.dk>  
Ulrich Kunitz <uli.kunitz@gmail.com>  
Uriel Mangado <uriel@berlinblue.org>  
Uttam C Pawar <uttam.c.pawar@intel.com>  
Vadim Grek <vadimprog@gmail.com>  
Vadim Vygonets <unixdj@gmail.com>  
Vega Garcia Luis Alfonso <vegacom@gmail.com>  
Victor Chudnovsky <vchudnov@google.com>  
Vincent Ambo <tazjin@googlemail.com>  
Vincent Batts <vbatts@hashbangbash.com> <vbatts@gmail.com>  
Vincent Vanackere <vincent.vanackere@gmail.com>

Vinu Rajashekhar <vinutheraj@gmail.com>  
Vish Subramanian <vish@google.com>  
Vishvananda Ishaya <vishvananda@gmail.com>  
Vitor De Mario <vitordemario@gmail.com>  
Vlad Krasnov <vlad@cloudflare.com>  
Vladimir Mihailenco <vladimir.webdev@gmail.com>  
Vladimir Nikishenko <vova616@gmail.com>  
Vladimir Stefanovic <vladimir.stefanovic@imgtec.com>  
Volker  
Dobler <dr.volker.dobler@gmail.com>  
Volodymyr Paprotski <vpaprots@ca.ibm.com>  
Walter Poupore <wpoupore@google.com>  
Wedson Almeida Filho <wedsonaf@google.com>  
Wei Guangjing <vcc.163@gmail.com>  
Will Chan <willchan@google.com>  
Will Norris <willnorris@google.com>  
Willem van der Schyff <willemvds@gmail.com>  
William Chan <willchan@chromium.org>  
William Josephson <wjosephson@gmail.com>  
William Orr <will@worrbase.com> <ay1244@gmail.com>  
Wisdom Omuya <deafgoat@gmail.com>  
Xia Bin <snyh@snyh.org>  
Xing Xing <mikespook@gmail.com>  
Xudong Zhang <felixmelon@gmail.com>  
Xuyang Kang <xuyangkang@gmail.com>  
Yan Zou <yzou@google.com>  
Yann Kerherv <yann.kerherve@gmail.com>  
Yao Zhang <lunaria21@gmail.com>  
Yasuharu Goto <matope.ono@gmail.com>  
Yasuhiro Matsumoto <mattn.jp@gmail.com>  
Yesudeep Mangalapilly <yesudeep@google.com>  
Yissakhar Z. Beck <yissakhar.beck@gmail.com>  
Yo-An Lin <yoanlin93@gmail.com>  
Yongjian Xu <i3dmaster@gmail.com>  
Yorman Arias <cixtords@gmail.com>  
Yoshiyuki Kanno <nekotaroh@gmail.com> <yoshiyuki.kanno@stoic.co.jp>  
Yu  
Heng Zhang <annita.zhang@cn.ibm.com>  
Yu Xuan Zhang <zyxsh@cn.ibm.com>  
Yuki Yugui Sonoda <yugui@google.com>  
Yusuke Kagiwada <block.rxckin.beats@gmail.com>  
Yuusei Kuwana <kuwana@kumama.org>  
Yuval Pavel Zholkover <paulzhol@gmail.com>  
Yves Junqueira <yvesj@google.com> <yves.junqueira@gmail.com>  
Zac Bergquist <zbergquist99@gmail.com>  
Zev Goldstein <zev.goldstein@gmail.com>  
Zhongwei Yao <zhongwei.yao@arm.com>  
Ziad Hatahet <hatahet@gmail.com>



Zorion Arrizabalaga <zorionk@gmail.com>

<faxriddinjon@gmail.com>

<bronzel1man@gmail.com>

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```
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Taco de Wolff <tacodewolff@gmail.com>
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```

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```
This is the official list of people who can contribute
(and typically have contributed) code to the Go repository.
The AUTHORS file lists the copyright holders; this file
lists people. For example, Google employees are listed here
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#
Names should be added to this file only after verifying that
the individual or the individual's organization has agreed to
the appropriate Contributor License Agreement, found here:
#
http://code.google.com/legal/individual-cla-v1.0.html
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#
The agreement for individuals can be filled out on the web.

Names should be added to this file like so:
Individual's name <submission email address>
Individual's name <submission email address> <email2> <emailN>
#
An entry with multiple email addresses specifies that the
first address should be used in the submit logs and
that the other addresses should be recognized
```

as the  
# same person when interacting with Gerrit.

# Please keep the list sorted.

Aamir Khan <syst3m.w0rm@gmail.com>  
Aaron Cannon <cannona@fireantproductions.com>  
Aaron France <aaron.l.france@gmail.com>  
Aaron Jacobs <jacobsa@google.com>  
Aaron Kemp <kemp.aaron@gmail.com>  
Aaron Stein <aaronstein12@gmail.com>  
Aaron Torres <tcboox@gmail.com>  
Aaron Zinman <aaron@azinman.com>  
Aarti Parikh <aarti.parikh@gmail.com>  
Abdullah Al Maruf <mymail.maruf@gmail.com>  
Abe Haskins <abeisgreat@abeisgreat.com>  
Abhinav Gupta <abhinav.g90@gmail.com>  
Adam Azarchs <adam.azarchs@10xgenomics.com>  
Adam Bender <abender@google.com>  
Adam Eijdenberg <adam@continusec.com>  
Adam Harvey <aharvey@php.net>  
Adam Kisala <adam.kisala@gmail.com>  
Adam Langley <agl@golang.org>  
Adam Medzinski <adam.medzinski@gmail.com>  
Adam Shannon <adamkshannon@gmail.com>  
Adam Sindelar <adamsh@google.com>  
Adam Thomason <athomason@gmail.com>  
Adam Woodbeck <adam@woodbeck.net>  
Adarsh Ravichandran <adarshravichandran91@gmail.com>  
Aditya Mukerjee  
<dev@chimeracoder.net>  
Adrian Hesketh <adrianhesketh@hushmail.com>  
Adrian Nos <nos.adrian@gmail.com>  
Adrian O'Grady <elpollouk@gmail.com>  
Adrien Bustany <adrien-xx-google@bustany.org>  
Adrien Petel <peteladrien@gmail.com>  
Acio Jnior <aeciodantasjunior@gmail.com>  
Aeneas Rekkas <aeneas@ory.am>  
Afanasev Stanislav <phpprogger@gmail.com>  
Agis Anastasopoulos <agis.anast@gmail.com>  
Agniva De Sarker <agnivade@yahoo.co.in>  
Ahmed Wahed <oneofone@gmail.com>  
Ahmet Alp Balkan <ahmetb@google.com>  
Ahmet Soormally <ahmet@mangomm.co.uk>  
Ahmy Yulrizka <yulrizka@gmail.com>  
Ahsun Ahmed <ahmed.ahsun@gmail.com>  
Aiden Scandella <ai@uber.com>  
Ainar Garipov <gugl.zadolbal@gmail.com>

Aishraj Dahal <aishraj@users.noreply.github.com>  
Akhil Indurti <contact@akhilindurti.com>  
Akihiro Suda <suda.kyoto@gmail.com>  
Akshat Kumar <seed@mail.nanosouffle.net>  
Al Cutter <al@google.com>  
Alan Braithwaite <alan@ipaddr.org>  
Alan Donovan <adonovan@google.com>  
Alan Shreve <alan@inconshreveable.com>  
Albert Nigmatzianov <albertnigma@gmail.com>  
Albert  
Strasheim <fullung@gmail.com>  
Albert Teoh <albert.teoh@gmail.com>  
Albert Yu <yukinying@gmail.com>  
Alberto Bertogli <albertito@blitiri.com.ar>  
Alberto Donizetti <alb.donizetti@gmail.com>  
Alberto Garca Hierro <alberto@garciahierro.com> <alberto.garcia.hierro@gmail.com>  
Aleksa Sarai <cyphar@cyphar.com>  
Aleksandar Dezelin <dezelin@gmail.com>  
Aleksandr Lukinykh <a.lukinykh@xsolla.com>  
Aleksandr Razumov <ar@cydev.ru>  
Alekseev Artem <a.artem060@gmail.com>  
Alessandro Arzilli <alessandro.arzilli@gmail.com>  
Alessandro Baffa <alessandro.baffa@gmail.com>  
Alex A Skinner <alex@lx.lc>  
Alex Brainman <alex.brainman@gmail.com>  
Alex Bramley <abramley@google.com>  
Alex Browne <stephenalexbrowne@gmail.com>  
Alex Carol <alex.carol.c@gmail.com>  
Alex Jin <toalexjin@gmail.com>  
Alex Kohler <alexjohnkohler@gmail.com>  
Alex Myasoedov <msoedov@gmail.com>  
Alex Plugaru <alex@plugaru.org> <alexandru.plugaru@gmail.com>  
Alex Schroeder <alex@gnu.org>  
Alex Sergeyev <abc@alexsergeyev.com>  
Alex Tokarev  
<aleksator@gmail.com>  
Alex Vaghin <crhyme@google.com>  
Alexander Demakin <alexander.demakin@gmail.com>  
Alexander Dring <email@alex.d.ch>  
Alexander F Rdseth <alexander.rodseth@appeartv.com>  
Alexander Guz <kalimatas@gmail.com>  
Alexander Kauer <alexander@affine.space>  
Alexander Kucherenko <alxkchr@gmail.com>  
Alexander Larsson <alexander.larsson@gmail.com>  
Alexander Lourier <aml@rulezz.ru>  
Alexander Menzhinsky <amenzhinsky@gmail.com>  
Alexander Morozov <lk4d4math@gmail.com>  
Alexander Neumann <alexander@bumper.de>

Alexander Orlov <alexander.orlov@loxal.net>  
Alexander Pantyukhin <apantykhin@gmail.com>  
Alexander Polcyn <apolcyn@google.com>  
Alexander Rakoczy <alex@golang.org>  
Alexander Reece <awreece@gmail.com>  
Alexander Surma <surma@surmair.de>  
Alexander Zhavnerchik <alex.vizor@gmail.com>  
Alexander Zillion <alex@alexzillion.com>  
Alexander Zolotov <goldifit@gmail.com>  
Alexandre Cesaro <alexandre.cesaro@gmail.com>  
Alexandre Fiori <fiorix@gmail.com>  
Alexandre Maari <draeron@gmail.com>  
Alexandre  
Normand <alexandre.normand@gmail.com>  
Alexandre Parentea <aubonbeurre@gmail.com>  
Alexandre Viau <alexandre@alexandreviau.net>  
Alexandru Mooi <brtznr@gmail.com>  
Alexei Sholik <alcosholik@gmail.com>  
Alexey Alexandrov <aalexand@google.com>  
Alexey Borzenkov <snaury@gmail.com>  
Alexey Naidonov <alexey.naidyonov@gmail.com>  
Alexey Neganov <neganovalexey@gmail.com>  
Alexey Palazhchenko <alexey.palazhchenko@gmail.com>  
Alexis Hildebrandt <surryhill@gmail.com>  
Alexis Hunt <lexer@google.com>  
Alexis Imperial-Legrand <ail@google.com>  
Ali Rizvi-Santiago <arizvisa@gmail.com>  
Aliaksandr Valialkin <valyala@gmail.com>  
Alif Rachmawadi <subosito@gmail.com>  
Allan Simon <allan.simon@supinfo.com>  
Allen Li <ayatane@google.com>  
Alok Menghrajani <alok.menghrajani@gmail.com>  
Aman Gupta <aman@tmm1.net>  
Amir Mohammad Saied <amir@gluegadget.com>  
Amr Mohammed <merodiro@gmail.com>  
Amrut Joshi <amrut.joshi@gmail.com>  
Anand K. Mistry <anand@mistry.ninja>  
Anders Pearson <anders@columbia.edu>  
Anderson Queiroz <contato@andersonq.eti.br>  
Andr  
Carvalho <asantostc@gmail.com>  
Andre Nathan <andrenth@gmail.com>  
Andrea Nodari <andrea.nodari91@gmail.com>  
Andrea Spadaccini <spadaccio@google.com>  
Andreas Auernhammer <aead@mail.de>  
Andreas Jellinghaus <andreas@ionisiert.de> <anj@google.com>  
Andreas Litt <andreas.litt@gmail.com>  
Andrei Gherzan <andrei@resin.io>

Andrei Korzhevskii <a.korzhevskiy@gmail.com>  
Andrei Matei <andrei@cockroachlabs.com>  
Andrei Tudor Clin <mail@acln.ro>  
Andrei Vagin <avagin@google.com>  
Andrei Vieru <euvieru@gmail.com>  
Andres Erbsen <andreser@google.com>  
Andres Lowrie <andres.lowrie@gmail.com>  
Andrew Austin <andrewaact@gmail.com>  
Andrew Balholm <andybalholm@gmail.com>  
Andrew Benton <andrewmbenton@gmail.com>  
Andrew Bonventre <andybons@chromium.org>  
Andrew Braunstein <awbraunstein@gmail.com>  
Andrew Bursavich <abursavich@gmail.com>  
Andrew Ekstedt <andrew.ekstedt@gmail.com>  
Andrew Etter <andrew.etter@gmail.com>  
Andrew Gerrand <adg@golang.org>  
Andrew Harding <andrew@spacemonkey.com>  
Andrew Jackura  
<ajackura@google.com>  
Andrew Lutomirski <andy@luto.us>  
Andrew Pilloud <andrewpilloud@igneoussystems.com>  
Andrew Pogrebnoy <absourd.noise@gmail.com>  
Andrew Poydence <apoydence@pivotal.io>  
Andrew Pritchard <awpritchard@gmail.com>  
Andrew Radev <andrey.radev@gmail.com>  
Andrew Skiba <skibaa@gmail.com>  
Andrew Stribblehill <ads@wompom.org>  
Andrew Szeto <andrew@jabagawee.com>  
Andrew Todd <andrew.todd@wework.com>  
Andrew Werner <andrew@upthere.com> <awerner32@gmail.com>  
Andrew Wilkins <axwalk@gmail.com>  
Andrew Williams <williams.andrew@gmail.com>  
Andrew Z Allen <me@andrewzallen.com>  
Andrey Mirtchovski <mirtchovski@gmail.com>  
Andrey Petrov <andrey.petrov@shazow.net>  
Andrii Soldatenko <andrii.soldatenko@gmail.com>  
Andrii Soluk <isoluchok@gmail.com>  
Andriy Lytvynov <lytvynov.a.v@gmail.com>  
Andrzej eel <andrii.zhezhel@gmail.com>  
Andy Balholm <andy@balholm.com>  
Andy Davis <andy@bigandian.com>  
Andy Finkensadt <afinkensadt@zynga.com>  
Andy Lindeman <andy@lindeman.io>  
Andy Maloney <asmaloney@gmail.com>  
Andy  
Walker <walkeraj@gmail.com>  
Andzej Maciusovic <andzej.maciusovic@gmail.com>  
Anfernee Yongkun Gui <anfernee.gui@gmail.com>

Angelo Bulfone <mbulfone@gmail.com>  
Anh Hai Trinh <anh.hai.trinh@gmail.com>  
Anit Gandhi <anitgandhi@gmail.com>  
Ankit Goyal <ankit3goyal@gmail.com>  
Anmol Sethi <anmol@aubble.com>  
Anschel Schaffer-Cohen <anschelsc@gmail.com>  
Anthony Alves <cvballa3g0@gmail.com>  
Anthony Canino <anthony.canino1@gmail.com>  
Anthony Eufemio <anthony.eufemio@gmail.com>  
Anthony Fok <foka@debian.org>  
Anthony Martin <ality@pbrane.org>  
Anthony Sottile <asottile@umich.edu>  
Anthony Starks <ajstarks@gmail.com>  
Anthony Voutas <voutasaurus@gmail.com>  
Anthony Woods <awoods@raintank.io>  
Antoine GIRARD <sapk@sapk.fr>  
Antoine Martin <antoine97.martin@gmail.com>  
Anton Gyllenberg <anton@iki.fi>  
Antonin Amand <antonin.amand@gmail.com>  
Antonio Antelo <aantelov87@gmail.com>  
Antonio Bibiano <antbbn@gmail.com>  
Antonio Murdaca <runcom@redhat.com>  
Antonio Troina <thoeni@gmail.com>  
Aofei Sheng <aofei@aofeisheng.com>  
Apisak  
Darakananda <pongad@gmail.com>  
Aram Hvrneanu <aram@mgk.ro>  
Arash Bina <arash@arash.io>  
Areski Belaid <areski@gmail.com>  
Ariel Mashraki <ariel@mashraki.co.il>  
Arkadi Pyuro <arkadi@google.com>  
Arlo Breault <arlolra@gmail.com>  
Arnaud Ysmal <arnaud.ysmal@gmail.com>  
Arne Hormann <arnehormann@gmail.com>  
Arnout Engelen <arnout@bzzt.net>  
Aron Nopanen <aron.nopanen@gmail.com>  
Artem Kolin <artemkaxboy@gmail.com>  
Arthur Fabre <arthur@arthurfabre.com>  
Arthur Khashaev <arthur@khashaev.ru>  
Artyom Pervukhin <artyom.pervukhin@gmail.com>  
Arvindh Rajesh Tamilmanni <art@a-30.net>  
Ashish Gandhi <ag@ashishgandhi.org>  
Asim Shankar <asimshankar@gmail.com>  
Atin Malaviya <amalaviy@akamai.com>  
Ato Araki <ato.araki@gmail.com>  
Audrey Lim <audreylh@gmail.com>  
Audrius Butkevicius <audrius.butkevicius@gmail.com>  
Augusto Roman <aroman@gmail.com>



Aulus Egnatius Varialus <varialus@gmail.com>  
Aurlien Rainone <aurelien.rainone@gmail.com>  
Austin Clements <austin@google.com> <aclements@csail.mit.edu>  
Avi  
Flax <avi@timehop.com>  
awaw fumin <awawfumin@gmail.com>  
Awn Umar <awn@cryptolosophy.io>  
Axel Wagner <axel.wagner.hh@googlemail.com>  
Ayanamist Yang <ayanamist@gmail.com>  
Aymerick Jhanne <aymerick@jehanne.org>  
Azat Kaumov <kaumov.a.r@gmail.com>  
Baiju Muthukadan <baiju.m.mail@gmail.com>  
Balaram Makam <bmakam.qdt@qualcommdatacenter.com>  
Balazs Lecz <leczb@google.com>  
Baokun Lee <nototon@gmail.com>  
Bartosz Grzybowski <melkorm@gmail.com>  
Bartosz Oler <brtsz@google.com>  
Bastian Ike <bastian.ike@gmail.com>  
Ben Burkert <ben@benburkert.com>  
Ben Eitzen <eitzenb@golang.org>  
Ben Fried <ben.fried@gmail.com>  
Ben Haines <bhainesva@gmail.com>  
Ben Hoyt <benhoyt@gmail.com>  
Ben Laurie <ben@links.org> <benl@google.com>  
Ben Lubar <ben.lubar@gmail.com>  
Ben Lynn <benlynn@gmail.com>  
Ben Olive <sionide21@gmail.com>  
Ben Schwartz <bemasc@google.com>  
Ben Shi <powerman1st@163.com>  
Benjamin Black <b@b3k.us>  
Benjamin Cable <cable.benjamin@gmail.com>  
Benjamin Hsieh <tanookiben@users.noreply.github.com>  
Benjamin Peterson  
<benjamin@python.org>  
Benjamin Prosnitz <bprosnitz@google.com>  
Benjamin Wester <bwester@squareup.com>  
Benny Siegert <bsiegert@gmail.com>  
Benoit Sigoure <tsunanet@gmail.com>  
Berengar Lehr <Berengar.Lehr@gmx.de>  
Berkant Ipek <41230766+0xbkt@users.noreply.github.com>  
Bharath Thiruveedula <tbharath91@gmail.com>  
Bill Neubauer <wcn@golang.org> <wcn@google.com> <bill.neubauer@gmail.com>  
Bill O'Farrell <billo@ca.ibm.com>  
Bill Prin <waprin@google.com>  
Bill Thiede <couchmoney@gmail.com>  
Bill Zissimopoulos <billziss@navimatics.com>  
Billie Harold Cleek <bhcleek@gmail.com>  
Billy Lynch <wlynch@google.com>

Bjrn Erik Pedersen <bjorn.erik.pedersen@gmail.com>  
Bjorn Tillenius <bjorn@tilenius.me>  
Bjorn Tipling <bjorn.tipling@gmail.com>  
Blain Smith <rebelgeek@blainsmith.com>  
Blake Gentry <blakesgentry@gmail.com>  
Blake Mesdag <blakemesdag@gmail.com>  
Blake Mizerany <blake.mizerany@gmail.com>  
Blixt <me@blixt.nyc>  
Bob Briski <rbriski@gmail.com>  
Bob Potter <bobby.potter@gmail.com>  
Bobby DeSimone <bobbydesimone@gmail.com>  
Bobby  
Powers <bobbypowers@gmail.com>  
Boris Nagaev <nagaev@google.com>  
Borja Clemente <borja.clemente@gmail.com>  
Brad Burch <brad.burch@gmail.com>  
Brad Fitzpatrick <bradfitz@golang.org> <bradfitz@gmail.com>  
Brad Garcia <bgarcia@golang.org>  
Brad Jones <rbjones@google.com>  
Brad Morgan <brad@morgabra.com>  
Brad Whitaker <bwhitaker@fastly.com>  
Braden Bassingthwaite <bbassingthwaite@vendasta.com>  
Bradley Falzon <brad@teambrad.net>  
Brady Catherman <brady@gmail.com>  
Brady Sullivan <brady@bsull.com>  
Brandon Bennett <bbennett@fb.com>  
Brandon Gilmore <varz@google.com>  
Brandon Ryan <bjryan19@gmail.com>  
Brendan Daniel Tracey <tracey.brendan@gmail.com>  
Brendan O'Dea <bod@golang.org>  
Brett Cannon <bcannon@gmail.com>  
Brett Merrill <brett.j.merrill94@gmail.com>  
Brian Dellisanti <briandellisanti@gmail.com>  
Brian Downs <brian.downs@gmail.com>  
Brian G. Merrell <bgmerrell@gmail.com>  
Brian Gitonga Marete <marete@toshnix.com> <bgmarete@gmail.com> <bgm@google.com>  
Brian Kennedy <btkenney@gmail.com>  
Brian  
Kessler <brian.m.kessler@gmail.com>  
Brian Ketelsen <bketelsen@gmail.com>  
Brian Slesinsky <skybrian@google.com>  
Brian Smith <ohohvi@gmail.com>  
Brian Starke <brian.starke@gmail.com>  
Bryan Alexander <Kozical@msn.com>  
Bryan C. Mills <bcmills@google.com>  
Bryan Chan <bryan.chan@ca.ibm.com>  
Bryan Ford <brynosaurus@gmail.com>  
Bryan Heden <b.heden@gmail.com>

Bulat Gaifullin <gaifullinbf@gmail.com>  
Burak Guven <bguven@gmail.com>  
Caine Tighe <arctanofyourface@gmail.com>  
Caio Marcelo de Oliveira Filho <caio.oliveira@intel.com>  
Caleb Martinez <accounts@calebmartinez.com>  
Caleb Spare <cespare@gmail.com>  
Carl Chatfield <carlchatfield@gmail.com>  
Carl Henrik Lunde <chlunde@ifi.uio.no>  
Carl Jackson <carl@stripe.com>  
Carl Johnson <me@carlmjohnson.net>  
Carl Mastrangelo <notcarl@google.com>  
Carl Shapiro <cshapiro@google.com> <cshapiro@golang.org>  
Carlisia Campos <carlisia@grokkingtech.io>  
Carlo Alberto Ferraris <cafxx@strayorange.com>  
Carlos Castillo <cookieo9@gmail.com>  
Carlos Cirello <uldericofilho@gmail.com>  
Carlos  
Eduardo <me@carlosedp.com>  
Carlos Eduardo Seo <cseo@linux.vnet.ibm.com>  
Carlos Souza <carloshrsouza@gmail.com>  
Carolyn Van Slyck <me@carolynvanslyck.com>  
Carrie Bynon <cbynon@gmail.com>  
Cary Hull <chull@google.com>  
Case Nelson <case.nelson@gmail.com>  
Casey Callendrello <squeed@gmail.com>  
Casey Marshall <casey.marshall@gmail.com>  
Catalin Nicutar <cnicutar@google.com>  
Catalin Patulea <catalinp@google.com>  
Cedric Staub <cs@squareup.com>  
Cezar S Espinola <cezarsa@gmail.com>  
Chad Rosier <mrosier.qdt@qualcommdatacenter.com>  
ChaiShushan <chaishushan@gmail.com>  
Channing Kimble-Brown <channing@golang.org>  
Charles Fenwick Elliott <Charles@FenwickElliott.io>  
Charles Kenney <charlesc.kenney@gmail.com>  
Charles L. Dorian <cldorian@gmail.com>  
Charles Lee <zombie.fml@gmail.com>  
Charles Weill <weill@google.com>  
Cherry Zhang <cherryyz@google.com>  
Chew Choon Keat <choonkeat@gmail.com>  
Cholerae Hu <choleraehyq@gmail.com>  
Chotepud Teo <AlexRouSg@users.noreply.github.com>  
Chris Ball  
<chris@printf.net>  
Chris Biscardi <chris@christopherbiscardi.com>  
Chris Broadfoot <cbro@golang.org>  
Chris Dollin <ehog.hedge@gmail.com>  
Chris Farmiloe <chrisfarms@gmail.com>

Chris Hines <chris.cs.guy@gmail.com>  
Chris Howey <howeyc@gmail.com>  
Chris Hundt <hundt@google.com>  
Chris Jones <chris@cjohnes.org> <chris.jones.yar@gmail.com>  
Chris Kastorff <encryptio@gmail.com>  
Chris Lennert <calennert@gmail.com>  
Chris Liles <caveryliles@gmail.com>  
Chris Manghane <cmang@golang.org>  
Chris Marchesi <chrism@vanclueverttech.com>  
Chris McGee <sirnewton\_01@yahoo.ca> <newton688@gmail.com>  
Chris Raynor <raynor@google.com>  
Chris Roche <rodaine@gmail.com>  
Chris Smith <chrsmith@users.noreply.github.com>  
Chris Stockton <chrisstocktonaz@gmail.com>  
Chris Zou <chriszou@ca.ibm.com>  
Christian Alexander <christian@linux.com>  
Christian Couder <chriscool@tuxfamily.org>  
Christian Himpel <chressie@googlemail.com> <chressie@gmail.com>  
Christian Muehlhaeuser <muesli@gmail.com>  
Christian Pellegrin <chri@evolware.org>  
Christian  
R. Petrin <christianpetrin@gmail.com>  
Christine Hansmann <chhansmann@gmail.com>  
Christoffer Buchholz <christoffer.buchholz@gmail.com>  
Christoph Blecker <admin@toph.ca>  
Christoph Hack <christoph@tux21b.org>  
Christopher Cahoon <chris.cahoon@gmail.com>  
Christopher Guiney <chris@guiney.net>  
Christopher Henderson <chris@chenderson.org>  
Christopher Koch <chrisko@google.com>  
Christopher Nelson <nadiasvertex@gmail.com>  
Christopher Nielsen <m4dh4tt3r@gmail.com>  
Christopher Redden <christopher.redden@gmail.com>  
Christopher Swenson <cswenson@google.com>  
Christopher Wedgwood <cw@f00f.org>  
Christos Zoulas <christos@zoulas.com> <zoulasc@gmail.com>  
Christy Perez <christy@linux.vnet.ibm.com>  
CL Sung <clsung@gmail.com> <cl\_sung@htc.com>  
Clment Chigot <clement.chigot@atos.net>  
Clement Skau <clementskau@gmail.com>  
Cody Oss <the.cody.oss@gmail.com>  
Colby Ranger <cranger@google.com>  
Colin Arnott <colin@urandom.co.uk>  
Colin Cross <ccross@android.com>  
Colin Edwards <colin@recursivepenguin.com>  
Colin  
Kennedy <moshen.colin@gmail.com>  
Colin Nelson <colnnelson@google.com>

Colin Rice <clr@google.com>  
Conrad Irwin <conrad.irwin@gmail.com>  
Conrad Meyer <cemeyer@cs.washington.edu>  
Conrado Gouvea <conradopl@gmail.com>  
Constantin Konstantinidis <constantinkonstantinidis@gmail.com>  
Corey Thomasson <cthom.lists@gmail.com>  
Cosmos Nicolaou <cnicolaou@google.com>  
Costin Chirvasuta <ctin@google.com>  
Craig Citro <craigcitro@google.com>  
Cristian Staretu <unclejacksons@gmail.com>  
Cuihtlauac ALVARADO <cuihtlauac.alvarado@orange.com>  
Cyrill Schumacher <cyrill@schumacher.fm>  
Daisuke Fujita <dtanshi45@gmail.com>  
Daker Fernandes Pinheiro <daker.fernandes.pinheiro@intel.com>  
Damian Gryski <dgryski@gmail.com>  
Damien Lespiau <damien.lespiau@gmail.com> <damien.lespiau@intel.com>  
Damien Mathieu <42@dmathieu.com>  
Damien Neil <dneil@google.com>  
Damien Tournoud <damien@platform.sh>  
Dan Ballard <dan@mindstab.net>  
Dan Caddigan <goldcaddy77@gmail.com>  
Dan Callahan <dan.callahan@gmail.com>  
Dan Harrington <harringtond@google.com>  
Dan  
Jacques <dnj@google.com>  
Dan Johnson <computerdruid@google.com>  
Dan Peterson <dpiddy@gmail.com>  
Dan Pupius <dan@medium.com>  
Dan Sinclair <dan.sinclair@gmail.com>  
Daniel Cormier <danielc@knowbe4.com>  
Danil de Kok <me@danieldk.eu>  
Daniel Fleischman <danielfleischman@gmail.com>  
Daniel Ingram <ingramds@appstate.edu>  
Daniel Johansson <dajo2002@gmail.com>  
Daniel Kerwin <d.kerwin@gini.net>  
Daniel Krech <eikeon@eikeon.com>  
Daniel Langner <s8572327@gmail.com>  
Daniel Lidn <daniel.liden.87@gmail.com>  
Daniel Lublin <daniel@lublin.se>  
Daniel Mart <mvdan@mvdan.cc>  
Daniel Morsing <daniel.morsing@gmail.com>  
Daniel Nadasi <dnadasi@google.com>  
Daniel Nephin <dnephin@gmail.com>  
Daniel Ortiz Pereira da Silva <daniel.particular@gmail.com>  
Daniel Skinner <daniel@dasa.cc>  
Daniel Speichert <daniel@speichert.pl>  
Daniel Theophanes <kardianos@gmail.com>  
Daniel Upton <daniel@floppy.co>

Daniela Petruzalek <daniela.petruszalek@gmail.com>  
Danny Rosseau <daniel.rosseau@gmail.com>  
Daria Kolistratova  
<daria.kolistratova@intel.com>  
Darien Raymond <admin@v2ray.com>  
Darren Elwood <darren@textnode.com>  
Darren Grant <darren.e.grant@gmail.com>  
Darren McCleary <darren.rmc@gmail.com>  
Darshan Parajuli <parajulidarshan@gmail.com>  
Datong Sun <dndx@idndx.com>  
Dave Borowitz <dborowitz@google.com>  
Dave Bort <dbort@golang.org>  
Dave Cheney <dave@cheney.net>  
Dave Day <djd@golang.org>  
Dave Grijalva <dgrijalva@ngmoco.com>  
Dave MacFarlane <driusan@gmail.com>  
Dave Russell <forfuncsake@gmail.com>  
David Anderson <danderson@google.com>  
David Barnett <dbarnett@google.com>  
David Benjamin <davidben@google.com>  
David Brophy <dave@brophy.uk>  
David Brgin <676c7473@gmail.com>  
David Calavera <david.calavera@gmail.com>  
David Carlier <devnexen@gmail.com>  
David Chase <drchase@google.com>  
David Covert <davidhcovert@gmail.com>  
David Crawshaw <david.crawshaw@zentus.com> <crawshaw@google.com> <crawshaw@golang.org>  
David du Colombier <0intro@gmail.com>  
David Finkel <david.finkel@gmail.com>  
David Forsythe <dforsythe@gmail.com>  
David  
G. Andersen <dave.andersen@gmail.com>  
David Glasser <glasser@meteor.com>  
David Heuschmann <heuschmann.d@gmail.com>  
David Howden <dhowden@gmail.com>  
David Hubbard <dsp@google.com>  
David Jakob Fritz <david.jakob.fritz@gmail.com>  
David Jones <dxjones@gmail.com>  
David Lazar <lazard@golang.org>  
David Leon Gil <coruus@gmail.com>  
David McLeish <davemc@google.com>  
David Ndungu <dnjuguna@gmail.com>  
David NewHamlet <david@newhamlet.com>  
David Presotto <presotto@gmail.com>  
David R. Jenni <david.r.jenni@gmail.com>  
David Sansome <me@davidsansome.com>  
David Stainton <dstainton415@gmail.com>  
David Symonds <dsymonds@golang.org>

David Thomas <davidthomas426@gmail.com>  
David Timm <dtimm@pivotal.io>  
David Titarenco <david.titarenco@gmail.com>  
David Tolpin <david.tolpin@gmail.com>  
David Url <david@url.io>  
David Volquartz Lebech <david@lebech.info>  
David Wimmer <davidlwimmer@gmail.com>  
Davies Liu <davies.liu@gmail.com>  
Davor Kapsa <davor.kapsa@gmail.com>  
Dean Prichard <dean.prichard@gmail.com>  
Deepak  
Jois <deepak.jois@gmail.com>  
Denis Bernard <db047h@gmail.com>  
Denis Brandolini <denis.brandolini@gmail.com>  
Denis Nagorny <denis.nagorny@intel.com>  
Dennis Kuhnert <mail.kuhnert@gmail.com>  
Denys Honsiorovskyi <honsiorovskyi@gmail.com>  
Denys Smirnov <denis.smirnov.91@gmail.com>  
Derek Buitenhuis <derek.buitenhuis@gmail.com>  
Derek Che <drc@yahoo-inc.com>  
Derek McGowan <derek@mcgstyle.net>  
Derek Parker <parkerderek86@gmail.com>  
Derek Phan <derekphan94@gmail.com>  
Derek Shockey <derek.shockey@gmail.com>  
Dev Ojha <dojha12@gmail.com>  
Dev Zhoujun <dev.zhoujun@gmail.com>  
Devon H. O'Dell <devon.odell@gmail.com>  
Dhaivat Pandit <dhaivatpandit@gmail.com>  
Dhananjay Nakrani <dhananjayn@google.com>  
Dhiru Kholia <dhiru.kholia@gmail.com>  
Dhruvdutt Jadhav <dhruvdutt.jadhav@gmail.com>  
Di Xiao <dixiao@google.com>  
Didier Spezia <didier.06@gmail.com>  
Diego Siqueira <diego9889@gmail.com>  
Dieter Plaetinck <dieter@raintank.io>  
Dimitri Sokolyuk <sokolyuk@gmail.com>  
Dimitri Tcaciuc <dtcaciuc@gmail.com>  
Dina  
Garmash <dgrmsh@gmail.com>  
Diogo Pinela <diogoid7400@gmail.com>  
Dirk Gadsden <dirk@esherido.com>  
Diwaker Gupta <diwakergupta@gmail.com>  
Dmitri Goutnik <dgoutnik@gmail.com>  
Dmitri Popov <operator@cv.dp-net.com>  
Dmitri Shuralyov <dmitshur@golang.org> <dmitri@shuralyov.com>  
Dmitriy Cherchenko <dcherchenko@gmail.com>  
Dmitriy Dudkin <dudkin.dmitriy@gmail.com>  
Dmitriy Shelenin <deemok@googlemail.com> <deemok@gmail.com>

Dmitriy Vyukov <dvyukov@google.com>  
Dmitry Chestnykh <dchest@gmail.com>  
Dmitry Doroginin <doroginin@gmail.com>  
Dmitry Mottl <dmitry.mottl@gmail.com>  
Dmitry Neverov <dmitry.neverov@gmail.com>  
Dmitry Savintsev <dsavints@gmail.com>  
Dmitry Yakunin <nonamezeil@gmail.com>  
Domen Ipavec <domen@ipavec.net>  
Dominic Green <dominicgreen1@gmail.com>  
Dominik Honnef <dominik.honnef@gmail.com>  
Dominik Vogt <vogt@linux.vnet.ibm.com>  
Don Byington <don@dbyington.com>  
Donald Huang <don.hcd@gmail.com>  
Dong-hee Na <donghee.na92@gmail.com>  
Donovan Hide <donovanhide@gmail.com>  
Doug Anderson <douga@google.com>  
Doug  
Fawley <dfawley@google.com>  
Douglas Danger Manley <doug.manley@gmail.com>  
Drew Flower <drewvanstone@gmail.com>  
Drew Hintz <adhintz@google.com>  
Duncan Holm <mail@frou.org>  
Dustin Carlino <dcarlino@google.com>  
Dustin Herbison <djherbis@gmail.com>  
Dustin Long <dustmop@gmail.com>  
Dustin Sallings <dsallings@gmail.com>  
Dustin Shields-Cloues <dcloues@gmail.com>  
Dvir Volk <dvir@everything.me> <dvirsky@gmail.com>  
Dylan Waits <dylan@waits.io>  
Edan Bedrik <3d4nb3@gmail.com>  
Eddie Scholtz <escholtz@google.com>  
Eden Li <eden.li@gmail.com>  
Eduard Urbach <e.urbach@gmail.com>  
Eduardo Ramalho <eduardo.ramalho@gmail.com>  
Edward Muller <edwardam@interlix.com>  
Egon Elbre <egonelbre@gmail.com>  
Ehren Kret <ehren.kret@gmail.com>  
Eitan Adler <lists@eitanadler.com>  
Eivind Uggedal <eivind@uggedal.com>  
Elbert Fliek <efliek@gmail.com>  
Eldar Rakhimberdin <ibeono@gmail.com>  
Elena Grahovac <elena@grahovac.me>  
Eli Bendersky <eliben@google.com>  
Elias Naur <mail@eliasnaur.com> <elias.naur@gmail.com>  
Elliot  
Morrison-Reed <elliotmr@gmail.com>  
Emerson Lin <linyintor@gmail.com>  
Emil Hessman <emil@hessman.se>



Emil Mursalimov <mursalimovemeel@gmail.com>  
Emilien Kenler <hello@emilienkenler.com>  
Emmanuel Odeke <emm.odeke@gmail.com> <odeke@ualberta.ca>  
Eno Compton <enocom@google.com>  
Eoghan Sherry <ejsherry@gmail.com>  
Eric Chiang <eric.chiang.m@gmail.com>  
Eric Clark <zerohp@gmail.com>  
Eric Daniels <eric@erdaniels.com>  
Eric Engestrom <eric@engestrom.ch>  
Eric Garrido <ekg@google.com>  
Eric Koleda <ekoleda+devrel@google.com>  
Eric Lagergren <ericscottlagergren@gmail.com>  
Eric Milliken <emilliken@gmail.com>  
Eric Pauley <eric@pauley.me>  
Eric Ponce <tricokun@gmail.com>  
Eric Rescorla <ekr@rtfm.com>  
Eric Roshan-Eisner <eric.d.eisner@gmail.com>  
Eric Rykwalder <e.rykwalder@gmail.com>  
Erik Aigner <aigner.erik@gmail.com>  
Erik Dubbelboer <erik@dubbelboer.com>  
Erik St. Martin <alakriti@gmail.com>  
Erik Staab <estaab@google.com>  
Erik Westrup <erik.westrup@gmail.com>  
Erin Masatsugu <erin.masatsugu@gmail.com>  
Ernest  
Chiang <ernest\_chiang@htc.com>  
Erwin Oegema <blablaechthema@hotmail.com>  
Esko Luontola <esko.luontola@gmail.com>  
Ethan Burns <eaburns@google.com>  
Ethan Miller <eamiller@us.ibm.com>  
Euan Kemp <euank@euank.com>  
Eugene Kalinin <e.v.kalinin@gmail.com>  
Evan Broder <evan@stripe.com>  
Evan Brown <evanbrown@google.com>  
Evan Digby <evandigby@gmail.com>  
Evan Hicks <evan.hicks2@gmail.com>  
Evan Jones <ej@evanjones.ca>  
Evan Klitzke <evan@eklitzke.org>  
Evan Kroske <evankroske@google.com>  
Evan Martin <evan.martin@gmail.com>  
Evan Phoenix <evan@phx.io>  
Evan Shaw <chickencha@gmail.com>  
Evgeniy Polyakov <zbr@ioremap.net>  
Ewan Chou <coocood@gmail.com>  
Ewan Valentine <ewan.valentine89@gmail.com>  
Eyal Posener <posener@gmail.com>  
Fabian Wickborn <fabian@wickborn.net>  
Fabian Zaremba <fabian@youremail.eu>

Fabrizio Milo <mistobaan@gmail.com>  
Faiyaz Ahmed <ahmedf@vmware.com>  
Fan Hongjian <fan.howard@gmail.com>  
Fangming Fang <fangming.fang@arm.com>  
Fannie Zhang <fannie.zhang@arm.com>  
Fatih Arslan <fatih@arslan.io>  
Fazal  
Majid <majid@apsalar.com>  
Fazlul Shahriar <fshahriar@gmail.com>  
Federico Bond <federicobond@gmail.com>  
Federico Simoncelli <fsimonce@redhat.com>  
Fedor Indutny <fedor@indutny.com>  
Fedor Korotkiy <dartslon@gmail.com>  
Felipe Oliveira <felipeweb.programador@gmail.com>  
Felix Bnemann <Felix.Buenemann@gmail.com>  
Felix Geisendrfer <haimuiba@gmail.com>  
Felix Kollmann <fk@konsorten.de>  
Filip Gruszczyski <gruszczy@gmail.com>  
Filip Haglund <drathier@users.noreply.github.com>  
Filip Stanis <fstanis@google.com>  
Filippo Valsorda <filippo@golang.org> <filippo@cloudflare.com> <hi@filippo.io>  
Firmansyah Adiputra <frm.adiputra@gmail.com>  
Florian Forster <octo@google.com>  
Florian Uekermann <florian@uekermann-online.de> <f1@uekermann-online.de>  
Florian Weimer <fw@deneb.enyo.de>  
Florin Patan <florinpatan@gmail.com>  
Folke Behrens <folke@google.com>  
Ford Hurley <ford.hurley@gmail.com>  
Francesc Campoy <campoy@golang.org>  
Francesco Renzi <rentziass@gmail.com>  
Francisco Claude <fclaud@recoded.cl>  
Francisco  
Rojas <francisco.rojas.gallegos@gmail.com>  
Francisco Souza <franciscossouza@gmail.com>  
Frank Schroeder <frank.schroeder@gmail.com>  
Frank Somers <fsomers@arista.com>  
Frederic Guillot <frederic.guillot@gmail.com>  
Frederick Kelly Mayle III <frederickmayle@gmail.com>  
Frederik Ring <frederik.ring@gmail.com>  
Fredrik Enestad <fredrik.enestad@soundtrackyourbrand.com>  
Fredrik Forsmo <fredrik.forsmo@gmail.com>  
Fredrik Wallgren <fredrik.wallgren@gmail.com>  
Frew Schmidt <github@frew.co>  
Frithjof Schulze <schulze@math.uni-hannover.de> <sfrithjof@gmail.com>  
Frits van Bommel <fvbommel@gmail.com>  
Fumitoshi Ukai <ukai@google.com>  
G. Hussain Chinoy <ghchinoy@gmail.com>  
Gaal Yahas <gaal@google.com>

Gabriel Arthr Ptursson <gabriel@system.is>  
Gabriel Aszalos <gabriel.aszalos@gmail.com>  
Gabriel Guzman <gabe.guzman@gmail.com>  
Gabriel Nelle <tehsphinx@web.de>  
Gabriel Nicolas Avellaneda <avellaneda.gabriel@gmail.com>  
Gabriel Russell <gabriel.russell@gmail.com>  
Gareth Paul Jones <gpj@foursquare.com>  
Garret  
Kelly <gdk@google.com>  
Garrick Evans <garrick@google.com>  
Gary Burd <gary@beagledreams.com> <gary.burd@gmail.com>  
Gary Elliott <garyelliott@google.com>  
Gaurish Sharma <contact@aurishsharma.com>  
Gautham Thambidorai <gautham.dorai@gmail.com>  
Gauthier Jolly <gauthier.jolly@gmail.com>  
Geert-Johan Riemer <gjr19912@gmail.com>  
Genevieve Luyt <genevieve.luyt@gmail.com>  
Gengliang Wang <ltnwgl@gmail.com>  
Geoff Berry <gberry.qdt@qualcommdatacenter.com>  
Geoffroy Lorieux <lorieux.g@gmail.com>  
Geon Kim <geon0250@gmail.com>  
Georg Reinke <guelfey@gmail.com>  
George Gkirtsou <ggirtsou@gmail.com>  
George Shammass <george@shamm.as> <georgyo@gmail.com>  
Gerasimos (Makis) Maropoulos <kataras2006@hotmail.com>  
Gerasimos Dimitriadis <gedimitr@gmail.com>  
Gergely Brautigam <skarls0777@gmail.com>  
Gernot Vormayr <gvormayr@gmail.com>  
Getulio Snchez <valentin2507@gmail.com>  
Gianguido Sora` <g.sora4@gmail.com>  
Gideon Jan-Wessel Redelinghuys <gjredelinghuys@gmail.com>  
Giles Lean <giles.lean@pobox.com>  
Giovanni Bajo <rasky@develer.com>  
GitHub  
User @ajnrp (1688456) <ajnrp@users.noreply.github.com>  
GitHub User @alkesh26 (1019076) <alkesh26@gmail.com>  
GitHub User @andrius4669 (4699695) <andrius4669@gmail.com>  
GitHub User @as (8127015) <as.utf8@gmail.com>  
GitHub User @bakape (7851952) <bakape@gmail.com>  
GitHub User @bgadrian (830001) <aditza8@gmail.com>  
GitHub User @bontequero (2674999) <bontequero@gmail.com>  
GitHub User @cch123 (384546) <buaa.cch@gmail.com>  
GitHub User @chanxuehong (3416908) <chanxuehong@gmail.com>  
GitHub User @dupoxy (1143957) <dupoxy@users.noreply.github.com>  
GitHub User @erifan (31343225) <eric.fang@arm.com>  
GitHub User @esell (9735165) <eujon.sellers@gmail.com>  
GitHub User @frennkier (6499251) <mail@rhab.de>  
GitHub User @hengwu0 (41297446) <41297446+hengwu0@users.noreply.github.com>

GitHub User @itchyny (375258) <itchyny@hatena.ne.jp>  
GitHub User @kazysshr (30496953) <kazysshr0301@gmail.com>  
GitHub User @kc1212 (1093806) <kc1212@users.noreply.github.com>  
GitHub User @Kropekk (13366453)  
<kamilkropiewnicki@gmail.com>  
GitHub User @linguohua (3434367) <lghchinaidea@gmail.com>  
GitHub User @LotusFenn (13775899) <fenn.lotus@gmail.com>  
GitHub User @madiganz (18340029) <zacharywmadigan@gmail.com>  
GitHub User @micnncim (21333876) <micnncim@gmail.com>  
GitHub User @mkishere (224617) <224617+mkishere@users.noreply.github.com>  
GitHub User @OlgaVIPetrova (44112727) <OVPPetrova@gmail.com>  
GitHub User @pityonline (438222) <pityonline@gmail.com>  
GitHub User @pytimer (17105586) <lixin20101023@gmail.com>  
GitHub User @saitarunreddy (21041941) <saitarunreddypalla@gmail.com>  
GitHub User @shogo-ma (9860598) <Choroma194@gmail.com>  
GitHub User @tatsumack (4510569) <tatsu.mack@gmail.com>  
GitHub User @tell-k (26263) <ffk2005@gmail.com>  
GitHub User @uhei (2116845) <uhei@users.noreply.github.com>  
GitHub User @uropek (39370426) <uropek@gmail.com>  
GitHub User @utkarsh-extc (53217283) <53217283+utkarsh-extc@users.noreply.github.com>  
GitHub User @yuanhh (1298735) <yuan415030@gmail.com>  
GitHub User  
@ZZMarquis (7624583) <zhonglingjian3821@163.com>  
Giulio Iotti <dullgiulio@gmail.com>  
Giulio Micheloni <giulio.micheloni@gmail.com>  
Giuseppe Valente <gvalente@arista.com>  
Gleb Stepanov <glebstepanov1992@gmail.com>  
Glenn Brown <glennb@google.com>  
Glenn Lewis <gmlewis@google.com>  
Gordon Klaus <gordon.klaus@gmail.com>  
Gordon Tyler <gordon@doxxx.net>  
Graham King <graham4king@gmail.com>  
Graham Miller <graham.miller@gmail.com>  
Grant Griffiths <ggp493@gmail.com>  
Greg Poirier <greg.istehbest@gmail.com>  
Greg Steuck <gneздо+github@google.com>  
Greg Thelen <gthelen@google.com>  
Greg Ward <greg@gerg.ca>  
Grgoire Delattre <gregoire.delattre@gmail.com>  
Gregory Man <man.gregory@gmail.com>  
Guilherme Caruso <gui.martinscaruso@gmail.com>  
Guilherme Garnier <guilherme.garnier@gmail.com>  
Guilherme Goncalves <guilhermeaugustosg@gmail.com>  
Guilherme Rezende <guilhermebr@gmail.com>  
Guillaume J. Charmes <guillaume@charmes.net>  
Guobiao Mei <meiguobiao@gmail.com>  
Guoliang Wang <iamwgliang@gmail.com>  
Gustav Paul <gustav.paul@gmail.com>

Gustav  
Westling <gustav@westling.xyz>  
Gustavo Franco <gustavorfranco@gmail.com>  
Gustavo Niemeyer <gustavo@niemeyer.net> <n13m3y3r@gmail.com>  
Gwenael Treguier <gwenn.kahz@gmail.com>  
Gyu-Ho Lee <gyuhox@gmail.com>  
H. brahim Gngr <igungor@gmail.com>  
Hajime Hoshi <hajimehoshi@gmail.com>  
Hallgrimur Gunnarsson <halg@google.com>  
HAMANO Tsukasa <hamano@osstech.co.jp>  
Han-Wen Nienhuys <hanwen@google.com>  
Hang Qian <hangqian90@gmail.com>  
Hanjun Kim <hallazzang@gmail.com>  
Haosdent Huang <haosdent@gmail.com>  
Harald Nordgren <haraldnordgren@gmail.com>  
Hari haran <hariharan.uno@gmail.com>  
Hariharan Srinath <srinathh@gmail.com>  
Harley Laue <losinggeneration@gmail.com>  
Harry Moreno <morenoh149@gmail.com>  
Harshavardhana <hrshvardhana@gmail.com>  
Hasan Ozgan <hasan@ozgan.net>  
Hauke Lffler <hloeffler@users.noreply.github.com>  
Hvard Haugen <havard.haugen@gmail.com>  
He Liu <liulonnie@gmail.com>  
Hector Chu <hectorchu@gmail.com>  
Hector Martin Cantero <hector@marcansoft.com>  
Henning Schmiedehausen  
<henning@schmiedehausen.org>  
Henrik Edwards <henrik.edwards@gmail.com>  
Henrik Hodne <henrik@hodne.io>  
Henry Adi Sumarto <henry.adisumarto@gmail.com>  
Henry Bubert <google@mindeco.de>  
Henry Chang <mr.changyuheng@gmail.com>  
Henry Clifford <h.a.clifford@gmail.com>  
Henry Wong <liushuai.wang@elastic.co>  
Herbert Georg Fischer <herbert.fischer@gmail.com>  
Herbie Ong <herbie@google.com>  
Heschi Kreinick <heschi@google.com>  
Hidetatsu Yaginuma <ygnmhdt@gmail.com>  
Hilko Bengen <bengen@hilluzination.de>  
Hiroaki Nakamura <hnakamur@gmail.com>  
Hironao OTSUBO <motemen@gmail.com>  
Hiroshi Ioka <hirochachacha@gmail.com>  
Hitoshi Mitake <mitake.hitoshi@gmail.com>  
Holden Huang <ttyh061@gmail.com>  
Hong Ruiqi <hongruiqi@gmail.com>  
Hongfei Tan <feilengcui008@gmail.com>  
Horst Rutter <hhrutter@gmail.com>

Hossein Sheikh Attar <hattar@google.com>  
Hsin Tsao <tsao@google.com>  
Hsin-Ho Yeh <yhh92u@gmail.com>  
Hu Keping <hukeping@huawei.com>  
Hugues Bruant <hugues.bruant@gmail.com>  
Huy Le <huy.dinh.le.89@gmail.com>  
Hyang-Ah  
Hana Kim <hakim@google.com> <hyangah@gmail.com>  
Ian Cottrell <iancottrell@google.com>  
Ian Davis <nospam@iandavis.com>  
Ian Gudger <ian@loosescr.ws>  
Ian Haken <ihaken@netflix.com>  
Ian Kent <iankent85@gmail.com>  
Ian Lance Taylor <iant@golang.org>  
Ian Leue <ian@appboy.com>  
Ian Zapolsky <ianzapolsky@gmail.com>  
Ibrahim AshShohail <ibra.sho@gmail.com>  
Icarus Sparry <golang@icarus.freeuk.com>  
Iccha Sethi <icchasethi@gmail.com>  
Idora Shinatose <idora.shinatose@gmail.com>  
Igor Bernstein <igorbernstein@google.com>  
Igor Dolzikhov <bluesriverz@gmail.com>  
Igor Vashyst <ivashyst@gmail.com>  
Igor Zhilianin <igor.zhilianin@gmail.com>  
Illya Yalovyy <yalovoy@gmail.com>  
Ilya Tocar <ilya.tocar@intel.com>  
INADA Naoki <songofacandy@gmail.com>  
Inanc Gumus <m@inanc.io>  
Ingo Gottwald <in.gottwald@gmail.com>  
Ingo Krabbe <ikrabbe.ask@gmail.com>  
Ingo Oeser <nightlyone@googlemail.com> <nightlyone@gmail.com>  
Ioannis Georgoulas <geototti21@hotmail.com>  
Irfan Sharif <irfanmahmoudsharif@gmail.com>  
Irieda Noboru  
<irieda@gmail.com>  
Isaac Ardis <isaac.ardis@gmail.com>  
Isaac Wagner <ibw@isaacwagner.me>  
Iskander Sharipov <iskander.sharipov@intel.com> <quasilyte@gmail.com>  
Issac Trotts <issactrotts@google.com>  
Ivan Babrou <ivan@cloudflare.com>  
Ivan Bertona <ivan.bertona@gmail.com>  
Ivan Krasin <krasin@golang.org>  
Ivan Kutuzov <arbrix@gmail.com>  
Ivan Markin <sw@nogoegst.net>  
Ivan Moscoso <moscoso@gmail.com>  
Ivan Osadchiy <ivan.osadchii@gmail.com>  
Ivan Sharavuev <shpiwan@gmail.com>  
Ivan Ukhov <ivan.ukhov@gmail.com>

Ivy Evans <ivy@ivyevans.net>  
Jaana Burcu Dogan <jbd@google.com> <jbd@golang.org> <burcujdogan@gmail.com>  
Jack Britton <jackxbritton@gmail.com>  
Jack Lindamood <jlindamo@justin.tv>  
Jacob Baskin <jbaskin@google.com>  
Jacob Blain Christen <dweomer5@gmail.com>  
Jacob H. Haven <jacob@cloudflare.com>  
Jacob Hoffman-Andrews <github@hoffman-andrews.com>  
Jacob Walker <jacobwalker0814@gmail.com>  
Jae Kwon <jae@tendermint.com>  
Jake B <doogie1012@gmail.com>  
Jakob Borg <jakob@nym.se>  
Jakob Weisblat <jakobw@mit.edu>  
Jakub  
ajka <jcajka@redhat.com>  
Jakub Ryszard Czarnowicz <j.czarnowicz@gmail.com>  
James Aguilar <jaguilar@google.com>  
James Bardin <j.bardin@gmail.com>  
James Chacon <jchacon@google.com>  
James Clarke <jrtc27@jrtc27.com>  
James Cowgill <James.Cowgill@imgtec.com>  
James Craig Burley <james-github@burleyarch.com>  
James David Chalfant <james.chalfant@gmail.com>  
James Eady <jmeady@google.com>  
James Fysh <james.fysh@gmail.com>  
James Gray <james@james4k.com>  
James Hartig <fastest963@gmail.com>  
James Lawrence <jlratone@gmail.com>  
James Meneghello <rawrz0r@gmail.com>  
James Myers <jfmyers9@gmail.com>  
James Neve <jamesoneve@gmail.com>  
James Nugent <james@jen20.com>  
James P. Cooper <jamespcooper@gmail.com>  
James Robinson <jamesr@google.com> <jamesr.gatech@gmail.com>  
James Schofield <james@shoeboxapp.com>  
James Smith <jrs1995@icloud.com>  
James Sweet <james.sweet88@googlemail.com>  
James Toy <nil@opensesame.st>  
James Treanor <jtreanor3@gmail.com>  
James Tucker <raggi@google.com>  
James Whitehead  
<jnwhiteh@gmail.com>  
Jamie Beverly <jamie.r.beverly@gmail.com>  
Jamie Gennis <jgennis@google.com> <jgennis@gmail.com>  
Jamie Kerr <jkerr113@googlemail.com>  
Jamie Liu <jamiliu@google.com>  
Jamie Stackhouse <contin673@gmail.com>  
Jamie Turner <jamwt@dropbox.com>

Jamie Wilkinson <jaq@spacepants.org>  
Jamil Djadala <djadala@gmail.com>  
Jan Berktold <jan@berktold.co>  
Jan H. Hosang <jan.hosang@gmail.com>  
Jan Kratochvil <jan.kratochvil@redhat.com>  
Jan Lehnardt <jan@apache.org>  
Jan Mercl <0xjnml@gmail.com> <befelemepeseveze@gmail.com>  
Jan Newmarch <jan.newmarch@gmail.com>  
Jan Pilzer <jan.pilzer@gmx.de>  
Jan Steinke <jan.steinke@gmail.com>  
Jan Ziak <0xe2.0x9a.0x9b@gmail.com>  
Jani Monoses <jani.monoses@ubuntu.com> <jani.monoses@gmail.com>  
Jannis Andrija Schnitzer <jannis@schnitzer.im>  
Jared Culp <jculp14@gmail.com>  
Jaroslavas Poepko <jp@webmaster.ms>  
Jason A. Donenfeld <Jason@zx2c4.com>  
Jason Barnett <jason.w.barnett@gmail.com>  
Jason Buberel <jbuberel@google.com>  
Jason Chu <jasonchujc@gmail.com>  
Jason  
Del Ponte <delpontej@gmail.com>  
Jason Hall <jasonhall@google.com>  
Jason Keene <jasonkeene@gmail.com>  
Jason LeBrun <jblebrun@gmail.com>  
Jason Smale <jsmale@zendesk.com>  
Jason Travis <infomaniac7@gmail.com>  
Jason Wangsadinata <jwangsadinata@gmail.com>  
Javier Kohen <jkohen@google.com>  
Javier Revillas <jrevillas@massivedynamic.io>  
Javier Segura <javism@gmail.com>  
Jay Conrod <jayconrod@google.com>  
Jay Taylor <outtatime@gmail.com>  
Jay Weisskopf <jay@jayschwa.net>  
Jean de Klerk <deklerk@google.com>  
Jean-Andr Santoni <jean.andre.santoni@gmail.com>  
Jean-Franois Bustarret <jf@bustarret.com>  
Jean-Francois Cantin <jfcantin@gmail.com>  
Jean-Marc Eurin <jmeurin@google.com>  
Jean-Nicolas Moal <jn.moal@gmail.com>  
Jed Denlea <jed@fastly.com>  
Jeet Parekh <jeetparekh96@gmail.com>  
Jeevanandam M <jeeva@myjeeva.com>  
Jeff (Zhefu) Jiang <jeffjiang@google.com>  
Jeff Craig <jeffcraig@google.com>  
Jeff Dupont <jeff.dupont@gmail.com>  
Jeff Hodges <jeff@somethingsimilar.com>  
Jeff Johnson <jrjohnson@google.com>  
Jeff



R. Allen <jra@nella.org> <jeff.allen@gmail.com>  
Jeff Sickel <jas@corpus-callosum.com>  
Jeff Wendling <jeff@spacemonkey.com>  
Jeffrey H <jeffreyh192@gmail.com>  
Jelte Fennema <github-tech@jeltef.nl>  
Jens Frederich <jfrederich@gmail.com>  
Jeremiah Harmsen <jeremiah@google.com>  
Jeremy Banks <\_@jeremy.ca>  
Jeremy Canady <jcanady@gmail.com>  
Jeremy Jackins <jeremyjackins@gmail.com>  
Jeremy Jay <jeremy@pbnjay.com>  
Jeremy Schlatter <jeremy.schlatter@gmail.com>  
Jeroen Bobbeldijk <jrbob92@gmail.com>  
Jeroen Simonetti <jeroen@simonetti.nl>  
Jerrin Shaji George <jerrinsg@gmail.com>  
Jess Frazelle <me@jessfraz.com>  
Jesse Szwedko <jesse.szwedko@gmail.com>  
Jess Espino <jespinog@gmail.com>  
Jianing Yu <jnyu@google.com>  
Jianqiao Li <jianqiaoli@google.com>  
Jihyun Yu <yjh0502@gmail.com>  
Jim Cote <jfcote87@gmail.com>  
Jim Kingdon <jim@bolt.me>  
Jim McGrath <jimmc2@gmail.com>  
Jim Minter <jminter@redhat.com>  
Jimmy Frasche <soapboxcicero@gmail.com>  
Jimmy Zelinskie <jimmyzelinskie@gmail.com>  
Jin-wook Jeong <jeweljar@hanmail.net>  
Jingcheng  
Zhang <diogin@gmail.com>  
Jingguo Yao <yaojingguo@gmail.com>  
Jingnan Si <jingnan.si@gmail.com>  
Jinkun Zhang <franksnolf@gmail.com>  
Jiong Du <londevil@gmail.com>  
Jirka Dank <dnk@mail.muni.cz>  
Jiulong Wang <jiulongw@gmail.com>  
Joakim Sernbrant <serbaut@gmail.com>  
Joe Bowbeer <joe.bowbeer@gmail.com>  
Joe Cortopassi <joe@joecortopassi.com>  
Joe Farrell <joe2farrell@gmail.com>  
Joe Harrison <joebuzzers@gmail.com>  
Joe Henke <joed.henke@gmail.com>  
Joe Kyo <xunianzu@gmail.com>  
Joe Poirier <jdpoirier@gmail.com>  
Joe Richey <joerichey@google.com>  
Joe Shaw <joe@joeshaw.org>  
Joe Sylve <joe.sylve@gmail.com>  
Joe Tsai <joetsai@digital-static.net>

Joel Sing <joel@sing.id.au> <jsing@google.com>  
Jol Stemmer <jstemmer@google.com>  
Joel Stemmer <stemmertech@gmail.com>  
Joey Geiger <jgeiger@users.noreply.github.com>  
Johan Brandhorst <johan.brandhorst@gmail.com>  
Johan Euphrosine <propy@google.com>  
Johan Sageryd <j@1616.se>  
John Asmuth <jasmuth@gmail.com>  
John Beisley <huin@google.com>  
John C Barstow  
<jbowtie@amathaine.com>  
John DeNero <denero@google.com>  
John Dethridge <jcd@golang.org>  
John Gibb <johngibb@gmail.com>  
John Gilik <john@jgilik.com>  
John Graham-Cumming <jgc@jgc.org> <jgrahamc@gmail.com>  
John Howard Palevich <jack.palevich@gmail.com>  
John Jeffery <jjeffery@sp.com.au>  
John Jenkins <twodopeslaggy@gmail.com>  
John Leidegren <john.leidegren@gmail.com>  
John Moore <johnkenneth.moore@gmail.com>  
John Newlin <jnewlin@google.com>  
John Potocny <johnp@vividcortex.com>  
John R. Lenton <jlenton@gmail.com>  
John Schnake <schnake.john@gmail.com>  
John Shahid <jvshahid@gmail.com>  
John Tuley <john@tuley.org>  
John Weldon <johnweldon4@gmail.com>  
Johnny Luo <johnnyluo1980@gmail.com>  
Jon Chen <jchen@justin.tv>  
Jonas Bernoulli <jonas@bernoul.li>  
Jonathan Allie <jonallie@google.com>  
Jonathan Amsterdam <jba@google.com>  
Jonathan Boule <jonathanboule@gmail.com>  
Jonathan Chen <dijonkitchen@users.noreply.github.com>  
Jonathan Feinberg <feinberg@google.com>  
Jonathan Gold <jgold.bg@gmail.com>  
Jonathan  
Hseu <jhseu@google.com>  
Jonathan Mark <jhmark@xenops.com> <jhmark000@gmail.com>  
Jonathan Nieder <jrn@google.com>  
Jonathan Pentecost <pentecostjonathan@gmail.com>  
Jonathan Pittman <jmpittman@google.com> <jonathan.mark.pittman@gmail.com>  
Jonathan Rudenberg <jonathan@titanous.com>  
Jonathan Stacks <jonstacks13@gmail.com>  
Jonathan Wills <runningwild@gmail.com>  
Jonathon Lacher <jonathon.lacher@gmail.com>  
Jongmin Kim <atomaths@gmail.com>

Joonas Kuorilehto <joneskoo@derbian.fi>  
Joop Kiefte <ikojba@gmail.com> <joop@kiefte.net>  
Jordan Krage <jmank88@gmail.com>  
Jordan Lewis <jordanthelewis@gmail.com>  
Jordan Liggitt <liggitt@google.com>  
Jordan Rhee <jordanrh@microsoft.com>  
Jordi Martin <jordimartin@gmail.com>  
Jorge Araya <jorgejavieran@yahoo.com.mx>  
Jos Visser <josv@google.com>  
Jose Luis Vzquez Gonzlez <josvazg@gmail.com>  
Joseph Bonneau <jcb@google.com>  
Joseph Holsten <joseph@josephholsten.com>  
Josh Bleecher Snyder <josharian@gmail.com>  
Josh Chorlton <jchorlton@gmail.com>  
Josh Deprez <josh.deprez@gmail.com>  
Josh  
Goebel <dreamer3@gmail.com>  
Josh Hoak <jhoak@google.com>  
Josh Holland <jrh@joshh.co.uk>  
Josh Roppo <joshroppo@gmail.com>  
Josh Varga <josh.varga@gmail.com>  
Joshua Boelter <joshua.boelter@intel.com>  
Joshua Chase <jcjosuachase@gmail.com>  
Joshua M. Clulow <josh.clulow@joyent.com>  
Joshua Rubin <joshua@rubixconsulting.com>  
Josselin Costanzi <josselin@costanzi.fr>  
Jostein Stuhau <js@solidsystem.no>  
JP Sugarbroad <jpsugar@google.com>  
JT Olds <jtolds@xnet5.com>  
JT Olio <hello@jtolio.com>  
Juan Carlos <juanjcsr@gmail.com>  
Juan Pablo Civile <elementohb@gmail.com>  
Jude Pereira <judebpereira@gmail.com>  
Jukka-Pekka Kekkonen <karatepekka@gmail.com>  
Julia Hansbrough <flowerhack@google.com>  
Julian Kornberger <jk+github@digineo.de>  
Julian Pastarmov <pastarmovj@google.com>  
Julian Phillips <julian@quantumfyre.co.uk>  
Julie Qiu <julie@golang.org>  
Julien Kauffmann <julien.kauffmann@freelan.org>  
Julien Salleyron <julien.salleyron@gmail.com>  
Julien Schmidt <google@julienschmidt.com>  
Julio  
Montes <julio.montes@intel.com>  
Junda Liu <junda@celer.network>  
Jungho Ahn <jhahn@google.com>  
Junya Hayashi <ledmonster@gmail.com>  
Juraj Sukop <sukop@users.noreply.github.com>

Jure Ham <jure.ham@zemanta.com>  
Justin Gracenin <jgracenin@gmail.com>  
Justin Li <git@justinli.net>  
Justin Nu <nuss.justin@gmail.com>  
Justyn Temme <justyntemme@gmail.com>  
Kelly Heller <pestophagous@gmail.com>  
Kai Backman <kaib@golang.org>  
Kai Dong <dokia2357@gmail.com>  
Kai Trukenmller <ktye78@gmail.com>  
Kale Blankenship <kale@lemnisis.com>  
Kaleb Elwert <kelwert@atlassian.com>  
Kamal Aboul-Hosn <aboulhosn@google.com>  
Kamil Chmielewski <kamil.chm@gmail.com>  
Kamil Kisiel <kamil@kamilkisiel.net> <kamil.kisiel@gmail.com>  
Kamil Rytarowski <krytarowski@users.noreply.github.com>  
Kang Hu <hukangustc@gmail.com>  
Karan Dhiman <karandhi@ca.ibm.com>  
Karel Pazdera <pazderak@gmail.com>  
Karoly Negyesi <chx1975@gmail.com>  
Karsten Khler <karsten.koehler95@gmail.com>  
Karthik Nayak <karthik.188@gmail.com>  
Kashav Madan <kshvmdn@gmail.com>  
Kate  
Manson <kate.manson@izettle.com>  
Katie Hockman <katie@golang.org>  
Kato Kazuyoshi <kato.kazuyoshi@gmail.com>  
Katrina Owen <katrina.owen@gmail.com>  
Kaviraj Kanagaraj <kavirajkanagaraj@gmail.com>  
Kay Zhu <kayzhu@google.com>  
Kazuhiro Sera <seratch@gmail.com>  
KB Sriram <kbsriram@google.com>  
Keegan Carruthers-Smith <keegan.csmith@gmail.com>  
Kei Son <hey.calmdown@gmail.com>  
Keiji Yoshida <keijiyoshida.mail@gmail.com>  
Keith Ball <inflatablewoman@gmail.com>  
Keith Randall <khr@golang.org>  
Keith Rarick <kr@xph.us>  
Kelsey Hightower <kelsey.hightower@gmail.com>  
Kelvin Foo Chuan Lyi <vmirage@gmail.com>  
Ken Friedenbach <kenliz@cruzio.com>  
Ken Rockot <ken@oz.gs> <ken.rockot@gmail.com>  
Ken Sedgwick <ken@bonsai.com>  
Ken Thompson <ken@golang.org>  
Kenichi Tsunokawa <kenichi.tsunokawa@gmail.com>  
Kenji Kaneda <kenji.kaneda@gmail.com>  
Kenji Yano <kenji.yano@gmail.com>  
Kenneth Shaw <kenshaw@gmail.com>  
Kenny Grant <kennygrant@gmail.com>

Kenta Mori <zoncoen@gmail.com>  
Ketan Parmar <ketanbparmar@gmail.com>  
Kevin  
Ballard <kevin@sb.org>  
Kevin Burke <kev@inburke.com>  
Kevin Gillette <extemporalgenome@gmail.com>  
Kevin Kirsche <kev.kirsche@gmail.com>  
Kevin Klues <klueska@gmail.com> <klueska@google.com>  
Kevin Malachowski <chowski@google.com>  
Kevin Ruffin <kruffin@gmail.com>  
Kevin Vu <kevin.m.vu@gmail.com>  
Kevin Zita <bleedgreenandgold@gmail.com>  
Kieran Colford <kieran@kcolford.com>  
Kim Shrier <kshrier@racktopsystems.com>  
Kim Yongbin <kybinz@gmail.com>  
Kir Kolyshkin <kolyshkin@gmail.com>  
Kirill Motkov <Motkov.Kirill@gmail.com>  
Kirill Smelkov <kirr@nexedi.com>  
Kirk Han <kirk91.han@gmail.com>  
Kirklin McDonald <kirklin.mcdonald@gmail.com>  
Klaus Post <klauspost@gmail.com>  
Kodie Goodwin <kodiegoodwin@gmail.com>  
Koichi Shiraishi <zchee.io@gmail.com>  
Koki Ide <niconegoto@yahoo.co.jp>  
Komu Wairagu <komuw05@gmail.com>  
Konstantin <konstantin8105@gmail.com>  
Konstantin Shaposhnikov <k.shaposhnikov@gmail.com>  
Kris Kwiatkowski <kris@cloudflare.com>  
Kris Nova <kris@nivenly.com>  
Kris Rousey <krousey@google.com>  
Kristopher  
Watts <traetox@gmail.com>  
Kshitij Saraogi <kshitij@saraogi@gmail.com>  
Kun Li <likunarmstrong@gmail.com>  
Kunpei Sakai <namusyaka@gmail.com>  
Kuntal Majumder <hellozee@disroot.org>  
Kyle Consalus <consalus@gmail.com>  
Kyle Isom <kyle@gokyle.net>  
Kyle Jones <kyle@kyledj.com>  
Kyle Lemons <kyle@kylelemons.net> <kevlar@google.com>  
Kyle Shannon <kyle@pobox.com>  
Kyle Spiers <eiais@google.com>  
Kyle Wood <kyle@kylewood.cc>  
Kyohei Kadota <lufia@lufia.org>  
Kyrylo Silin <silin@kyrylo.org>  
L Campbell <unpantso@gmail.com>  
Lai Jiangshan <eag0628@gmail.com>  
Lajos Papp <lalyos@yahoo.com>

Lakshay Garg <lakshay.garg.1996@gmail.com>  
Lann Martin <lanm@google.com>  
Lanre Adelowo <yo@lanre.wtf>  
Larry Clapp <larry@thecclapp.org>  
Larry Hosken <lahosken@golang.org>  
Lars Jeppesen <jeppesen.lars@gmail.com>  
Lars Lehtonen <lars.lehtonen@gmail.com>  
Lars Wiegman <lars@namsral.com>  
Larz Conwell <larzconwell@gmail.com>  
Laurent Voisin <lpvoisin@gmail.com>  
Laurie Clark-Michalek <laurie@qubit.com>  
LE Manh Cuong  
<cuong.manhle.vn@gmail.com>  
Lee Hinman <hinman@gmail.com>  
Lee Packham <lpackham@gmail.com>  
Lehner Florian <dev@der-flo.net>  
Leigh McCulloch <leighmcc@gmail.com>  
Leo Antunes <leo@costela.net>  
Leo Rudberg <ljr@google.com>  
Leon Klingele <git@leonklingele.de>  
Leonardo Comelli <leonardo.comelli@gmail.com>  
Leonel Quinteros <leonel.quinteros@gmail.com>  
Lev Shamardin <shamardin@gmail.com>  
Lewin Bormann <lewin.bormann@gmail.com>  
Lion Yang <lion@aosc.xyz>  
Lloyd Dewolf <foolswisdom@gmail.com>  
Lorenz Bauer <lmb@cloudflare.com>  
Lorenz Nickel <mail@lorenznickel.de>  
Lorenzo Masini <rugginoso@develer.com>  
Lorenzo Stoakes <lstoakes@gmail.com>  
Louis Kruger <louisk@google.com>  
Luan Santos <cfcluan@gmail.com>  
Lubomir I. Ivanov <neolit123@gmail.com>  
Luca Bruno <luca.bruno@coreos.com>  
Luca Greco <luca.greco@alcacoop.it>  
Lucas Bremgartner <lucas.bremgartner@gmail.com>  
Lucas Clemente <lclemente@google.com>  
Lucien Stuker <lucien.stuker@gmail.com>  
Lucio De Re <lucio.dere@gmail.com>  
Ludi Rehak <ludi317@gmail.com>  
Luigi  
Riefolo <luigi.riefolo@gmail.com>  
Luit van Drongelen <luitvd@gmail.com>  
Luka Zakrajek <tr00.g33k@gmail.com>  
Luka Zitnik <luka.zitnik@gmail.com>  
Lukasz Milewski <lmilewski@gmail.com>  
Luke Champine <luke.champine@gmail.com>  
Luke Curley <qpingu@gmail.com>

Luke Granger-Brown <git@lukegb.com>  
Luna Duclos <luna.duclos@palmstonegames.com>  
Luuk van Dijk <lvd@golang.org> <lvd@google.com>  
Lyle Franklin <lylejfranklin@gmail.com>  
Lynn Boger <laboger@linux.vnet.ibm.com>  
Ma Peiqi <mapeiqi2017@gmail.com>  
Maarten Bezemer <maarten.bezemer@gmail.com>  
Maciej Dbski <maciejd@google.com>  
Madhu Rajanna <madhupr007@gmail.com>  
Magnus Hiie <magnus.hiie@gmail.com>  
Maicon Costa <maiconscosta@gmail.com>  
Mak Kolybabi <mak@kolybabi.com>  
Maksym Trykur <maksym.trykur@gmail.com>  
Mal Curtis <mal@mal.co.nz>  
Manfred Touron <m@42.am>  
Manigandan Dharmalingam <manigandan.jeff@gmail.com>  
Manish Goregaokar <manishsmail@gmail.com>  
Manoj Dayaram <platform-dev@moovweb.com> <manoj.dayaram@moovweb.com>  
Mansour Rahimi <rahimi.mnr@gmail.com>  
Manu  
Garg <manugarg@google.com>  
Manu S Ajith <neo@codingarena.in>  
Manuel Mendez <mmendez534@gmail.com>  
Marat Khabibullin <marat.khabibullin@jetbrains.com>  
Marc Weistroff <marc@weistroff.net>  
Marc-Antoine Ruel <maruel@chromium.org>  
Marcel Edmund Franke <marcel.edmund.franke@gmail.com>  
Marcel van Lohuizen <mpvl@golang.org>  
Marcelo Cantos <marcelo.cantos@gmail.com>  
Marcelo E. Magallon <marcelo.magallon@gmail.com>  
Marco Hennings <marco.hennings@freiheit.com>  
Marcus Willock <crazcalm@gmail.com>  
Marga Manterola <marga@google.com>  
Marin Bai <marin.basic02@gmail.com>  
Mario Arranz <marioarranzr@gmail.com>  
Marius A. Eriksen <marius@grailbio.com>  
Marius Nuennerich <mnu@google.com>  
Mark Adams <mark@markadams.me>  
Mark Bucciarelli <mkbucc@gmail.com>  
Mark Glines <mark@glines.org>  
Mark Harrison <marhar@google.com>  
Mark Percival <m@mdp.im>  
Mark Pulford <mark@kyne.com.au>  
Mark Rushakoff <mark.rushakoff@gmail.com>  
Mark Ryan <mark.d.ryan@intel.com>  
Mark Severson <miquella@gmail.com>  
Mark

Theunissen <mark.theunissen@gmail.com>  
Mark Villacampa <m@markvillacampa.com>  
Mark Wolfe <mark@wolfe.id.au>  
Mark Zavislak <zavislak@google.com>  
Marko Juhani Silokunnas <marko.silokunnas@gmail.com>  
Marko Kevac <marko@kevac.org>  
Marko Mikulicic <mkm@google.com>  
Marko Mudrinic <mudrinic.mare@gmail.com>  
Marko Tiikkaja <marko@joh.to>  
Markus Duft <markus.duft@salomon.at>  
Markus Sonderegger <marraison@gmail.com>  
Markus Zimmermann <zimmski@gmail.com>  
Marten Seemann <martenseemann@gmail.com>  
Martin Bertschler <mbertschler@gmail.com>  
Martin Garton <garton@gmail.com>  
Martin Habbecke <marhab@google.com>  
Martin Hamrle <martin.hamrle@gmail.com>  
Martin Hoefling <martin.hoefling@gmx.de>  
Martin Kreichgauer <martinkr@google.com>  
Martin Kunc <martinkunc@users.noreply.github.com>  
Martin Lindhe <martin.j.lindhe@gmail.com>  
Martin Mohrmann <moehrmann@google.com> <martisch@uos.de>  
Martin Neubauer <m.ne@gmx.net>  
Martin Olsen <github.com@martinolsen.net>  
Martin Olsson <martin@minimum.se>  
Martin Probst <martin@probst.io>  
Martin  
Sucha <anty.sk+git@gmail.com>  
Martin Tournoij <martin@arp242.net>  
Martins Sipenko <martins.sipenko@gmail.com>  
Martynas Budrinas <mabu@google.com>  
Marvin Stenger <marvin.stenger94@gmail.com>  
Marwan Sulaiman <marwan.sulaiman@work.co>  
Maryan Hratson <gmarik@gmail.com>  
Masahiro Furudate <masahiro.furudate@gmail.com>  
Masahiro Wakame <vvakame@gmail.com>  
Masaki Yoshida <yoshida.masaki@gmail.com>  
Mat Byczkowski <mbyczkowski@gmail.com>  
Mat Ryer <thatmatryer@gmail.com>  
Mt Gulys <mgulyas86@gmail.com>  
Matej Bao <matejbaco@gmail.com>  
Mateus Amin <mateus.amin@gmail.com>  
Mateusz Czapliski <czapkofan@gmail.com>  
Mathias Beke <git@denbeke.be>  
Mathias Hall-Andersen <mathias@hall-andersen.dk>  
Mathias Leppich <mleppich@muhqu.de>  
Mathieu Lonjaret <mathieu.lonjaret@gmail.com>  
Mats Lidell <mats.lidell@cag.se> <mats.lidell@gmail.com>



Matt Aimonetti <mattaimonetti@gmail.com>  
Matt Blair <me@matthewblair.net>  
Matt Bostock <matt@mattbostock.com>  
Matt Brown <mbrown@google.com>  
Matt Dee <mdee@hioscar.com>  
Matt  
Drollette <matt@drollette.com>  
Matt Harden <matt.harden@gmail.com>  
Matt Jibson <matt.jibson@gmail.com>  
Matt Joiner <anacrolix@gmail.com>  
Matt Jones <mrjones@google.com>  
Matt Juran <thepciet@gmail.com>  
Matt Layher <mdlayher@gmail.com>  
Matt Reiferson <mreiferson@gmail.com>  
Matt Robenolt <matt@ydekproductions.com>  
Matt Strong <mstrong1341@gmail.com>  
Matt T. Proud <matt.proud@gmail.com>  
Matt Williams <gh@mattyw.net> <mattyjwilliams@gmail.com>  
Matthew Brennan <matty.brennan@gmail.com>  
Matthew Broberg <matthewbbroberg@gmail.com>  
Matthew Cottingham <mattcottingham@gmail.com>  
Matthew Dempsey <mdempsey@google.com>  
Matthew Denton <mdenton@skyportsystems.com>  
Matthew Holt <Matthew.Holt+git@gmail.com>  
Matthew Horsnell <matthew.horsnell@gmail.com>  
Matthew Waters <mwwaters@gmail.com>  
Matthieu Hauglustaine <matt.hauglustaine@gmail.com>  
Matthieu Olivier <olivier.matthieu@gmail.com>  
Matthijs Kooijman <matthijs@stdn.nl>  
Max Riveiro <kavu13@gmail.com>  
Max Schmitt <max@schmitt.mx>  
Max Semenik  
<maxsem.wiki@gmail.com>  
Max Ushakov <ushmax@gmail.com>  
Maxim Eryomenko <moeryomenko@gmail.com>  
Maxim Khitrov <max@mxcrypt.com>  
Maxim Pimenov <mpimenov@google.com>  
Maxim Ushakov <ushakov@google.com>  
Maxime de Roucy <maxime.deroucy@gmail.com>  
Mximo Cuadros Ortiz <mcuadros@gmail.com>  
Maxwell Krohn <themax@gmail.com>  
Maya Rashish <maya@NetBSD.org>  
Mayank Kumar <krmayankk@gmail.com>  
Meir Fischer <meirfischer@gmail.com>  
Meng Zhuo <mengzhuo1203@gmail.com>  
Mhd Sulhan <m.shulhan@gmail.com>  
Micah Stetson <micah.stetson@gmail.com>  
Michael Anthony Knyszek <mknyszek@google.com>

Michael Brandenburg <mbrandenburg@bolste.com>  
Michael Chaten <mchaten@gmail.com>  
Michael Cook <code@mdcook.net>  
Michael Darakananda <pongad@google.com>  
Michael Dorner <mail@michaeldorner.de>  
Michael Edwards <medwards@walledcity.ca>  
Michael Elkins <michael.elkins@gmail.com>  
Michael Ellis <micellis@justin.tv>  
Michael Fraenkel <michael.fraenkel@gmail.com>  
Michael Fromberger <michael.j.fromberger@gmail.com>  
Michael Gehring <mg@ebfe.org>  
<gnirheg.leahcim@gmail.com>  
Michael Henderson <mdhender@users.noreply.github.com>  
Michael Hendricks <michael@ndrix.org>  
Michael Hoisie <hoisie@gmail.com>  
Michael Hudson-Doyle <michael.hudson@linaro.org>  
Michael Kasch <michael.kasch@gmail.com>  
Michael Kufl <golang@c.michael-kaeufl.de>  
Michael Kelly <mjk@google.com>  
Michael Lewis <mikelikespie@gmail.com>  
Michael MacInnis <Michael.P.MacInnis@gmail.com>  
Michael Marineau <michael.marineau@coreos.com>  
Michael Matloob <matloob@google.com>  
Michael McConville <momconville@gmail.com>  
Michael McGreevy <mcgreevy@golang.org>  
Michael McLoughlin <mmcloughlin@gmail.com>  
Michael Munday <mike.munday@ibm.com>  
Michael Pearson <mipearson@gmail.com>  
Michael Piatek <piatek@google.com>  
Michael Pratt <mpratt@google.com>  
Michael Schaller <michael@5challer.de>  
Michael Schurter <michael.schurter@gmail.com>  
Michael Shields <mshields@google.com>  
Michael Stapelberg <michael@stapelberg.de> <mstplbrg@googlemail.com>  
Michael Steinert <mike.steinert@gmail.com>  
Michael  
T. Jones <mtj@google.com> <michael.jones@gmail.com>  
Michael Teichgrber <mteichgraeber@gmx.de> <mt4swm@googlemail.com>  
Michael Traver <mtraver@google.com>  
Michael Vetter <g.bluehut@gmail.com>  
Michael Vogt <mvo@ubuntu.com>  
Michal Bohuslvek <mbohuslvek@gmail.com>  
Michal Cierniak <cierniak@google.com>  
Micha Derkacz <ziutek@lnet.pl>  
Michal Franc <lam.michal.franc@gmail.com>  
Michal Pristas <michal.pristas@gmail.com>  
Michal Rostecki <mrostecki@suse.de>  
Michalis Kargakis <michaliskargakis@gmail.com>

Michel Lespinasse <walken@google.com>  
Mickael Kerjean <mickael.kerjean@gmail.com>  
Mickey Reiss <mickeyreiss@gmail.com>  
Miek Gieben <miek@miek.nl> <remigius.gieben@gmail.com>  
Miguel Mendez <stxmendez@gmail.com>  
Miguel Molina <hi@mvader.me>  
Mihai Borobocea <MihaiBorobocea@gmail.com>  
Mihai Moldovan <ionic@ionic.de>  
Mihai Todor <todormihai@gmail.com>  
Mihail Minaev <minaev.mike@gmail.com>  
Mikael Tillenius <mikti42@gmail.com>  
Mike Andrews <mra@xoba.com>  
Mike Appleby <mike@app.leby.org>  
Mike  
Danese <mikedanese@google.com>  
Mike Houston <mike@kothar.net>  
Mike Kabischev <kabischev@gmail.com>  
Mike Rosset <mike.rosset@gmail.com>  
Mike Samuel <mikesamuel@gmail.com>  
Mike Solomon <msolo@gmail.com>  
Mike Strosaker <strosake@us.ibm.com>  
Mike Tsao <mike@sowbug.com>  
Mike Wiacek <mjwiacek@google.com>  
Mikhail Gusarov <dottedmag@dottedmag.net>  
Mikhail Panchenko <m@mihasya.com>  
Miki Tebeka <miki.tebeka@gmail.com>  
Mikio Hara <mikioh.mikioh@gmail.com>  
Mikkel Krautz <mikkel@krautz.dk> <krautz@gmail.com>  
Mikoaj Baranowski <mikolajb@gmail.com>  
Milan Knezevic <milan.knezevic@mips.com>  
Milutin Jovanovic <jovanovic.milutin@gmail.com>  
MinJae Kwon <mingrammer@gmail.com>  
Miquel Sabat Sol <mikisabate@gmail.com>  
Mirko Hansen <baaazen@gmail.com>  
Miroslav Genov <mgenov@gmail.com>  
Misty De Meo <mistydemeo@gmail.com>  
Mohit Agarwal <mohit@sdf.org>  
Mohit kumar Bajoria <mohitbajo36@gmail.com>  
Momchil Velikov <momchil.velikov@gmail.com>  
Monis Khan <mkhan@redhat.com>  
Monty Taylor <mordred@inaugust.com>  
Moriyoshi  
Koizumi <mozo@mozo.jp>  
Morten Siebuhr <sbhr@sbhr.dk>  
Mshe van der Sterre <moshevds@gmail.com>  
Mostyn Bramley-Moore <mostyn@antipode.se>  
Mrunal Patel <mrunalp@gmail.com>  
Muhammad Falak R Wani <falakreyaz@gmail.com>

Muhammed Uluyol <uluyol0@gmail.com>  
Muir Manders <muir@mnd.rs>  
Mura Li <mura\_li@castech.com.tw>  
Mykhailo Lesyk <mikhail@lesyk.org>  
Nan Deng <monnand@gmail.com>  
Nao Yonashiro <owan.orisano@gmail.com>  
Naoki Kanatani <k12naoki@gmail.com>  
Nate Wilkinson <nathanwilk7@gmail.com>  
Nathan Cantelmo <n.cantelmo@gmail.com>  
Nathan Caza <mastercactus@gmail.com>  
Nathan Humphreys <nkhumphreys@gmail.com>  
Nathan John Youngman <nj@nathany.com>  
Nathan Otterness <otterness@cs.unc.edu>  
Nathan P Finch <nate.finch@gmail.com>  
Nathan VanBenschoten <nvanbenschoten@gmail.com>  
Nathan Youngman <git@nathany.com>  
Nathan(yinian) Hu <nathanhu@google.com>  
Nathaniel Cook <nvcook42@gmail.com>  
Naveen Kumar Sangi <naveenkumarsangi@protonmail.com>  
Neelesh Chandola <neelesh.c98@gmail.com>  
Neil Lyons <nwjlyons@googlemail.com>  
Neuman  
Vong <neuman.vong@gmail.com>  
Neven Sajko <nsajko@gmail.com>  
Nevins Bartolomeo <nevins.bartolomeo@gmail.com>  
Niall Sheridan <nsheridan@gmail.com>  
Nic Day <nic.day@me.com>  
Nicholas Katsaros <nick@nickkatsaros.com>  
Nicholas Maniscalco <nicholas@maniscalco.com>  
Nicholas Ng <nickng@nickng.io>  
Nicholas Presta <nick@nickpresta.ca> <nick1presta@gmail.com>  
Nicholas Sullivan <nicholas.sullivan@gmail.com>  
Nicholas Waples <nwaples@gmail.com>  
Nick Anthony <Liberatys@outlook.com>  
Nick Cooper <nmvc@google.com>  
Nick Craig-Wood <nick@craig-wood.com> <nickcw@gmail.com>  
Nick Harper <nharper@google.com>  
Nick Kubala <nkubala@google.com>  
Nick Leli <nicholasleli@gmail.com>  
Nick Miyake <nmiyake@users.noreply.github.com>  
Nick Patavalis <nick.patavalis@gmail.com>  
Nick Petroni <npetroni@cs.umd.edu>  
Nick Robinson <nrobinson13@gmail.com>  
Nick Smolin <nick27surgut@gmail.com>  
Nicolas BRULEZ <n.brulez@gmail.com>  
Nicolas Kaiser <nikai@nikai.net>  
Nicolas Owens <mischief@offblast.org>  
Nicolas S. Dade

<nic.dade@gmail.com>  
Niek Sanders <niek.sanders@gmail.com>  
Niels Widger <niels.widger@gmail.com>  
Nigel Kerr <nigel.kerr@gmail.com>  
Nigel Tao <nigeltao@golang.org>  
Nik Nyby <nnyby@columbia.edu>  
Nikhil Benesch <nikhil.benesch@gmail.com>  
Nikita Kryuchkov <nkryuchkov10@gmail.com>  
Niklas Schnelle <niklas.schnelle@gmail.com>  
Niko Dziemba <niko@dziemba.com>  
Nikolay Turpitko <nikolay@turpitko.com>  
Nils Larsgrd <nilsmagnus@gmail.com>  
Nir Soffer <nirsof@gmail.com>  
Niranjan Godbole <niranjan8192@gmail.com>  
Nishanth Shanmugham <nishanth.gerrard@gmail.com>  
Noah Campbell <noahcampbell@gmail.com>  
Noble Johnson <noblepoly@gmail.com>  
Nodir Turakulov <nodir@google.com>  
Noel Georgi <git@frezbo.com>  
Norberto Lopes <nlopes.ml@gmail.com>  
Norman B. Lancaster <qbradq@gmail.com>  
Odin Ugedal <odin@ugedal.com>  
Oleg Bulatov <dmage@yandex-team.ru>  
Oleg Vakheta <helginet@gmail.com>  
Oleku Konko <oleku.konko@gmail.com>  
Oling Cat <olingcat@gmail.com>  
Oliver Hookins <ohookins@gmail.com>  
Oliver Stenbom <ostenbom@pivotal.io>  
Oliver  
Tonnhofer <olt@bogosoftware.com>  
Olivier Antoine <olivier.antoine@gmail.com>  
Olivier Duperray <duperray.olivier@gmail.com>  
Olivier Poitrey <rs@dailymotion.com>  
Olivier Saingre <osaingre@gmail.com>  
Omar Jarjur <ojarjur@google.com>  
Oryan Moshe <iamoryanmoshe@gmail.com>  
Osamu TONOMORI <osamingo@gmail.com>  
zgr Kesim <oec-go@kesim.org>  
Pablo Lalloni <plalloni@gmail.com>  
Pablo Rozas Larraondo <pablo.larraondo@anu.edu.au>  
Pablo Santiago Blum de Aguiar <scorpus@gmail.com>  
Padraig Kitterick <padraigkitterick@gmail.com>  
Pallat Anchaleechamaikorn <yod.pallat@gmail.com>  
Paolo Giarrusso <p.giarrusso@gmail.com>  
Paolo Martini <mrtnpaolo@gmail.com>  
Parker Moore <parkrmoore@gmail.com>  
Parminder Singh <parmsingh101@gmail.com>  
Pascal Dierich <pascal@pascaldierich.com>

Pascal S. de Kloe <pascal@quies.net>  
Pat Moroney <pat@pat.email>  
Patrick Barker <barkerp@vmware.com>  
Patrick Crosby <patrick@stathat.com>  
Patrick Gavlin <pgavlin@gmail.com>  
Patrick Higgins <patrick.allen.higgins@gmail.com>  
Patrick  
Lee <pattyshack101@gmail.com>  
Patrick Mzard <patrick@mezard.eu>  
Patrick Mylund Nielsen <patrick@patrickmn.com>  
Patrick Pelletier <pp.pelletier@gmail.com>  
Patrick Riley <pfr@google.com>  
Patrick Smith <pat42smith@gmail.com>  
Patrik Lundin <patrik@sigterm.se>  
Paul A Querna <paul.querna@gmail.com>  
Paul Borman <borman@google.com>  
Paul Boyd <boyd.paul2@gmail.com>  
Paul Chang <paulchang@google.com>  
Paul Hammond <paul@paulhammond.org>  
Paul Hankin <paulhankin@google.com>  
Paul Jolly <paul@myitcv.org.uk>  
Paul Lalonde <paul.a.lalonde@gmail.com>  
Paul M Furley <paul@paulfurley.com>  
Paul Marks <pmarks@google.com>  
Paul Meyer <paul.meyer@microsoft.com>  
Paul Nasrat <pnasrat@google.com>  
Paul PISCUC <paul.piscuc@gmail.com>  
Paul Querna <pquerna@apache.org>  
Paul Rosania <paul.rosania@gmail.com>  
Paul Ruest <pruest@gmail.com>  
Paul Sbarra <Sbarra.Paul@gmail.com>  
Paul Smith <paulsmith@pobox.com> <paulsmith@gmail.com>  
Paul Tyng <paul@paultyng.net>  
Paul van Brouwershaven <paul@vanbrouwershaven.com>  
Paul Wankadia <junyer@google.com>  
Paulo  
Casaretto <pcasaretto@gmail.com>  
Paulo Flabiano Smorigo <pfsmorigo@linux.vnet.ibm.com>  
Pavel Paulau <pavel.paulau@gmail.com>  
Pavel Zinovkin <pavel.zinovkin@gmail.com>  
Pavlo Sumkin <ymkins@gmail.com>  
Pawel Knap <pawelknap88@gmail.com>  
Pawel Szczur <filemon@google.com>  
Percy Wegmann <ox.to.a.cart@gmail.com>  
Perry Abbott <perry.j.abbott@gmail.com>  
Petar Maymounkov <petarm@gmail.com>  
Peter Armitage <peter.armitage@gmail.com>  
Peter Bourgon <peter@bourgon.org>

Peter Collingbourne <pcc@google.com>  
Peter Conerly <pconerly@gmail.com>  
Peter Dotchev <dotchev@gmail.com>  
Peter Froehlich <peter.hans.froehlich@gmail.com>  
Peter Gonda <pgonda@google.com>  
Peter Hoyes <pahoyes@gmail.com>  
Peter Kleiweg <pkleiweg@xs4all.nl>  
Peter McKenzie <petermck@google.com>  
Peter Moody <pmoody@uber.com>  
Peter Morjan <pmorjan@gmail.com>  
Peter Mundy <go.peter.90@gmail.com>  
Peter Nguyen <peter@mictis.com>  
Pter Surnyi <speter.go1@gmail.com>  
Pter Szab <pts@google.com>  
Pter Szilgyi <peterke@gmail.com>  
Peter  
Teichman <pteichman@fastly.com>  
Peter Tseng <ptseng@squareup.com>  
Peter Waldschmidt <peter@waldschmidt.com>  
Peter Waller <peter.waller@gmail.com>  
Peter Weinberger <pjw@golang.org>  
Peter Williams <pwil3058@gmail.com>  
Peter Wu <pwu@cloudflare.com>  
Peter Zhang <i@ddatsh.com>  
Petr Jedin <petr.jediny@gmail.com>  
Petrica Voicu <pvoicu@paypal.com>  
Phil Pearl <philip.j.r.pearl@gmail.com>  
Phil Pennock <pdp@golang.org>  
Philip Brgesen <philip.borgesen@gmail.com>  
Philip Brown <phil@bolthole.com>  
Philip Hofer <phofer@umich.edu>  
Philip K. Warren <pkwarren@gmail.com>  
Philip Nelson <me@pnelson.ca>  
Philipp Stephani <phst@google.com>  
Pierre Durand <pierredurand@gmail.com>  
Pierre Prinetti <pierreprinetti@gmail.com>  
Pierre Roullon <pierre.roullon@gmail.com>  
Piers <google@hellopiers.pro>  
Pieter Droogendijk <pieter@binky.org.uk>  
Pietro Gagliardi <pietro10@mac.com>  
Piyush Mishra <piyush@codeitout.com>  
Plekhanov Maxim <kishtatix@gmail.com>  
Pontus Leitzler <leitzler@gmail.com>  
Prasanna Swaminathan <prasanna@mediamath.com>  
Prashant  
Varanasi <prashant@prashantv.com>  
Pravendra Singh <hackpravj@gmail.com>  
Preetam Jinka <pj@preet.am>

Pure White <wu.purewhite@gmail.com>  
Qais Patankar <qaisjp@gmail.com>  
Qiuxuan Zhu <ilsh1022@gmail.com>  
Quan Tran <qeed.quan@gmail.com>  
Quan Yong Zhai <qyzhai@gmail.com>  
Quentin Perez <qperez@ocs.online.net>  
Quentin Renard <contact@asticode.com>  
Quentin Smith <quentin@golang.org>  
Quinn Slack <sqs@sourcegraph.com>  
Quinten Yearsley <qyearsley@chromium.org>  
Quoc-Viet Nguyen <afelion@gmail.com>  
Radek Sohlich <sohlich@gmail.com>  
Radu Berinde <radu@cockroachlabs.com>  
Rafal Jeczalik <rjeczalik@gmail.com>  
Raghavendra Nagaraj <jamdagni86@gmail.com>  
Rahul Chaudhry <rahulchaudhry@chromium.org>  
Raif S. Naffah <go@naffah-raif.name>  
Rajat Goel <rajat.goel2010@gmail.com>  
Rajath Agasthya <rajathagasthya@gmail.com>  
Rajender Reddy Kompally <rajenderreddykompally@gmail.com>  
Ralph Corderoy <ralph@inputplus.co.uk>  
Ramazan AYYILDIZ <rayyildiz@gmail.com>  
Ramesh Dharan <dharan@google.com>  
Raph  
Levien <raph@google.com>  
Raphael Geronimi <raphael.geronimi@gmail.com>  
Raul Silvera <rsilvera@google.com>  
Ravil Bikbulatov <weeellz12@gmail.com>  
RaviTeja Pothana <ravi.tezu@gmail.com>  
Ray Tung <rtung@thoughtworks.com>  
Raymond Kazlauskas <raima220@gmail.com>  
Rebecca Stambler <rstambler@golang.org>  
Reilly Watson <reillywatson@gmail.com>  
Reinaldo de Souza Jr <juniorz@gmail.com>  
Remi Gillig <remigillig@gmail.com>  
Rmy Oudompheng <oudomphe@phare.normalesup.org> <remyoudompheng@gmail.com>  
Rens Rikkerink <Ikkerens@users.noreply.github.com>  
Rhys Hiltner <rhys@justin.tv>  
Ricardo Padilha <ricardospadilha@gmail.com>  
Richard Barnes <rlb@ipv.sx>  
Richard Crowley <r@rcrowley.org>  
Richard Dingwall <rdingwall@gmail.com>  
Richard Eric Gavaletz <gavaletz@gmail.com>  
Richard Gibson <richard.gibson@gmail.com>  
Richard Miller <miller.research@gmail.com>  
Richard Musiol <mail@richard-musiol.de> <neelance@gmail.com>  
Rick Arnold <rickarnoldjr@gmail.com>  
Rick Hudson <rlh@golang.org>



Rick Sayre <whorfin@gmail.com>  
Rijnard  
van Tonder <rvantonder@gmail.com>  
Riku Voipio <riku.voipio@linaro.org>  
Risto Jaakko Saarelm <rsaarelm@gmail.com>  
Rob Earhart <earhart@google.com>  
Rob Norman <rob.norman@infinitycloud.com>  
Rob Phoenix <rob@robphoenix.com>  
Rob Pike <r@golang.org>  
Robert Ayrapetyan <robert.ayrapetyan@gmail.com>  
Robert Daniel Kortschak <dan.kortschak@adelaide.edu.au> <dan@kortschak.io>  
Robert Dinu <r@varp.se>  
Robert Figueiredo <robfig@gmail.com>  
Robert Griesemer <gri@golang.org>  
Robert Hencke <robert.hencke@gmail.com>  
Robert Iannucci <iannucci@google.com>  
Robert Obryk <robryk@gmail.com>  
Robert Sesek <rsesek@google.com>  
Robert Snedegar <roberts@google.com>  
Robert Stepanek <robert.stepanek@gmail.com>  
Robert van Gent <rvangent@google.com>  
Robert-Andr Mauchin <zebob.m@gmail.com>  
Roberto Clapis <robclap8@gmail.com>  
Roberto Selbach <roberto@selbach.ca>  
Robin Eklind <r.eklind.87@gmail.com>  
Rodolfo Carvalho <rhcarvalho@gmail.com>  
Rodolfo Rodriguez <rodolfobgibson@gmail.com>  
Rodrigo Moraes de Oliveira  
<rodrigo.moraes@gmail.com>  
Rodrigo Rafael Monti Kochenburger <divoxx@gmail.com>  
Roger Pau Monn <royger@gmail.com>  
Roger Peppe <rogpeppe@gmail.com>  
Rohan Verma <rohanverma2004@gmail.com>  
Roland Illig <roland.illig@gmx.de>  
Roland Shoemaker <rolandshoemaker@gmail.com>  
Romain Bague <romain.bague@elwinar.com>  
Roman Budnikov <romanyx90@yandex.ru>  
Roman Shchekin <mrqtros@gmail.com>  
Ron Hashimoto <mail@h2so5.net>  
Ron Minnich <rminnich@gmail.com>  
Ross Chater <rdchater@gmail.com>  
Ross Light <light@google.com> <rlight2@gmail.com>  
Ross Smith II <ross@smithii.com>  
Rowan Marshall <rowanajmarshall@gmail.com>  
Rowan Worth <sqweek@gmail.com>  
Rudi Kramer <rudi.kramer@gmail.com>  
Rui Ueyama <rui@uoyama.com>  
Ruslan Nigmatullin <elessar@dropbox.com>

Russ Cox <rsc@golang.org>  
Russell Haering <russellhaering@gmail.com>  
Ryan Bagwell <ryanbagwell@outlook.com>  
Ryan Barrett <ryanb@google.com>  
Ryan Boehning <ryan.boehning@apcera.com>  
Ryan Brown <ribldb@google.com>  
Ryan Canty <jrcanty@gmail.com>  
Ryan Dahl <ry@tinyclouds.org>  
Ryan  
Hitchman <hitchmanr@gmail.com>  
Ryan Lower <rpjlower@gmail.com>  
Ryan Roden-Corrent <ryan@rcorre.net>  
Ryan Seys <ryan@ryanseys.com>  
Ryan Slade <ryanslade@gmail.com>  
Ryan Zhang <ryan.zhang@docker.com>  
Ryoichi KATO <ryo1kato@gmail.com>  
Ryuji Iwata <qt.luigi@gmail.com>  
Ryuma Yoshida <ryuma.y1117@gmail.com>  
Ryuzo Yamamoto <ryuzo.yamamoto@gmail.com>  
S.alar Onur <caglar@10ur.org>  
Sabin Mihai Rapan <sabin.rapan@gmail.com>  
Sad Pencil <qh06@qq.com>  
Sai Cheemalapati <saicheems@google.com>  
Sakeven Jiang <jc5930@sina.cn>  
Salmn Aljammz <s@0x65.net>  
Sam Arnold <sarnold64@bloomberg.net>  
Sam Boyer <tech@samboyer.org>  
Sam Ding <samding@ca.ibm.com>  
Sam Hug <samuel.b.hug@gmail.com>  
Sam Thorogood <thorogood@google.com> <sam.thorogood@gmail.com>  
Sam Whited <sam@samwhited.com>  
Sameer Ajmani <sameer@golang.org> <ajmani@gmail.com>  
Sami Commerot <samic@google.com>  
Sami Pnknen <sami.ponkanen@gmail.com>  
Samuel Kelemen <SCKelemen@users.noreply.github.com>  
Samuel Tan <samueltan@google.com>  
Samuele  
Pedroni <pedronis@lucediaruna.net>  
Sander van Harmelen <sander@vanharmelen.nl>  
Sanjay Menakuru <balasanjay@gmail.com>  
Santhosh Kumar Tekuri <santhosh.tekuri@gmail.com>  
Sarah Adams <shadams@google.com>  
Sascha Brawer <sascha@brawer.ch>  
Sasha Lionheart <lionhearts@google.com>  
Sasha Sobol <sasha@scaledinference.com>  
Scott Barron <scott.barron@github.com>  
Scott Bell <scott@sctsm.com>  
Scott Crunkleton <crunk1@gmail.com>

Scott Ferguson <scottwferg@gmail.com>  
Scott Lawrence <bytbox@gmail.com>  
Scott Mansfield <smansfield@netflix.com>  
Scott Schwartz <scotts@golang.org>  
Scott Van Woudenberg <scottvw@google.com>  
Sean Burford <sburford@google.com>  
Sean Chen <oohcode@gmail.com>  
Sean Chittenden <seanc@joyent.com>  
Sean Christopherson <sean.j.christopherson@intel.com>  
Sean Dolphin <Sean.Dolphin@kpcompass.com>  
Sean Harger <sharger@google.com>  
Sean Rees <sean@erifax.org>  
Sebastiaan van Stijn <github@gone.nl>  
Sebastian Schmidt <yath@google.com>  
Sebastien Binet <seb.binet@gmail.com>  
Sbastien Paolacci <sebastien.paolacci@gmail.com>  
Sebastien  
Williams-Wynn <sebastien@cytora.com>  
Segev Finer <segev208@gmail.com>  
Seiji Takahashi <timaki.st@gmail.com>  
Sergei Skorobogatov <skorobo@rambler.ru>  
Sergei Zagurskii <gvozdoder@gmail.com>  
Sergey 'SnakE' Gromov <snake.scaly@gmail.com>  
Sergey Arseev <sergey.arseev@intel.com>  
Sergey Dobrodey <sergey.dobrodey@synesis.ru>  
Sergey Frolov <sfrolov@google.com>  
Sergey Lukjanov <me@slukjanov.name>  
Sergey Mishin <sergeymishine@gmail.com>  
Sergey Mudrik <sergey.mudrik@gmail.com>  
Sergey Semin <gray12511@gmail.com>  
Sergey Yanykin <syanykin@ozon.ru>  
Sergio Luis O. B. Correia <sergio@correia.cc>  
Sergiusz Bazanski <bazanski@gmail.com>  
Serhii Aheienko <serhii.aheienko@gmail.com>  
Seth Hoenig <seth.a.hoenig@gmail.com>  
Seth Vargo <sethvargo@gmail.com>  
Shahar Kohanim <skohanim@gmail.com>  
Shamil Garatuev <garatuev@gmail.com>  
Shane Hansen <shanemhansen@gmail.com>  
Shaozhen Ding <dsz0111@gmail.com>  
Shaun Dunning <shaun.dunning@uservoice.com>  
Shawn Elliott <sellott@microsoft.com>  
Shawn  
Ledbetter <sledbetter@google.com>  
Shawn Smith <shawn.p.smith@gmail.com>  
Shawn Walker-Salas <shawn.walker@oracle.com>  
Shenghou Ma <minux@golang.org> <minux.ma@gmail.com>  
Shengjing Zhu <zsj950618@gmail.com>

Shengyu Zhang <shengyu.zhang@chaitin.com>  
Shi Han Ng <shihanng@gmail.com>  
Shijie Hao <haormj@gmail.com>  
Shinji Tanaka <shinji.tanaka@gmail.com>  
Shintaro Kaneko <kaneshin0120@gmail.com>  
Shivakumar GN <shivakumar.gn@gmail.com>  
Shivani Singhal <shivani.singhal2804@gmail.com>  
Shivansh Rai <shivansh@freebsd.org>  
Shubham Sharma <shubham.sha12@gmail.com>  
Shun Fan <sfan@google.com>  
Silvan Jegen <s.jegen@gmail.com>  
Simon Jefford <simon.jefford@gmail.com>  
Simon Rawet <simon@rawet.se>  
Simon Thulbourn <simon+github@thulbourn.com>  
Simon Whitehead <chemnova@gmail.com>  
Sina Siadat <siadat@gmail.com>  
Sokolov Yura <funny.falcon@gmail.com>  
Song Gao <song@gao.io>  
Spencer Nelson <s@spenczar.com>  
Spencer Tung <spencertung@google.com>  
Spring Mc <heresy.mc@gmail.com>  
Srdjan Petrovic <spetrovic@google.com>  
Sridhar  
Venkatakrisnan <sridhar@laddoo.net>  
StalkR <stalkr@stalkr.net>  
Stan Schwertly <stan@schwertly.com>  
Stanislav Afanasev <php.progger@gmail.com>  
Steeve Morin <steeve.morin@gmail.com>  
Stefan Baebler <sbaebler@outbrain.com>  
Stefan Nilsson <snilsson@nada.kth.se> <trolleriprofessorn@gmail.com>  
Stepan Shabalin <neverliberty@gmail.com>  
Stephan Renatus <srenatus@chef.io>  
Stephan Zuercher <zuercher@gmail.com>  
Stphane Travostino <stephane.travostino@gmail.com>  
Stephen Lewis <stephen@sock.org.uk>  
Stephen Lu <steuhs@users.noreply.github.com>  
Stephen Ma <stephenm@golang.org>  
Stephen McQuay <stephen@mcquay.me>  
Stephen Searles <stephens2424@gmail.com>  
Stephen Weinberg <stephen@q5comm.com>  
Steve Francia <spf@golang.org>  
Steve Gilbert <stevegilbert23@gmail.com>  
Steve LoFurno <slofurno@gmail.com>  
Steve McCoy <mccoyst@gmail.com>  
Steve Mynott <steve.mynott@gmail.com>  
Steve Newman <snewman@google.com>  
Steve Phillips <elimistev@gmail.com>  
Steve Streeting <steve@stevestreeting.com>

Steven Buss  
<sbuss@google.com>  
Steven Elliot Harris <seharris@gmail.com>  
Steven Erenst <stevenerenst@gmail.com>  
Steven Hartland <steven.hartland@multiplay.co.uk>  
Steven Littlebrant <imgroxx@gmail.com>  
Steven Wilkin <stevenwilkin@gmail.com>  
Stuart Jansen <sjansen@buscaluz.org>  
Sue Spence <virtuallysue@gmail.com>  
Sugu Sougoumarane <ssougou@gmail.com>  
Suharsh Sivakumar <suharshs@google.com>  
Sukrit Handa <sukrit.handa@utoronto.ca>  
Sunny <me@darkowlzz.space>  
Suriyaa Sundararuban <suriyaasundararuban@gmail.com>  
Suyash <dextrous93@gmail.com>  
Suzy Mueller <suzmue@golang.org>  
Sven Almgren <sven@tras.se>  
Sven Blumenstein <svbl@google.com>  
Sylvain Zimmer <sylvain@sylvainzimmer.com>  
Syohei YOSHIDA <syohex@gmail.com>  
Szabolcs Nagy <nsz@port70.net>  
Taavi Kivisik <taavi.kivisik@gmail.com>  
Tad Fisher <tadfisher@gmail.com>  
Tad Glines <tad.glines@gmail.com>  
Tadas Valiukas <tadovas@gmail.com>  
Taesu Pyo <pyotaesu@gmail.com>  
Tai Le <letientai299@gmail.com>  
Taj Khattri <taj.khattri@gmail.com>  
Takashi Matsuo <tmatsuo@google.com>  
Takayoshi  
Nishida <takayoshi.nishida@gmail.com>  
Takeshi YAMANASHI <9.nashi@gmail.com>  
Takuto Ikuta <tikuta@google.com>  
Takuya Ueda <uedatakuya@gmail.com>  
Tal Shprecher <tshprecher@gmail.com>  
Tamir Duberstein <tamird@gmail.com>  
Tao Shen <shentaoskyking@gmail.com>  
Tao Wang <twang2218@gmail.com>  
Tarmigan Casebolt <tarmigan@gmail.com>  
Taro Aoki <aizu.s1230022@gmail.com>  
Taru Karttunen <taruti@taruti.net>  
Tatsuhiko Tsujikawa <tatsuhiko.t@gmail.com>  
Tatsuya Kaneko <m.ddotx.f@gmail.com>  
Taufiq Rahman <taufiqrx8@gmail.com>  
Teague Cole <tnc1443@gmail.com>  
Ted Kornish <golang@tedkornish.com>  
Tejasvi Nareddy <tejunareddy@gmail.com>  
Terin Stock <terinjokes@gmail.com>

Terrel Shumway <gopher@shumway.us>  
Tetsuo Kiso <tetsuokiso9@gmail.com>  
Than McIntosh <thanm@google.com>  
Thanabodee Charoenpiriyakij <wingyminus@gmail.com>  
Thanatat Tamtan <acoshift@gmail.com>  
Thiago Avelino <t@avelino.xxx>  
Thiago Fransosi Farina <thiago.farina@gmail.com> <tfarina@chromium.org>  
Thomas Alan Copeland <talan.copeland@gmail.com>  
Thomas  
Bonfort <thomas.bonfort@gmail.com>  
Thomas Bouldin <inlined@google.com>  
Thomas Bruyelle <thomas.bruyelle@gmail.com>  
Thomas Bushnell, BSG <tbushnell@google.com>  
Thomas de Zeeuw <thomasdezeeuw@gmail.com>  
Thomas Desrosiers <thomasdesr@gmail.com>  
Thomas Habets <habets@google.com>  
Thomas Kappler <tkappler@gmail.com>  
Thomas Meson <zllak@hycik.org>  
Thomas Wanielista <tomwans@gmail.com>  
Thorben Krueger <thorben.krueger@gmail.com>  
Thordur Bjornsson <thorduri@secnorth.net>  
Tiago Queiroz <contato@tiago.eti.br>  
Tianon Gravi <admwiggin@gmail.com>  
Tilman Dilo <tilman.dilo@gmail.com>  
Tim Cooijmans <timcooijmans@gmail.com>  
Tim Cooper <tim.cooper@layeh.com>  
Tim Ebringer <tim.ebringer@gmail.com>  
Tim Heckman <t@heckman.io>  
Tim Henderson <tim.tadh@gmail.com>  
Tim Hockin <thockin@google.com>  
Tim Swast <swast@google.com>  
Tim Wright <tenortim@gmail.com>  
Tim Xu <xiaoxubeii@gmail.com>  
Timo Savola <timo.savola@gmail.com>  
Timo Truys <alkaloid.btx@gmail.com>  
Timothy Studd <tim@timstudd.com>  
Tipp  
Moseley <tipp@google.com>  
Tobias Assarsson <tobias.assarsson@gmail.com>  
Tobias Columbus <tobias.columbus@gmail.com> <tobias.columbus@googlemail.com>  
Tobias Klauser <tklauser@distanz.ch>  
Toby Burrell <kurin@google.com>  
Todd Kulesza <tkulesza@google.com>  
Todd Neal <todd@tneal.org>  
Todd Wang <toddwang@gmail.com>  
Tom Anthony <git@tomanthony.co.uk>  
Tom Bergan <tombergan@google.com>  
Tom Heng <zhm20070928@gmail.com>

Tom Lanyon <tomlanyon@google.com>  
Tom Levy <tomlevy93@gmail.com>  
Tom Limoncelli <tal@whatexit.org>  
Tom Linfoord <tomlinfoord@gmail.com>  
Tom Payne <twpayne@gmail.com>  
Tom Szymanski <tgs@google.com>  
Tom Thorogood <me+google@tomthorogood.co.uk>  
Tom Wilkie <tom@weave.works>  
Tommy Schaefer <tommy.schaefer@teecom.com>  
Tomoya Ishizaki <zaq1tomo@gmail.com>  
Tonis Tiigi <tonistiigi@gmail.com>  
Tony Reix <tony.reix@bull.net>  
Tony Walker <walkert.uk@gmail.com>  
Tooru Takahashi <tooru.takahashi134@gmail.com>  
Tor Andersson <tor.andersson@gmail.com>  
Tormod Erevik Lea <tormodlea@gmail.com>  
Toshihiro  
Shiino <shiino.toshihiro@gmail.com>  
Toshiki Shima <hayabusa1419@gmail.com>  
Totoro W <tw19881113@gmail.com>  
Travis Bischel <travis.bischel@gmail.com>  
Travis Cline <travis.cline@gmail.com>  
Trevor Strohman <trevor.strohman@gmail.com>  
Trey Lawrence <lawrence.trey@gmail.com>  
Trey Roessig <trey.roessig@gmail.com>  
Trey Tacon <ttacon@gmail.com>  
Tristan Amini <tamini01@ca.ibm.com>  
Tristan Colgate <tcolgate@gmail.com>  
Tristan Ooohry <ooohry@gmail.com>  
Tristan Rice <rice@fn.lc>  
Troels Thomsen <troels@thomsen.io>  
Trung Nguyen <trung.n.k@gmail.com>  
Tudor Golubenco <tudor.g@gmail.com>  
Tugdual Saunier <tugdual.saunier@gmail.com>  
Tuo Shan <sturbo89@gmail.com> <shantuo@google.com>  
Tyler Bui-Palsulich <tpalsulich@google.com>  
Tyler Bunnell <tylerbunnell@gmail.com>  
Tyler Treat <ttreat31@gmail.com>  
Tzu-Jung Lee <roylee17@currant.com>  
Udalov Max <re.udalov@gmail.com>  
Ugorji Nwoke <ugorji@gmail.com>  
Ulf Holm Nielsen <doktor@dyregod.dk>  
Ulrich Kunitz <uli.kunitz@gmail.com>  
Umang Parmar <umangjparmar@gmail.com>  
Uriel  
Mangado <uriel@berlinblue.org>  
Urvil Patel <patelurvil38@gmail.com>  
Uttam C Pawar <uttam.c.pawar@intel.com>

Vadim Grek <vadimprog@gmail.com>  
Vadim Vygonets <unixdj@gmail.com>  
Val Polouchkine <vpolouch@justin.tv>  
Valentin Vidic <vvidic@valentin-vidic.from.hr>  
Vega Garcia Luis Alfonso <vegacom@gmail.com>  
Venil Noronha <veniln@vmware.com>  
Veselkov Konstantin <kostozyb@gmail.com>  
Viacheslav Poturaev <vearutop@gmail.com>  
Victor Chudnovsky <vchudnov@google.com>  
Victor Vrantchan <vrancean+github@gmail.com>  
Vignesh Ramachandra <vickynamachandra@gmail.com>  
Vikas Kedia <vikask@google.com>  
Vincent Ambo <tazjin@googlemail.com>  
Vincent Batts <vbatts@hashbangbash.com> <vbatts@gmail.com>  
Vincent Vanackere <vincent.vanackere@gmail.com>  
Vinu Rajashekhar <vinutheraaj@gmail.com>  
Vish Subramanian <vish@google.com>  
Vishvananda Ishaya <vishvananda@gmail.com>  
Visweswara R <r.visweswara@gmail.com>  
Vitor De Mario <vitordemario@gmail.com>  
Vivek Sekhar <vsekhar@google.com>  
Vlad Krasnov <vlad@cloudflare.com>  
Vladimir  
Kovpak <cn007b@gmail.com>  
Vladimir Kuzmin <vkuzmin@uber.com>  
Vladimir Mihailenco <vladimir.webdev@gmail.com>  
Vladimir Nikishenko <vova616@gmail.com>  
Vladimir Stefanovic <vladimir.stefanovic@imgtec.com>  
Vladimir Varankin <nek.narqo@gmail.com>  
Volker Dobler <dr.volker.dobler@gmail.com>  
Volodymyr Paprotski <vpaprots@ca.ibm.com>  
W. Trevor King <wking@tremily.us>  
Wade Simmons <wade@wades.im>  
Wagner Riffel <wgriffel@gmail.com>  
Walter Poupore <wpoupore@google.com>  
Wander Lairson Costa <wcosta@mozilla.com>  
Warren Fernandes <warren.f.fernandes@gmail.com>  
Wayne Ashley Berry <wayneashleyberry@gmail.com>  
Wedson Almeida Filho <wedsonaf@google.com>  
Weerasak Chongnguluam <singpor@gmail.com>  
Wi Cngru <crvv.mail@gmail.com>  
Wei Fu <fhfuwei@163.com>  
Wei Guangjing <vcc.163@gmail.com>  
Wei Xiao <wei.xiao@arm.com>  
Wei Xikai <xykwei@gmail.com>  
Weichao Tang <tevic.tt@gmail.com>  
Wembley G. Leach, Jr <wembley.gl@gmail.com>  
Wenlei (Frank) He <wlhe@google.com>



Wenzel Lowe <lowewenzel@gmail.com>  
Wil  
Selwood <wselwood@gmail.com>  
Wilfried Teiken <wteiken@google.com>  
Will Beason <willbeason@gmail.com>  
Will Chan <willchan@google.com>  
Will Faught <will.faught@gmail.com>  
Will Morrow <wmorrow.qdt@qualcommdatacenter.com>  
Will Norris <willnorris@google.com>  
Will Storey <will@summercat.com>  
Willem van der Schyff <willemvds@gmail.com>  
William Chan <willchan@chromium.org>  
William Chang <mr.williamchang@gmail.com>  
William Josephson <wjosephson@gmail.com>  
William Orr <will@worrbase.com> <ay1244@gmail.com>  
Wisdom Omuya <deafgoat@gmail.com>  
Wu Yunzhou <yunzhouwu@gmail.com>  
Xi Ruoyao <xry23333@gmail.com>  
Xia Bin <snyh@snyh.org>  
Xing Xing <mikespook@gmail.com>  
Xu Fei <badgangkiller@gmail.com>  
Xudong Zhang <felixmelon@gmail.com>  
Xudong Zheng <7pkvm5aw@slicealias.com>  
Xuyang Kang <xuyangkang@gmail.com>  
Yamagishi Kazutoshi <ykzts@desire.sh>  
Yan Zou <yzou@google.com>  
Yang Tian <linuxty@gmail.com>  
Yann Hodique <yhodique@google.com>  
Yann Kerherv <yann.kerherv@gmail.com>  
Yann Salan <yannsalaun1@gmail.com>  
Yao  
Zhang <lunaria21@gmail.com>  
Yaron de Leeuw <jarondl@google.com>  
Yasha Bubnov <girokompas@gmail.com>  
Yasser Abdolmaleki <yasser@yasser.ca>  
Yasuharu Goto <matope.ono@gmail.com>  
Yasuhiro Matsumoto <mattn.jp@gmail.com>  
Yasuyuki Oka <yasuyk@gmail.com>  
Yazen Shunnar <yazen.shunnar@gmail.com>  
Yestin Sun <ylh@pdx.edu>  
Yesudeep Mangalapilly <yesudeep@google.com>  
Yissakhar Z. Beck <yissakhar.beck@gmail.com>  
Yo-An Lin <yoanlin93@gmail.com>  
Yohei Takeda <yo.tak0812@gmail.com>  
Yongjian Xu <i3dmaster@gmail.com>  
Yorman Arias <cixtords@gmail.com>  
Yoshiyuki Kanno <nekotaroh@gmail.com> <yoshiyuki.kanno@stoic.co.jp>  
Yoshiyuki Mineo <yoshiyuki.mineo@gmail.com>

Yosuke Akatsuka <yosuke.akatsuka@gmail.com>  
Yu Heng Zhang <annita.zhang@cn.ibm.com>  
Yu Xuan Zhang <zyxsh@cn.ibm.com>  
Yuji Yaginuma <yuuji.yaginuma@gmail.com>  
Yuki OKUSHI <huyuumi.dev@gmail.com>  
Yuki Yugui Sonoda <yugui@google.com>  
Yukihiro Nishinaka <6elpinal@gmail.com>  
Yury Smolsky <yury@smolsky.by>  
Yusuke Kagiwada <block.rxckin.beats@gmail.com>  
Yuusei  
Kuwana <kuwana@kumama.org>  
Yuval Pavel Zholkover <paulzhol@gmail.com>  
Yves Junqueira <yvesj@google.com> <yves.junqueira@gmail.com>  
Zac Bergquist <zbergquist99@gmail.com>  
Zach Bintliff <zbintliff@gmail.com>  
Zach Gershman <zachgersh@gmail.com>  
Zach Jones <zachj1@gmail.com>  
Zachary Amsden <zach@thundertoken.com>  
Zachary Gershman <zgershman@pivotal.io>  
Zak <zrjknill@gmail.com>  
Zakatell Kanda <hi@zkanda.io>  
Zellyn Hunter <zellyn@squareup.com> <zellyn@gmail.com>  
Zev Goldstein <zev.goldstein@gmail.com>  
Zheng Dayu <davidzheng23@gmail.com>  
Zheng Xu <zheng.xu@arm.com>  
Zhengyu He <hzy@google.com>  
Zhongpeng Lin <zplin@uber.com>  
Zhongtao Chen <chenzhongtao@126.com>  
Zhongwei Yao <zhongwei.yao@arm.com>  
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Ziad Hatahet <hatahet@gmail.com>  
Zorion Arrizabalaga <zorionk@gmail.com>  
<a.maksadbek@gmail.com>  
<max.faceless.frei@gmail.com>  
<hagen1778@gmail.com>  
<tbunyk@gmail.com>  
<faxriddinjon@gmail.com>  
<zs349596@gmail.com>  
<bronze1man@gmail.com>  
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## 1.388 zlib 1.2.11

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/\* zlib.h -- interface of the 'zlib' general purpose compression library  
version 1.2.11, January 15th, 2017

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|                  |                           |
|------------------|---------------------------|
| Jean-loup Gailly | Mark Adler                |
| jloup@gzip.org   | madler@alumni.caltech.edu |

The data format used by the zlib library is described by RFCs (Request for Comments) 1950 to 1952 in the files <http://tools.ietf.org/html/rfc1950> (zlib format), rfc1951 (deflate format) and rfc1952 (gzip format).

\*/

# 1.389 nss-pam-Idapd 0.9.11

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# 1.390 lvm2 2.02.162

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# 1.391 gnutls 3.6.13-2ubuntu1.7

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#####

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##  
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Constant-time SSSE3 AES core implementation.
version 0.1

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# 1.392 mongodb 5.0.6

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## 1.393 postgresql 12.12

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Version 3, 29 June 2007

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```
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## 1.401 coreutils 8.30-3



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```

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* Software Development Group
* National Center for Supercomputing Applications
* University of Illinois at Urbana-Champaign
* 605 E. Springfield, Champaign, IL 61820
* httpd@ncsa.uiuc.edu
*
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Written by Adam Twiss (adam@zeus.co.uk). March 1996

Thanks to the following people for their input:

Mike Belshe (mbelshe@netscape.com)

Michael Campanella (campanella@stevms.enet.dec.com)

\*/

<?xml version="1.0" encoding="UTF-8"?>

<!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.0 Strict//EN" "http://www.w3.org/TR/xhtml1/DTD/xhtml1-strict.dtd">

<html xmlns="http://www.w3.org/1999/xhtml" lang="en" xml:lang="en"><head>

<meta content="text/html; charset=UTF-8" http-equiv="Content-Type" />

<!--

XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX  
X

This file is generated from xml source: DO NOT EDIT

XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX  
X

-->

<title>The Apache License, Version 2.0 - Apache HTTP Server Version 2.4</title>

<link href="/style/css/manual.css" rel="stylesheet" media="all" type="text/css" title="Main stylesheet" />

<link href="/style/css/manual-loose-100pc.css" rel="alternate stylesheet" media="all" type="text/css" title="No Sidebar - Default font size" />

<link href="/style/css/manual-print.css" rel="stylesheet" media="print" type="text/css" /><link rel="stylesheet" type="text/css" href="/style/css/prettify.css" />

<script src="/style/scripts/prettify.min.js" type="text/javascript">


</script>

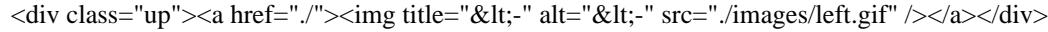
<link href="/images/favicon.ico" rel="shortcut icon" /></head>

<body id="manual-page" class="no-sidebar"><div id="page-header">

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<script type="text/javascript"><!--><![CDATA[//><!--
var comments_shortname = 'httpd';
var comments_identifier = 'http://httpd.apache.org/docs/2.4/license.html';
(function(w, d) {
 if (w.location.hostname.toLowerCase() == "httpd.apache.org") {
 d.write('<div id="comments_thread"></div>');
 var s = d.createElement('script');
 s.type = 'text/javascript';
 s.async = true;
 s.src = 'https://comments.apache.org/show_comments.lua?site=' + comments_shortname + '&page=' +
comments_identifier;
 (d.getElementsByTagName('head')[0] || d.getElementsByTagName('body')[0]).appendChild(s);
 }
 else {
 d.write('<div id="comments_thread">Comments are disabled for this page at the moment.</div>');
 }
})(window, document);
//--><![></script></div><div id="footer">
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if (typeof(prettyPrint) !== 'undefined') {
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## 1.405 docker-containerd 1.3.2

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procfs provides functions to retrieve system, kernel and process metrics from the pseudo-filesystem proc.

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Protocol Buffers for Go with Gadgets

Go support for Protocol Buffers - Google's data interchange format

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<https://github.com/golang/protobuf>

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# 1.406 Im-sensors 3.3.1

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- \* Frodo Looijaard  
Original author of libsensors, sensors-detect, sensors and isadump.
- \* Merlin Hughes  
Original author of sensord.
- \* Bob Schlaermann  
Dynamic chip feature detection (a.k.a. generic chip support) in  
libsensors and sensors.
- \* Mark M. Hoffman  
Many improvements to the libsensors configuration file scanner.
- \* Jean Delvare  
New libsensors API, and migration of sensors and sensord thereto.  
Many optimizations in libsensors and sensors.  
Configuration file converter.  
Rewrite of sensors-detect.  
Support for multiple configuration files in libsensors.

# 1.407 luafilesystem 1.5.0

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LuaFileSystem - File System Library for Lua

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<http://www.keplerproject.org/luafilesystem>

Description

-----

LuaFileSystem is a Lua library developed to complement the set of functions related to file systems offered by the standard Lua distribution.

LuaFileSystem offers a portable way to access the underlying directory structure and file attributes.

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LuaRocks Installation

-----

luarocks install luafilesystem

Documentation

-----

Please check the documentation at [doc/us/](http://doc.us/) for more information.

History

-----

Version 1.5.0 [20/Oct/2009]

- \* added explicit next and close methods to second return value of `lfs.dir` (the directory object), for explicit iteration or explicit closing.

- \* added directory locking via `lfs.lock_dir` function (see the manual).

Version 1.4.2 [03/Feb/2009]

- \* fixed

bug [#13198] `lfs.attributes(filename, 'size')` overflow on files > 2 Gb again (bug report and patch by KUBO Takehiro).

- \* fixed bug [#39794] Compile error on Solaris 10 (bug report and patch by Aaron B).

- \* fixed compilation problems with Borland C.

Version 1.4.1 [07/May/2008]

- \* documentation review
- \* fixed Windows compilation issues
- \* fixed bug in the Windows tests (patch by Shmuel Zeigerman)
- \* fixed bug [#2185] lfs.attributes(filename, 'size') overflow on files > 2 Gb

Version 1.4.0 [13/Feb/2008]

- \* added function lfs.setmode (works only in Windows systems).
- \* lfs.attributes raises an error if attribute does not exist

Version 1.3.0 [26/Oct/2007]

- \* added function lfs.symlinkattributes (works only in non Windows systems).

Version 1.2.1 [08/May/2007]

- \* compatible only with Lua 5.1 (Lua 5.0 support was dropped)

Version 1.2 [15/Mar/2006]

- \* added optional argument to lfs.attributes
- \* added  
function lfs.rmdir
- \* bug correction on lfs.dir

Version 1.1 [30/May/2005]

- \* added function lfs.touch.

Version 1.0 [21/Jan/2005]

Version 1.0 Beta [10/Nov/2004]

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## 1.408 luaposix 5.1.28

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## 1.409 luuid 1.0

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This is a uuid library for Lua 5.1. It generates Universally Unique Identifiers using libuuid, which is part of the e2fsprogs package and is available at <http://e2fsprogs.sourceforge.net/>

If you're running Linux, libuuid is probably already installed.

To try the library, just edit Makefile to reflect your installation of Lua and possibly of libuuid. Then run make. This will build the library and run a simple test. For detailed installation instructions, see <http://www.tecgraf.puc-rio.br/~lhf/ftp/lua/install.html>

There is no manual but the library is simple and intuitive; see the summary below. Read also test.lua, which shows the library in action.

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-----  
uuid library:

isvalid(s) new([s]) time(s) version

-----  
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\* /tp-luuid-1-051b6bb2c564-zip/cmake/luacmake

\* /tp-luuid-1-051b6bb2c564-zip/cmake/dist.cmake

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--- This dist file is part of LuaDist project

-- status:

name="luuid"

version="5.1.0.20101118"

desc = "A library for UUID generation"

author = "Luiz Henrique de Figueiredo"

url = "http://www.tecgraf.puc-rio.br/~lhf/ftp/luacmake/luuid"

license = "Public domain"

maintainer = "Peter Kapec"

dependencies = {

"lua ~> 5.1",

Linux = {

"uuid-dev >- 2.16"

}

}

Found in path(s):

\* /tp-luuid-1-051b6bb2c564-zip/dist.info

No license file was found, but licenses were detected in source scan.

/\*

\* luuid.c  
\* uuid interface for Lua 5.1  
\* Luiz Henrique de Figueiredo <lhf@tecgraf.puc-rio.br>  
\* 18 Nov 2010 19:16:20  
\* This code is hereby placed in the public domain.  
\*/

Found in path(s):

\* /tp-luuid-1-051b6bb2c564-zip/luuid.c  
No license file was found, but licenses were detected in source scan.

/\*  
\* wuuid.h  
\*  
\* Emulation of libuuid.so API functions based on the native Windows  
\* API. Only those functions actually used by luuid are provided.  
\* Extending this work to a complete emulation of libuuid would be  
\* possible, but of unknown value.  
\*  
\* Implemented by Ross Berteig <Ross@cheshireeng.com>  
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\*/

Found in path(s):

\* /tp-luuid-1-051b6bb2c564-zip/wuuid.h  
No license file was found, but licenses were detected in source scan.

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\* /tp-luuid-1-051b6bb2c564-zip/cmake/FindUUID.cmake  
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/\*  
\* wuuid.c  
\*  
\* Emulation of libuuid.so API functions based on the native Windows  
\* API. Only those functions actually used by luuid are provided.  
\* Extending this work to a complete emulation of libuuid would be  
\* possible, but of unknown value.  
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# 1.410 lvm2 2.02.79

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```

The following individuals contributed in part to the Network Time  
Protocol Distribution

Version 4 and are acknowledged as authors of this  
work.

1. [1]Takao Abe <takao\_abe@xurb.jp> Clock driver for JJY receivers
  2. [2]Mark Andrews <mark\_andrews@isc.org> Leitch atomic clock  
controller
  3. [3]Bernd Altmeier <altmeier@atlsoft.de> hopf Elektronik serial line  
and PCI-bus devices
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<kirkwood@striderfm.intel.com> port to WindowsNT 3.5
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  10. [11]Nelson B Bolyard <nelson@bolyard.me> update and complete  
broadcast and crypto features
- in sntp
11. [12]Jean-Francois Boudreault  
<Jean-Francois.Boudreault@viagenie.qc.ca> IPv6 support
  12. [13]Reg Clemens <reg@dwf.com> Oncore driver (Current maintainer)

13. [14]Steve Clift <clift@ml.csiro.au> OMEGA clock driver
14. [15]Casey Crellin <casey@csc.co.za> vxWorks (Tornado) port and help with target configuration
15. [16]Sven Dietrich <sven\_dietrich@trimble.com> Palisade reference clock driver, NT adj. residuals, integrated Greg's Winnt port.
16. [17]John A. Dundas III <dundas@salt.jpl.nasa.gov> Apple A/UX port
17. [18]Torsten Duwe <duwe@immd4.informatik.uni-erlangen.de> Linux port
18. [19]Dennis Ferguson <dennis@mrbill.canet.ca> foundation code for NTP Version 2 as specified in RFC-1119
19. [20]John Hay <jhay@icomtek.csir.co.za> IPv6 support and testing
20. [21]Dave Hart <davehart@davehart.com> General maintenance, Windows port interpolation rewrite
21. [22]Claas Hilbrecht <neoclock4x@linum.com> NeoClock4X clock driver
22. [23]Glenn Hollinger <glenn@herald.usask.ca> GOES clock driver
23. [24]Mike Iglesias <iglesias@uci.edu> DEC Alpha port
24. [25]Jim Jagielski <jim@jagubox.gsfc.nasa.gov> A/UX port
25. [26]Jeff Johnson <jbj@chatham.usdesign.com> massive prototyping overhaul
26. [27]Hans Lambermont <Hans.Lambermont@nl.origin-it.com> or [28]<H.Lambermont@chello.nl> ntpsweep
27. [29]Poul-Henning Kamp <phk@FreeBSD.ORG> Oncore driver (Original author)
28. [30]Frank Kardel [31]<kardel (at) ntp (dot) org> PARSE <GENERIC> (driver 14 reference clocks), STREAMS modules for PARSE, support scripts, syslog cleanup, dynamic interface handling
29. [32]Johannes Maximilian Kuehn <kuehn@ntp.org> Rewrote sntp to comply with NTPv4 specification, ntpq saveconfig
30. [33]William L. Jones <jones@hermes.chpc.utexas.edu> RS/6000 AIX modifications, HPUX modifications
31. [34]Dave Katz <dkatz@cisco.com> RS/6000 AIX port
32. [35]Craig Leres <leres@ee.lbl.gov> 4.4BSD port, ppsclock, Magnavox GPS clock driver
33. [36]George Lindholm <lindholm@ucs.ubc.ca> SunOS 5.1 port
34. [37]Louis A. Mamakos <louie@ni.umd.edu> MD5-based authentication
35. [38]Lars H. Mathiesen <thorinn@diku.dk> adaptation of foundation code for Version 3 as specified in RFC-1305
36. [39]Danny Mayer <mayer@ntp.org> Network I/O, Windows Port, Code Maintenance
37. [40]David L. Mills <mills@udel.edu> Version 4 foundation, precision kernel; clock drivers: 1, 3, 4, 6, 7, 11, 13, 18, 19, 22, 36
38. [41]Wolfgang Moeller <moeller@gwdgv1.dnet.gwdg.de> VMS port
39. [42]Jeffrey Mogul <mogul@pa.dec.com> ntptrace utility
40. [43]Tom Moore <tmoore@fivel.daytonoh.ncr.com> i386 svr4 port
41. [44]Kamal A Mostafa <kamal@whence.com> SCO OpenServer port
42. [45]Derek Mulcahy <derek@toybox.demon.co.uk> and [46]Damon Hart-Davis <d@hd.org> ARCRON MSF clock driver

43. [47]Rob Neal <neal@ntp.org> Bancomm refclock  
and config/parse code  
maintenance
44. [48]Rainer Pruy <Rainer.Pruy@informatik.uni-erlangen.de>  
monitoring/trap scripts, statistics file handling
45. [49]Dirce Richards <dirce@zk3.dec.com> Digital UNIX V4.0 port
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50. [54]Michael Shields <shields@tembel.org> USNO clock driver
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52. [56]Harlan Stenn <harlan@pfcs.com> GNU automake/autoconfigure  
makeover, various other bits (see the ChangeLog)
53. [57]Kenneth Stone <ken@sdd.hp.com> HP-UX port
54. [58]Ajit Thyagarajan <ajit@ee.udel.edu> IP multicast/anycast support
55. [59]Tomoaki TSURUOKA <tsuruoka@nc.fukuoka-u.ac.jp> TRAK  
clock driver
56. [60]Brian Utterback <brian.utterback@oracle.com> General codebase,  
Solaris issues
57. [61]Loganaden Velvindron <loganaden@gmail.com> Sandboxing  
(libseccomp) support
58. [62]Paul A Vixie <vixie@vix.com> TrueTime GPS driver, generic  
TrueTime clock driver
59. [63]Ulrich Windl <Ulrich.Windl@rz.uni-regensburg.de> corrected and  
validated HTML documents according to the HTML DTD
- 

## References

1. mailto:%20takao\_abe@xurb.jp
2. mailto:%20mark\_andrews@isc.org
3. mailto:%20altmeier@atlsoft.de
4. mailto:%20vbais@mailman1.intel.co
5. mailto:%20kirkwood@striderfm.intel.com
6. mailto:%20michael.barone@lmco.com
7. mailto:%20karl@owl.HQ.ileaf.com
8. mailto:%20greg.brackley@bigfoot.com
9. mailto:%20Marc.Brett@westgeo.com
10. mailto:%20Piete.Brooks@cl.cam.ac.uk
11. mailto:%20nelson@bolyard.me
12. mailto:%20Jean-Francois.Boudreault@viagenie.qc.ca
13. mailto:%20reg@dwf.com
14. mailto:%20clift@ml.csiro.au
15. mailto:%20casey@csc.co.za
16. mailto:%20Sven\_Dietrich@trimble.COM
17. mailto:%20dundas@salt.jpl.nasa.gov

18. mailto:%20duwe@immd4.informatik.uni-erlangen.de
19. mailto:%20dennis@mrbill.canet.ca
20. mailto:%20jhay@icomtek.csir.co.za
21. mailto:%20davehart@davehart.com
22. mailto:%20neoclock4x@linum.com
23. mailto:%20glenn@herald.usask.ca
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32. mailto:kuehn@ntp.org
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34. mailto:%20dkatz@cisco.com
35. mailto:%20leres@ee.lbl.gov
36. mailto:%20lindholm@ucs.ubc.ca
37. mailto:%20louie@ni.umd.edu
38. mailto:%20thorinn@diku.dk
39. mailto:%20mayer@ntp.org
40. mailto:%20mills@udel.edu
41. mailto:%20moeller@gwdgv1.dnet.gwdg.de
42. mailto:%20mogul@pa.dec.com
43. mailto:%20tmoore@fivel.daytonoh.ncr.com
44. mailto:%20kamal@whence.com
45. mailto:%20derek@toybox.demon.co.uk
46. mailto:%20d@hd.org
47. mailto:%20neal@ntp.org
48. mailto:%20Rainer.Pruy@informatik.uni-erlangen.de
49. mailto:%20dirce@zk3.dec.com
50. mailto:%20wsanchez@apple.com
51. mailto:%20mrapple@quack.kfu.com
52. mailto:%20jack@innovativeinternet.com
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60. mailto:%20brian.utterback@oracle.com
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 \* /Isof-4-85-zip/dialects/darwin/libproc/dproto.h  
 \* /Isof-4-85-zip/dialects/darwin/libproc/machine.h  
 \* /Isof-4-85-zip/dialects/darwin/libproc/dsock.c  
 \* /Isof-4-85-zip/dialects/darwin/libproc/dmnt.c  
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\* @(#)netdb.h 5.15 (Berkeley) 4/3/91

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\* /lsof-4-85-zip/scripts/list\_NULf.perl5  
\* /lsof-4-85-zip/scripts/shared.perl5  
\* /lsof-4-85-zip/scripts/list\_fields.perl  
\* /lsof-4-85-zip/scripts/ldrlogin.perl  
\* /lsof-4-85-zip/scripts/list\_fields.awk  
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\* /lsof-4-85-zip/tests/LTlock.c  
\* /lsof-4-85-zip/tests/LTnlink.c  
\* /lsof-4-85-zip/tests/LTbigf.c  
\* /lsof-4-85-zip/tests/LTszooff.c  
\* /lsof-4-85-zip/tests/LTsock.c  
\* /lsof-4-85-zip/tests/LTunix.c  
\* /lsof-4-85-zip/tests/LTnfs.c

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* /Isosf-4-85-zip/dialects/darwin/libproc/dproc.c
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/\*

\* GetOpt() -- Local get option

\*

\* Liberally adapted from the public domain AT&T getopt() source,  
 \* distributed at the 1985 UNIFORM conference in Dallas

\*

\* The modifications allow '?' to be an option character and allow  
 \* the caller to decide that an option that may be followed by a  
 \* value doesn't have one -- e.g., has a default instead.

\*/

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\* /Isof-4-85-zip/dialects/hpux/kmem/dnode2.c

\* /Isof-4-85-zip/dialects/aix/dnode1.c

\* /Isof-4-85-zip/dialects/uw/dlsof.h

\* /Isof-4-85-zip/dialects/uw/dnode2.c

\* /Isof-4-85-zip/dialects/uw/dproc.c

\* /Isof-4-85-zip/dialects/uw/dstore.c

\* /Isof-4-85-zip/dialects/uw/dfile.c

\* /Isof-4-85-zip/dialects/uw/dproto.h

\* /Isof-4-85-zip/dialects/uw/machine.h

\* /Isof-4-85-zip/dialects/n+os/dnode1.c

\* /Isof-4-85-zip/dialects/uw/dnode1.c

\* /Isof-4-85-zip/dialects/sun/dnode1.c

\* /Isof-4-85-zip/dialects/uw/dmnt.c

\* /Isof-4-85-zip/dialects/uw/dnode.c

\* /Isof-4-85-zip/dialects/uw/dsock.c

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\* /Isof-4-85-zip/dialects/n+obsd/dnode1.c

\* /Isof-4-85-zip/dialects/osr/dsock.c

\* /Isof-4-85-zip/dialects/darwin/kmem/dnode1.c

\* /Isof-4-85-zip/dialects/osr/machine.h

\* /Isof-4-85-zip/dialects/osr/dlsof.h

\* /Isof-4-85-zip/dialects/osr/dproto.h

\* /Isof-4-85-zip/dialects/osr/dstore.c

\* /Isof-4-85-zip/dialects/osr/dnode.c

\* /Isof-4-85-zip/dialects/hpux/kmem/dnode1.c

\* /Isof-4-85-zip/dialects/osr/dmnt.c

\* /Isof-4-85-zip/dialects/osr/dfile.c

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\* /lsof-4-85-zip/dialects/linux/dproto.h  
\* /lsof-4-85-zip/lib/ptti.c  
\* /lsof-4-85-zip/lib/dvch.c  
\* /lsof-4-85-zip/dialects/linux/dnode.c  
\* /lsof-4-85-zip/lib/rnch.c  
\* /lsof-4-85-zip/dialects/linux/dstore.c  
\* /lsof-4-85-zip/dialects/linux/dfile.c  
\* /lsof-4-85-zip/dialects/linux/dsock.c  
\* /lsof-4-85-zip/lib/rmnt.c  
\* /lsof-4-85-zip/lib/pdvn.c  
\* /lsof-4-85-zip/dialects/linux/machine.h  
\* /lsof-4-85-zip/lib/rdev.c  
\* /lsof-4-85-zip/lib/isfn.c  
\* /lsof-4-85-zip/lib/prfp.c  
\* /lsof-4-85-zip/lib/fino.c  
\* /lsof-4-85-zip/lib/cvfs.c  
\* /lsof-4-85-zip/lib/rnmh.c  
\* /lsof-4-85-zip/dialects/sun/dnode2.c  
\* /lsof-4-85-zip/lib/rnam.c  
\* /lsof-4-85-zip/lib/lkud.c  
\* /lsof-4-85-zip/dialects/linux/dproc.c  
\* /lsof-4-85-zip/dialects/linux/dmnt.c

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\* \$Id: pfsnode.h,v 1.1 1993/12/12 12:26:39 davidg Exp \$

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\* /Isof-4-85-zip/dialects/n+obsd/dproto.h

\* /Isof-4-85-zip/dialects/aix/dmnt.c

\* /Isof-4-85-zip/dialects/sun/dfile.c

\* /Isof-4-85-zip/dialects/sun/dmnt.c

\* /Isof-4-85-zip/dialects/hpux/kmem/dstore.c

\* /Isof-4-85-zip/dialects/aix/dlsof.h

\* /Isof-4-85-zip/store.c

\* /Isof-4-85-zip/dialects/sun/dproc.c

\* /Isof-4-85-zip/dialects/du/dproto.h

\* /Isof-4-85-zip/dialects/darwin/kmem/ddev.c

\* /Isof-4-85-zip/dialects/n+os/dnode.c

\* /Isof-4-85-zip/dialects/n+obsd/dlsof.h

\* /Isof-4-85-zip/dialects/du/dlsof.h

\* /Isof-4-85-zip/dialects/aix/dfile.c



- \* /Isof-4-85-zip/dialects/freebsd/dproc.c
- \* /Isof-4-85-zip/dialects/n+obsd/dstore.c
- \* /Isof-4-85-zip/dialects/n+os/dlsof.h
- \* /Isof-4-85-zip/dialects/aix/dnode.c
- \* /Isof-4-85-zip/dialects/du/dsock.c
- \* /Isof-4-85-zip/misc.c
- \* /Isof-4-85-zip/proc.c
- \* /Isof-4-85-zip/dialects/sun/machine.h
- \* /Isof-4-85-zip/dialects/darwin/kmem/dsock.c
- \*
- /Isof-4-85-zip/dialects/du/dproc.c
- \* /Isof-4-85-zip/dialects/darwin/kmem/machine.h
- \* /Isof-4-85-zip/dialects/darwin/kmem/dmnt.c
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- \* /Isof-4-85-zip/dialects/du/dnode.c
- \* /Isof-4-85-zip/dialects/hpux/kmem/machine.h
- \* /Isof-4-85-zip/dialects/freebsd/dmnt.c
- \* /Isof-4-85-zip/dialects/aix/dsock.c
- \* /Isof-4-85-zip/Isof\_fields.h
- \* /Isof-4-85-zip/dialects/aix/ddev.c
- \* /Isof-4-85-zip/dialects/aix/dstore.c
- \* /Isof-4-85-zip/arg.c
- \* /Isof-4-85-zip/dialects/hpux/kmem/dproc.c
- \* /Isof-4-85-zip/dialects/n+os/dstore.c
- \* /Isof-4-85-zip/dialects/sun/dlsof.h
- \* /Isof-4-85-zip/dialects/sun/dproto.h
- \* /Isof-4-85-zip/dialects/hpux/kmem/dmnt.c
- \* /Isof-4-85-zip/dialects/n+os/machine.h
- \* /Isof-4-85-zip/dialects/aix/dproc.c
- \* /Isof-4-85-zip/dialects/n+os/dsock.c
- \* /Isof-4-85-zip/dialects/darwin/kmem/dnode.c
- \* /Isof-4-85-zip/dialects/n+obsd/machine.h
- \* /Isof-4-85-zip/dialects/n+os/dproto.h
- \* /Isof-4-85-zip/dialects/aix/machine.h
- \*
- /Isof-4-85-zip/dialects/freebsd/machine.h
- \* /Isof-4-85-zip/dialects/du/dstore.c
- \* /Isof-4-85-zip/dialects/n+obsd/dmnt.c
- \* /Isof-4-85-zip/node.c
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- \* /Isof-4-85-zip/dialects/darwin/kmem/dlsof.h
- \* /Isof-4-85-zip/dialects/sun/ddev.c
- \* /Isof-4-85-zip/dialects/freebsd/dnode.c
- \* /Isof-4-85-zip/dialects/du/dmnt.c
- \* /Isof-4-85-zip/dialects/sun/dstore.c
- \* /Isof-4-85-zip/dialects/aix/dproto.h
- \* /Isof-4-85-zip/dialects/n+obsd/dnode.c

- \* /lsof-4-85-zip/dialects/sun/dsock.c
- \* /lsof-4-85-zip/dialects/freebsd/dsock.c
- \* /lsof-4-85-zip/dialects/freebsd/dstore.c
- \* /lsof-4-85-zip/dialects/du/machine.h
- \* /lsof-4-85-zip/dialects/n+os/dproc.c
- \* /lsof-4-85-zip/dialects/hpux/kmem/dnode.c
- \* /lsof-4-85-zip/dialects/darwin/kmem/dproc.c
- \* /lsof-4-85-zip/dialects/du/dfile.c
- \* /lsof-4-85-zip/proto.h
- \* /lsof-4-85-zip/dialects/darwin/kmem/dproto.h
- \* /lsof-4-85-zip/dialects/freebsd/dproto.h
- \* /lsof-4-85-zip/dialects/hpux/kmem/dsock.c
- \* /lsof-4-85-zip/dialects/sun/dnode.c
- \*
- /lsof-4-85-zip/lsof.h
- \* /lsof-4-85-zip/dialects/hpux/kmem/dproto.h
- \* /lsof-4-85-zip/dialects/n+obsd/dsock.c

No license file was found, but licenses were detected in source scan.

## Notes for the distribution of lsof version 4

```

| The latest release of lsof is always available via anonymous ftp |
| from lsof.itap.purdue.edu. Look in pub/tools/unix/lsof. |

```

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#### Dialects Supported

=====

Lsof (for LiSt

Open Files) lists files opened by processes on  
selected Unix systems. Version 4 is a source reorganization of

version 3, itself a major revision of version 2. Version 4 has been tested on:

AIX 5.3

Apple Darwin 9 and Mac OS X 10.[56]

FreeBSD 4.9 and 6.4 for x86-based systems

FreeBSD 8.[02] and 9.0 for AMD64-based systems

Linux 2.1.72 and above for x86-based systems

Solaris 9, 10 and 11

(The pub/tools/unix/Isf/contrib directory on Isf.itap.purdue.edu contains information on other ports.)

If your favorite Unix dialect is not in the list, or if your version of it is more recent than the ones listed, please contact me at <abe@purdue.edu>.

Version 3 of Isf was tested on:

AIX 3.2.5, 4.1.[1234], and 4.2

BSDI BSD/OS 2.0, 2.0.1, and 2.1 for x86-based systems

DC/OSx 1.1 for Pyramid systems

Digital UNIX (DEC OSF/1) 2.0, 3.0, 3.2, and 4.0

EP/IX 2.1.1 for the CDC 4680

FreeBSD 1.1.5.1, 2.0, 2.0.5, 2.1, 2.1.5 for x86-based systems

HP-UX 8.x, 9.x, 10.01, 10.10, and 10.20

IRIX

5.2, 5.3, 6.0, 6.0.1, and 6.[124]

Linux through 2.0.27 for x86-based systems

NetBSD 1.0, 1.1, and 1.2 for x86 and SPARC-based systems

NEXTSTEP 2.1 and 3.[0123]

OpenBSD 1.2 and 2.0 for x86-based systems

Reliant UNIX 5.43 for Pyramid systems

RISC/os 4.52 for MIPS R2000-based systems

SCO OpenServer Release 1.1, 3.0, and 5.0.x for x86-based systems

SCO UnixWare 2.1 and 2.1.1 for x86-based systems

Sequent PTX 2.1.[1569], 4.0.[23], 4.1.[024], 4.2.[1], and 4.3

Solaris 2.[12345], 2.5.1, and 2.6-Beta

SunOS 4.1.x

Ultrix 4.2, 4.3, 4.4, and 4.5

Version 3 and its predecessor, version 2, may be found at:

<ftp://Isf.itap.purdue.edu/pub/tools/unix/Isf/OLD>

## How Lsof Works

=====

Using available kernel data access methods -- `getproc()`, `getuser()`, `kvm_*`(), `nlist()`, `pstat()`, `read()`, `readx()`, `/proc` -- `lsof` reads process table entries, task table entries, user areas and file pointers to reach the underlying structures that describe files opened by processes.

### Lsof interprets

most file node structures -- `advfsnodes`, `autonodes`, `cnodes`, `cdnodes`, `devnodes`, `fifonodes`, `gnodes`, `hsnodes`, `inodes`, `mfsnodes`, `pcnodes`, `procnodes`, `rnodes`, `snodes`, `specnodes`, `s5inodes`, `tmpnodes`. It understands NFS connections. It recognizes FIFOs, multiplexed files, Unix and Internet sockets. It knows about streams. It understands `/proc` file systems for some dialects. On many dialects it recognizes execution text and library references. It knows about AFS on some Unix dialects.

### Lsof Output

=====

The `lsof` output describes:

- \* the identification number of the process (PID) that has opened the file;
- \* the process group identification number (PGID) of the process (optional);
- \* the process identification number of the parent process (PPID) (optional);
- \* the command the process is executing;
- \* the owner of the process;
- \* for all files in use by the process, including the executing text file and the shared libraries it is using:
  - \* the file descriptor number of the file, if applicable;
  - \* the file's access mode;
  - \* the file's lock status;

- \* the file's device numbers;
- \* the file's inode number;
- \* the file's size or offset;
- \* the name of the file system containing the file;
- \* any available components of the file's path name;
- \* the names of the file's stream components;
- \* the file's local and remote network addresses;
- \* the TLI network (typically UDP) state of the file;
- \* the TCP state, read queue length, and write queue length of the file;
- \* the file's TCP window read and write lengths (Solaris only);
- \* other file or dialect-specific values.

## Getting Started Quickly

=====

If you want to get started using `lsof` quickly, or see some examples of how `lsof` can be used, consult the `00QUICKSTART` file of the `lsof` distribution.

The `00QUICKSTART` file won't help you build or install `lsof`, but it will cut

through the density of the `lsof` man page, giving you more readily an idea of what you can do with `lsof`.

For information on building and installing `lsof`, consult the `00README` file of the `lsof` distribution.

## Limiting, Filtering, and Selecting `lsof` Output

=====

`lsof` accepts options to limit, filter, and select its output.

These are the possible criteria:

- \* Process ID (PID) number -- to list the open files for a given process;
- \* Process Group ID (PGID) -- to list the open files for all the processes of a given process group;
- \* User ID number or login name -- to list the open files for all the processes of a given user;
- \* Internet address -- to list the open files using a given Internet address (host name), protocol, or port (number or name); or to list all open Internet files;
- \* command name;
- \* file descriptor name or number;
- \* list all open NFS files;
- \* list all open Unix domain socket files;
- \* list all uses of a specific file;
- \* list all open files on a file system.

Selection options are normally ORed -- i.e., an open file meeting any of the criteria is listed. The selection options may be ANDed so that an open file will be listed only if it meets all the criteria.

In the absence of any selection criteria, lsof lists files open to all processes.

#### Parsing Lsof Output with Another Program

=====

The lsof -F option directs it to produce "field" output that can easily be parsed by another program. The lsof distribution contains sample awk, perl 4, and perl 5 scripts in its scripts subdirectory that show how to post-process field output.

#### Repeat Mode

=====

Lsof can be directed to produce output, delay for a specified time,



then repeat the output, cycling until stopped by an interrupt or quit signal. This mode is useful for monitoring the status of some file operation -- e.g., an ftp transfer or a tape backup operation.

Repeat mode is more efficient when combined with lsof's selection options, since they limit lsof overhead.

It's possible to use lsof's field output options to supply repeat mode output to another process for its manipulation. The scripts subdirectory of the lsof distribution has sample Perl scripts showing how to consume lsof repeat mode output from a pipe.

#### Distribution Restrictions

=====

Lsof may be used and distributed freely, subject to these limitations:

1. Neither the author nor Purdue University is responsible for any consequences of the use of this software.
2. The origin of this software must not be misrepresented, either by explicit claim or by omission. Credit to the author and Purdue University must appear in documentation and sources.
3. Altered versions must be plainly marked as such, and must not be misrepresented as being the original software.
4. This notice may not be removed from or altered in the lsof source files.

#### Cautions

=====

Lsof is a tool that is closely tied to the Unix operating system version. It uses header files that describe kernel structures and reads kernel structures that typically change from OS version to OS version.

DON'T TRY TO USE AN LSOF BINARY, COMPILED FOR ONE UNIX OS VERSION, ON ANOTHER.

On some Unix dialects, notably SunOS and Solaris, lsof versions may be even more restricted by architecture type. An lsof binary, compiled for SunOS 4.1.3 on a sun4c machine, for example, won't work on a sun4m machine.

AN LSOF BINARY, COMPILED FOR ONE SOLARIS 1.X ARCHITECTURE, ISN'T  
GUARANTEED TO WORK ON A DIFFERENT SOLARIS 1.X ARCHITECTURE.

## Distribution Contents

=====

The lsof distribution is checked for completeness when it is constructed and by the Inventory script when you run the Configure script. (See The Inventory Script section of the 00README file of this distribution.)

Lsof is organized in these parts:

- \* The main lsof directory, containing common sources, configuration and setup scripts and three subdirectories: dialects/, lib/, and scripts/.

Lsof is compiled in the main lsof directory after configuration. The selected dialect sources are copied or linked from the specified subdirectory. (Symbolic linking is the standard method.)

Common lsof definitions may be found in lsof.h; common function prototypes, proto.h; and common storage, store.c.

- \* The dialects/ subdirectory contains subdirectories with sources specific to UNIX dialect implementations -- e.g., the dialects/sun/ subdirectory contains sources for the SunOS (Solaris 1.x) and Solaris (2.x) implementations of lsof. The dialects subdirectories also contain Makefiles and scripts for assisting dialect source configuration.

Dialect configuration definitions may be found in dlsof.h; other dialect definitions, dlsof.h; dialect prototypes,

dproto.h; and dialect storage, dstore.c.

- \* The lib/ subdirectory contains sources for common lsof functions. Not all dialects use the functions -- some have their own versions of them. The lib/ functions are enabled and customized with #define's in the dialect machine.h header files.

- \* The scripts/ subdirectory contains sample scripts for processing lsof field (-F) output. The scripts are written

in AWK, Perl 4, and Perl 5.

The 00PORTING file of the lsof distribution has more information on lsof components, configuration, and construction.

#### Warranty

=====

Lsof is provided as-is without any warranty of any kind, either expressed or implied, including, but not limited to, the implied warranties of merchantability and fitness for a particular purpose. The entire risk as to the quality and performance of lsof is with you. Should lsof prove defective, you assume the cost of all necessary servicing, repair, or correction.

#### Bug

##### Reports

=====

Now that the obligatory disclaimer is out of the way, let me hasten to add that I accept lsof bug reports and try hard to respond to them. I will also consider and discuss requests for new features, ports to new dialects, or ports to new OS versions.

PLEASE DON'T SEND A BUG REPORT ABOUT LSOF TO THE UNIX DIALECT VENDOR.

At worst such a bug report will confuse the vendor; at best, the vendor will forward the bug report to me.

Please send all bug reports, requests, etc. to me via email at <abe@purdue.edu>.

#### The lsof-l Mailing List

=====

Information about lsof, including notices about the availability of new revisions, may be found in mailings of the lsof-l listserv. For more information about it, including instructions on how to subscribe, read the 00LSOF-L file of the lsof distribution.

#### Version 3 Release Notes

=====

See 00DIST in the last lsof 3 revision 3.88, for its complete set of release notes. Lsof revision 3.88 may be found at:

<ftp://lsof.itap.purdue.edu/pub/tools/unix/lsof/OLD>

3.0 May 24, 1994

This is the first official release of lsof 3.

...

3.88 February 17, 1997

```
+=====+
| This is the last version 3 revision. |
+=====+
```

Added documentation files -- 00.README.FIRST[\_<version>]  
and 00RELEASE.SUMMARY\_<version> -- to the distribution.

What's new in Version 4

=====

The main goal of version 4 was to eliminate the confusing common/fragment source file technique. Changing the version number also provided an opportunity to restart the numbering, which at 3.88 had risen to a large value.

The sources that appeared in the dialects/common subdirectory of version 3 in fragment files have been incorporated into the version 4 liblsof.a library as \*.c files. This results in significant changes to many source files, scripts, and Makefiles of all dialect versions. It allows elimination of some source files -- ddev.c, dfile.c, dmnt.c -- for dialects now obtaining functions from liblsof.a that formerly came from making dialect source files by combining fragment files.

The version 4 liblsof.a sources are stored in the lib/ subdirectory of the main lsof directory. The liblsof.a functions are activated and conditioned in their source files by values #define'd in the dialect dlsof.h and machine.h header files.

Dialects that provide a private version of a library function refrain from #define'ing the symbol that would activate the library function code.

## Version 4 Release Notes

=====

4.0 February 24, 1997

+=====+  
| This is the first lsof 4 revision. |  
+=====+

Reorganized sources: eliminated code fragment files  
and created a library in their place. Modified or  
deleted many dialect source and header files.  
Changed documentation accordingly.

Added a warning to sgi/Makefile and 00FAQ that  
advises  
against using the IRIX C compiler -n32 option when  
compiling lsof. Thanks go to Peter Ilieve  
<peter@memex.co.uk> for bringing this to my attention.

Dropped IRIX 5.2 in mid-stream, because my 5.2 test  
system was upgraded to 5.3.

4.01 March 3, 1997

Added TFS support for Pyramid dialects.

Added test to Configure and to the IRIX dnode.c  
for the different cnode struct that appears in  
<cache/fs/cache/fs.h> on the 6.2 IMPACT distribution.  
Heddy Boubaker <boubaker@amfou.cenatls.cena.dgac.fr>  
alerted me to the cnode change and helped test this  
lsof adjustment.

Shut down the lsof child process before doing a -r  
sleep(). A comment from Dan Mercer <dam@mmm.com>  
prompted this.

4.02 March 21, 1997

Based on a report from Pasi Kaara <Pasi.Kaara@atk.tpo.fi>,  
disabled HP-UX CCIT support in lsof for HP-UX  
versions 10 and above. Pasi's report also led to  
changes in the HP-UX machine.h to support use of  
gcc to compile lsof for HP-UX 10.20 and warnings  
against  
using `cc -Aa` or `gcc -ansi` to compile  
lsof under HP-UX 10.x.

With help from Richard Allen <ra@hp.is> taught HP-UX 10.x lsof to name file systems better by using the virtual file system device number. Elias Halldor Agustsson <elias@rhi.hi.is> provided a test system.

Changed NEXTSTEP and UNIXWARE Makefiles to use safer quoting when generating version.h. The change was suggested by Bob Farmer <ucs\_brf@unx1.shsu.edu>.

Added SHELL=/bin/sh string to all Makefiles.

Added support for Linux 2.1.28 on a test system, kindly provided by Jonathan Sargent <sergent@purdue.edu>. Configure tests the Linux 2.1.x's C library lseek() function for proper handling of kernel offsets. If lseek() appears suspect, Configure activates the use of a private lseek() function. Changed the private nlist() function to nlist\_private() and taught it to use the query\_module() syscall in place of the deprecated get\_kernel\_syms() one. Added rudimentary AX.25 support for Pierfrancesco Caci <ik5pvx@infogroup.it> who helped test it. Updated the old get\_kernel\_syms() code to recognize and skip module name entries.

Prompted by Marty Leisner <leisner@sdsp.mc.xerox.com>, eased the requirement that service name lookup for the -i option be accompanied by a protocol name. The name is not needed if both TCP and UDP names yield the same port number.

Added xusers.awk script from Dan Mercer <damercer@mmm.com> to the distribution scripts/ subdirectory.

Changed Configure script to use LSOF\_VERS for all UNIX dialect version numbers and to pass LSOF\_VERS to the dialect Mksrc functions. Also added the ability for a dialect stanza to declare a different dialect Makefile source. Modified dialect Mksrc files -- e.g., linux and sun -- accordingly.

Added support for BSD/OS 3.0 with help from Jim Reid <jim@mpn.cp.philips.com>. Terry Kennedy <TERRY@spcvxa.spc.edu> kindly provided a test system. During the port corrected

a bug that  
prevented proper handling of revoked files.

#### 4.03 April 7, 1997

At the suggestion of Dan Mercer <damercher@mmm.com>, made HP-UX building of lsof aware of differences between the HP-UX bundled and unbundled C compilers.

Added the ability for the lsof builder to define the default warning message issuance state. By default the issuance of warning messages is disabled; defining WARNINGSTATE in machine.h disables it. The Customize script was updated to handle WARNINGSTATE. Dan Mercer suggested this.

Eliminated compiler complaint about improperly cast get\_NL\_value() argument in ncache\_load() in lib/rnch.c.

Corrected zeromem() argument error in SCO dproc.c.  
Sped up parent directory cache lookup slightly.

Updated for PTX 4.4, including additional VxFS (EFS) file system support.

#### 4.04 April 17, 1997

At the suggestion of Bela Lubkin <belal@sco.COM> changed device cache handling to be more tolerant of a device cache file whose [cm]times are older than the ones on /dev or /devices. The change required adding information to Solaris device cache file clone lines, so the first time lsof 4.04 is run under Solaris it will complain about a bad cached clone device in a previous device cache file, then regenerate it.

Added boot file path detection for SCO OSR 5 and above, based on information supplied by Bela.

Fixed two bugs in DEC OSF/1 lsof -- an error in reporting locks and a missing continue statement in readdev() after a failure to open a directory. Jan Ole Suhr <josuhr@informatik.tu-clausthal.de> reported the second bug and supplied a fix.

Fixed XFS problems with IRIX 6.2 by abandoning the idea that SGI will distribute XFS header files and defining an lsof-private xfs\_inode structure. John

Paul Morrison <John.Paul.Morrison@MultiActive.com>  
helped develop and test the 5.3 definition. John  
R. Vanderpool <fish@daacdev1.gsfc.nasa.gov> helped  
develop and test the 6.2 definition.

Remove  
obsolete comments about common/\*.frag files.

Updated Linux lsof for Linux version 2.1.35.

4.04 April 18, 1997

Supplement Regenerated the 4.04 distribution to correct a non-  
device-cache #define misplacement in the Solaris and  
SunOS dlsof.h. Alexandre Oliva <oliva@dcc.unicamp.br>  
reported the problem.

4.05 April 24, 1997

Corrected an error in 00DCACHE.

Made sure SCO /etc/ps/booted.systems is closed.

Based on an observation by Bela Lubkin <belal@sco.COM>  
that the lsof child had needless file descriptors  
open, closed all but the open pipes between the  
lsof parent and child.

Decommissioned CDC EP/IX support; I no longer have a  
test system.

Based on a suggestion from Patrick Connor  
<connor@phreak.csd.sgi.com>, added -xansi to CFLAGS  
for IRIX 5.3 and 6.[234].

Also at Patrick's suggestion changed Configure to  
propagate exact SunOS 4.1.x version to the main  
and library Makefiles. This allowed the sunos413  
and sunos413cc Configure abbreviations  
to be  
shortened to sunos and sunoscc.

Updated obsolete argument uses (-H changed to -n)  
in count\_pf.perl\* and watch\_a\_file.perl scripts.

Adjusted Solaris 2.6 lsof for Beta\_Update with tips  
from Casper Dik <casper@holland.Sun.COM>.

Fixed a Solaris 2.4 TCP address reporting bug.



#### 4.06 April 30, 1997

Added a step to the Makefile clean rules that does a make clean in the lib subdirectory; suggested by Casper Dik <casper@holland.Sun.COM>. (Configure's -clean argument already did this.)

Fixed an incorrect awk argument in the sunos\*)  
Configure stanza, reported by Alexandre Oliva <oliva@dcc.unicamp.br>.

Added CD9660 (aka ISO) file system support to FreeBSD, NetBSD, and OpenBSD with mods and help from Kenneth Stailey <kstailey@disclosure.com>. (BSDI already had CD9660 support.) While at it, added file descriptor system support to BSDI and FreeBSD.

Added /kern file system support to OpenBSD. The support wasn't extended to BSDI, FreeBSD, or NetBSD, because it requires Kenneth Stailey's changes to /sys/miscfs/kernfs/kernfs.h.

Updated IRIX 6.3 support after getting access to a test system, provided by John Paul Morrison <John.Paul.Morrison@MultiActive.com>. Improved the handling of IRIX 5.1 and greater FIFOs.

#### 4.07 May 12, 1997

Based on AIX problem reports from David Capshaw <David.Capshaw@SEMATECH.Org>, changed the aix\* Configure script stanza to avoid -bnolibpath for gcc (which the GNU loader doesn't grok) and AIX below 4.1.4 (where -bnolibpath hasn't been tested or is known to be unimplemented), and to refuse to use gcc for compiling lsof in AIX versions below 4.1 (because of possible structure alignment problems). Updated 00FAQ appropriately.

Added OpenBSD support for EXT2FS. This support has yet to be tested.

Tested lsof under OpenBSD 2.1.

Activated /kern file system support for NetBSD when Configure senses that /sys/miscfs/kernfs/kernfs.h defines the kern\_target

structure. This support has not been tested under NetBSD, although it has been tested under OpenBSD.

Made some simple changes to the BSDI machine.h, suggested by Jeffrey C. Honig <jch@bsd.com>.

Improved handling of alternate dialect Configure abbreviations -- aix and aixgcc, hpux and hpuxgcc, solaris and solariscc, and sunos and sunoscc.

#### 4.08 May 23, 1997

Cleaned up dialect Makefile's, starting with a suggestion from Christopher Schanzle <chris@cam.nist.gov>.

Improved Configure's -clean processing.

Corrected bugs in Solaris lock reporting.

Changed NetBSD Configure stanza to put -I/usr/include before -I/sys.

#### 4.09 June 1, 1997

Adjusted for latest FreeBSD 3.0 release. This required adding a new kernel name cache module for reading BSD-form hashed kernel name cache entries, rnmh.c, to the lsof library, and adding a #define to each machine.h to select it.

Activated rnmh.c for BSDI 2.1, BSDI 3.0, NetBSD 1.2, and OpenBSD 2.1.

#### 4.10 June 8, 1997

Adjusted for Linux 2.1.x (x > 35) kernels with hashed task structure pointers. Marty Leisner <leisner@sdsp.mc.xerox.com> and Jonathan Sergent <sergent@io.com> tested the adjustment.

Replaced readdev() stat() calls with lstat() to reduce device table and cache entries with the same device number and inode values. Added code to remove all remaining duplicates. This fixes a Linux problem reported by Jonathan Sergent and makes device node name output predictable.

Corrected a bug in UnixWare stream file handling that prevented searching for the stream file by

its associated character device name.

Added Pyramid code to determine Reliant UNIX clone major device number differently from that of DC/OSx.

#### 4.11 June 12, 1997

Changed Configure to sense that the PTX `inp_[fl]addr` members of the `inpcb` structure of `<netinet/in_pcb.h>` have a struct type and set `HASINADDRSTR` for use in `PTX dnode.c` and `dsock.c` tests.

Changed PTX version 4.1.4 tests to use 4.1.3 instead.

Carson Wilson `<carson@mcs.com>` reported the need to do this and tested the change.

Fixed a block device table indexing bug in `lib/rdev.c`, reported by Carson Wilson. The same bug was squashed in `pyramid/ddev.c`.

Added code to the Pyramid Reliant UNIX `kread()` function to compensate for an address boundary error in the kernel's `/dev/kmem` driver.

Verified that `lsof` compiles and works under AIX 4.2.1. Added an AIX test for the presence of NFS header files, defined `HAS_NFS` and adjusted AIX dialect sources accordingly.

Based on a suggestion from Gaylord Holder `<holder@phy.ucsf.EDU>`, added DEC OSF/1 code to auto-detect the booted file, whence kernel symbol addresses are obtained.

#### 4.12 June 24, 1997

Corrected a device number sign extension problem in the reading and writing of device cache file.

The problem was reported by Bela Lubkin `<belal@sco.com>` and he suggested a fix.

Fixed an SCO stream device lookup problem. The report and solution came from Bela Lubkin

Enhanced the `Configure` script to enable cross-configuration of `lsof`, based on suggestions from Marty Leisner `<leisner@sdsp.mc.xerox.com>`. A new documentation file, `00XCONFIG`, describes the process.

Made Pyramid OBJFS support conditional on the presence of supporting header files. Corrected the Pyramid MkKernOpts script so it generates the necessary -D's for the Nile/Jolt architecture. Richard Coley <rcoley@pyra.co.uk> helped.

Added another IRIX xfs\_inode variant for 6.2, 32 bits, no XFS rollup patch.

Tested under UnixWare 2.1.2.

#### 4.13 July 9, 1997

Taught Pyramid lsof to grok ttyfs vnodes with help from Richard Coley <rcoley@pyra.co.uk>. Fixed some minor bugs in Pyramid FIFO reporting. Eliminated use of the Pyramid UCB compatibility library at Richard's suggestion.

Eliminated reporting of "strange" inode numbers for SCO OSR 3.2v5.0.x HPPS files with help from Bela Lubkin <belal@sco.com>

#### Modified

port to service name lookup to use a small number of getservbyport() calls before reading the entire map with getservent(). Changed port reporting to represent a zero as '\*' to be consistent with other prt number reporting tools like netstat. Casper Dik <casper@holland.Sun.COM> suggested these changes -- the getserv\*() one to improve performance for large NIS service name maps.

Changed all readdev() functions to make the absence of block devices a warning instead of a fatal error after Brian Redman <ber@ms.com> reported his IRIX 6.4 system had no block devices. (It really did have block devices, but readdev()'s lstat() use caused it to miss them in a directory symbolically linked from /dev/dsk->/hw/disk.) Fixed Brian's real problem by changing the IRIX readdev() to use stat() on /dev nodes if a Configure test shows /hw is readable. Extended the potential to do the same to all readdev() functions.

For consistency and convenience changed some Configure

abbreviations and dialect subdirectory  
names: "decof" abbreviation and "osf" dialect  
subdirectory name to "du"; "netbsd" dialect  
subdirectory name to "n+obsd"; "next3" abbreviation  
and "next" dialect subdirectory name to "ns"; "sco"  
abbreviation and dialect subdirectory name to "osr";  
"sgi" dialect subdirectory name to "irix"; and  
"unixware" abbreviation and dialect subdirectory  
name to "uw".

Added #if/#endif clauses to the AIX rmdupdev()  
function to avoid clone processing for AIX versions  
less than 4.1.4. The problem was reported by Toralf  
Foerster <toralf.foerster@io-warnemuende.de>, who  
supplied corrective code.

Added support for new style NetBSD inode with i\_ffs  
and i\_e2fs union members.

Improved Configure and 00FAQ information on Digital  
UNIX configuration subdirectory with suggestions  
from Brad Krebs <brad@EECS.Berkeley.EDU>.

#### 4.14 July 22, 1997

Reorganized the Solaris handling of the inode  
structure header file, ufs\_inode.h,  
to eliminate  
VxFS structure definition conflicts for Solaris  
2.4, based on information from Greg Earle  
<earle@netbsd4me.jpl.nasa.gov>.

Cleaned up some typos and confusion in Configure's  
help output, based on comments from Bela Lubkin  
<belal@sco.com>

Added a 00DIALECTS file, containing UNIX dialect  
version numbers, that can be used by Configure and  
the man page.

#### 4.15 August 15, 1997

Aligned `Configure -help` output better. Removed  
Configure's 2.6 Beta test adjustments.

Added improved Solaris VxFS configuration and  
handling, based on information from Greg Earle  
<earle@netbsd4me.jpl.nasa.gov>.

Added socket state -- TCO or TPI -- for socket

files at the suggestion of Ian Fitchet  
<I.D.Fitchet@ftel.co.uk>.

#### 4.16 September 25, 1997

Added reporting of TCP/TPI queue lengths and window sizes ala netstat to NAME column. Added -T option to select or de-select TCP/TPI info reporting. (Window sizes are only reported for Solaris.)  
Fixed anomalies along the way in SIZE/OFF processing for some dialects.

Fixed service name argument processor to allow minus signs as part of the name. Consequently this disallows names with embedded minus signs from being specified as the start of a range.

Added 00FAQ entries explaining why lsof won't find a file being edited with vi, why window sizes aren't reported for all dialects, and what the "no more information" message means.

Forced Pyramid CC to be /usr/ccs/bin/cc to avoid accidental use of the BSD variant in /usr/ucb/cc.

Added support for Linux glibc2, including a Configure test; cross-Configure support (00XCONFIG); and much unfortunate and risky sleight-of-hand in lsof Linux dialect header and source files, forced upon lsof by incompatibilities between Linux kernel and glibc2 header files.

Included in scripts/identd.perl5 a Perl 5 implementation of an identd server, using lsof, provided by Kapil Chowksey <kchowksey@hss.hns.com>.

Updated  
IRIX 6.4 xfs\_inode guess.

#### 4.17 October 14, 1997

Added -V option for verbose search result reporting. Verbose reports are prepared for failure to locate file names, command names, Internet addresses or files, login names, NFS files, PIDs, PGIDs, and UIDs.

Augmented Linux NFS file test to cope with kernels whose NFS code is in a loadable module. Need for the test was pointed out by Jonathan Sergeant

<sergent@csociety.ecn.purdue.edu>. The change required that Linux have private dmnt.c source,

Completed a Linux 2.1.57 port on a system provided by Jonathan Sergent.

4.18 October 25, 1997

Eliminated memory leaks in alloc\_lfile(), lkup\_port(), and NEXTSTEP's process\_text() function.

Added recognition of OpenBSD 2.2 in Configure, supplied by Kenneth Stailey <kstailey@disclosure.com>.

Consolidated print\_file() functions to use the one in lib/prtf.c. Made it configurable and changed it to size print columns dynamically.

!!! WARNING !!!

WITH

DYNAMICALLY SIZED PRINT COLUMNS LSOF 4.18

PRODUCES OUTPUT SIGNIFICANTLY DIFFERENT FROM THAT OF PREVIOUS REVISIONS. LINES ARE GENERALLY SHORTER AND THERE IS GENERALLY LESS BLANK SPACE BETWEEN COLUMNS AND THE ITEMS IN THEM. THERE ARE NO LONGER ANY SPACES BETWEEN DEVICE NUMBER ELEMENTS, ONLY COMMAS.

!!! WARNING !!!

Added special types and print specification modifiers for file size and offset to handle UNIX dialects with 64 bit sizes and offsets. Paul Eggert <eggert@twinsun.com> reported the need for this addition.

With Paul Eggert's help picked lint from the lsof library, the main level lsof sources, and the Sun dialect sources.

Added documentation, including the file 00LSOF-L, about the lsof-l LISTSERV.

Added support for Reliant UNIX on the RM600. Bob Passarella <rmpassar@pyramid.com> supplied the changes. Kevin Smith <kevin@pyramid.com> helped arrange test systems. While incorporating Bob's changes, modified lib/rnch.c to handle kernel

ncache

structs whose name is accessed via a char \*, rather than in a char array.

Changed #include order of <sys/socketvar.h> for Solaris 2.x. W. Richard Stevens <rstevens@kohala.com> pointed out the need to do this.

4.19 October 30, 1997

Changed Pyramid Reliant RM600 proc scan to skip SSYS (p\_flag) processes, since they don't seem to have a readable u\_cdir vnode.

Enabled Pyramid Reliant UNIX kread() work-around for DC/OSx, too, since its read(/dev/kmem) kernel driver seems to share the page boundary bug this work-around circumvents.

Changed SzOffFtm\_d and SzOffFtm\_dv (new formats at 4.18 to print size and offset) from signed to unsigned. Setting them signed at 4.18 was an oversight.

Plugged a memory leak that caused the loss of 130 bytes per repeat-mode pass. Fixed it with a simple work-around in main(). Lionel Cons <Lionel.Cons@cern.ch> reported the leak.

4.20 November 11, 1997

Tested under BSDI 3.1.

Added support for Reliant UNIX Mesh IPC files with help from Billy Ho <bho@pyramid.com>.

Added support to Digital UNIX lsof that uses the libmsfs tag\_to\_path() function (when it exists) to look up AdvFS path names. The idea and sample code came from Dean Brock <brock@cs.unca.edu>. Converted Dean's code into more general purpose support for private name cache lookups via the HASPRIVNMCACHE #define in the dialect machine.h file and code conditional on it in the printname() function.

Taught Digital UNIX lsof to recognize NFS3 file systems. Corrected Digital UNIX lsof DEVICE column alignment.



#### 4.21 December 1, 1997

Squashed bug, introduced at revision 4.18, that resulted in double reporting of each selected PID when terse mode (-t) was specified.

Corrected minor bug, also introduced at 4.18, that might cause an extra `print_proc()` pass when one PID has been specified.

Added -R to `lsnf` options in `scripts/ldrlogin.perl*`. The option should have been there -- it was supposed to be mandatory for PGID reporting -- but a bug, corrected in revision 4.18, previously made -R unnecessary.

Enabled configuring for BSDI BSD/OS 4.0 per a suggestion from Jeff Honig <jch@bsd.com>.

Enabled replacement of `scoff_t` with `off64_t` (`scoff_t` is used to type `r_size` and `r_localsize` in the `rnode` struct) for IRIX 5.3 systems that have the NFS kernel rollup patch (1477). This compensates for SGI's failure to distribute an updated `<sys/fs/rnode.h>` with their patch.

Validated under Linux 2.0.3[12], Linux 2.1.64, and NetBSD 1.3.

Added FreeBSD root directory reporting, courtesy of Dan Nelson <dnelson@emsphone.com>.

#### 4.22 December 15, 1997

Made adjustments for Linux 2.1.7[02].

Improved NAME information for Linux UNIX domain sockets.

Added option `+|-M` to control the reporting of portmapper registration information in square brackets after the TCP or UDP port or service name. Kenneth Stailey <kstailey@disclosure.com> suggested the feature and provided sample code from OpenBSD. Reporting is disabled by default in the distribution and may be enabled with `+M`; if `lsnf` is compiled with `HASPMAPENABLED` (e.g., from `machine.h`), reporting will be enabled by default and can be disabled with

-M.

Changed the -w option to +/-w to match the syntax of the +/-M option and to eliminate any options that flip meaning when a symbol is defined at compile time. For both +/-M and +/-w, specifying '-' when the default state is disabled or specifying '+' when the default state is enabled causes no problems.

!!!WARNING The -w option has changed in lsof 4.22. WARNING!!!

Made the +/- prefix legal for most options, but didn't document it in the man page or help panel. Most options that disable something -- e.g., -b, -C, -n, -P -- now disable when the prefix is '-' and enable when it is '+'. Since the states these options disable are enabled by default, I chose to avoid documentation complexity and confusion by not mentioning that they can be used with the '+' prefix.

Condensed the help panel.

Made sure Digital UNIX Configure stanza puts normal include path (e.g., /usr/include) before system include paths.

Added IPX socket information reporting to Linux with help from Jonathan Sergent <sergent@purdue.edu>.

4.23 January 16, 1998

Fixed conflict arising from the quondam replacement of the Sun Solaris <netdb.h> with a BIND/BSD version.

With help from Jonathan Sergent <sergent@purdue.edu> developed a /proc file system based Linux lsof. It needs some Linux 2.1.x release to work -- I'm not sure which, but I tested under 2.1.72, 2.1.76, and 2.1.79. The Configure script selects special sources for this lsof, so the full lsof distribution now contains both /dev/kmem and /proc based sources for Linux lsof. An optional kernel mod, written by Jonathan, enhances the /proc-based lsof ability to recognize IPX socket files. Reorganized and augmented

the Linux sections in 00FAQ to explain  
the two types of Linux lsof.

Defined DOSTAT\_FUNCTION for dostat() in misc.c to  
select the function, stat() or lstat(), it will use.  
DOSTAT\_FUNCTION is normally undefined, defaults to  
lstat(), and is only defined for the /proc-based  
Linux lsof in its dlsof.h.

Made conditional on the presence of IRIX 6.4 XFS  
rollup patch #6 an XFS node change introduced in  
revision 4.16. Identified the patch with help  
from John R. Vanderpool <fish@daacdev1.gsfc.nasa.gov>.

Added NFS node compensation for NetBSD 1.3. The  
code and suggestion for it was supplied by Jean-Luc  
Richier <richier@imag.fr>.

Added diagnostic messages to the /dev/kmem-based  
Linux Mksrc script to report errors during the  
construction of the kernel name cache header file,  
kncache.h. Added 00FAQ information on kncache.h.

Added a new Linux test host, running 2.0.33 and  
Glibc, provided by Steve Logue <stevel@mail.cdsnet.net>.

Ported to PTX 4.1.3  
and 4.4.2. Adjusted lib/rnch.c  
for 4.4.2 to allow customization of additional ncache  
struct element names.

4.24 January 28, 1998

Changed /proc-based Linux lsof offset test to use "/"  
instead of "/etc/passwd".

To assist Jim Mintha <jim@geog.ubc.ca> with the  
packaging of lsof for Debian Linux, added a  
DEBIAN\_LINUX\_LSOFS #define to trigger the activation  
of special system map file location code in the  
/dev/kmem-based dproc.c.

Applied modification to dialects/bsd/dlsof.h from  
Ingimar Robertson <iar@skyrr.is>, enabling lsof to  
compile for BSDI BSD/OS 2.0.

Corrected a documentation error in 00DCACHE, pointed  
out by Thomas Anders <anders@hmi.de>. The error was  
created when the -V option was added at lsof 4.17.

Made IRIX 5.3 through 6.3 lsof aware of IRIX SCSI tape devices (e.g., /dev/tape). Dave Olson of SGI and Randolph J. Herber of FNAL provided valuable advice, and Igor Schein <ischein@air-boston.com> helped test.

Added a machine.h symbol (NEVER\_HASDCACHE) that prevents Customize from offering to change HASDCACHE. The symbol may appear anywhere in machine.h -- e.g., in a comment. Included the symbol in a comment of the HASDCACHE section of the /proc-based Linux lsof machine.h, and accompanied it with warnings against #define'ing HASDCACHE. Did the same thing for WARNDDEVACCESS (NEVER\_WARNDEVACCESS is the suppressant.)

4.25 February 7, 1998

Corrected an IRIX mis-cast of file offset (position). Igor Schein <ischein@air-boston.com> reported the problem. This was offered as a patch to 4.24. Picked some lint Igor pointed out.

At Igor's suggestion added an optional decimal digit size argument to the -o option. This argument specifies how many file offset decimal digits can follow "0t" before lsof switches to a "0x..." form. The argument size specification doesn't count the two characters of the "0t". A size of 0 means unlimited. The default is OFFDECDIG (8), preserving compatibility with existing lsof output; it can be changed by the lsof builder. When size is specified with -o it does not force offset display; -o without a size still must be used to do that.

Added an IRIX 6.2, 32 bit system, XFS node patch, courtesy of Ulrich Bernhard <rzubu@rzu.unizh.ch>.

For my own convenience enabled Configure to use /usr/local/bin/gcc for NEXTSTEP. This allows circumvention of a gcc 2.8.0 ranlib problem on my test 3.1 `040 cube.

Added flags recommended by the RISC/os and Ultrix compilers for the updated (and longer) main.c.

Updated FreeBSD cd9660\_node.h Configure test.

4.26 February 17, 1998

Added shared process group processing for IRIX 5.3, and IRIX 6.1 and above, based on investigation of a bug report from Igor Schein <ischein@air-boston.com>. Igor helped test this addition.

Improved handling of file system name arguments.

It's now done in a manner similar to fuser. The -f argument forces path names to be considered as simple

files, rather than as file system names.

The +f flag forces them to be considered as file system names. Normally path arguments are considered file system names when they match a mounted-on directory in the system's mount table, or when they match a mounted file system's block device. Igor Schein helped test this change.

Igor also suggests that the proper compilation of the IRIX 6.4 proc structure after patch 2536 has been installed may need -DPIOMEMOPS. So Isot's MkKernOpts script was updated to propagate that option from CCOPTS in /var/sysgen/system/irix.sm, even though patch 2536 doesn't add -DPIOMEMOPS to it. Added a 00FAQ item on this patch.

Added a fatal warning message about names forced to be file system names (with +f) that have no match in the mount table.

Improved the -V message for files and file systems for which no open files were found. Added reporting of /proc file and file system search failures.

Did some code reorganization to combine the multiple ck\_file\_arg() functions into one. Moved the new function from the library to the top level and put it in arg.c; moved the usage function from arg.c to a new top-level source file, usage.c, to balance top-level source file size. The new usage.c depends on version.h; arg.c no longer does.

Added flag recommended by the DU compiler for the updated (and longer) main.c.

4.27 March 6, 1998

At the request of Igor Schein <ischein@air-boston.com> added a conditional repeat mode option, using the '+' prefix to the 'r' option. +r operates as does -r with the exception that it exits the first time no open files have been listed during a cycle. The exit code will be zero when any open files have been listed; one, if none were ever listed.

Ported lsof to HP-UX 11.0 with the help of Richard Allen. This port hasn't been tested on a 64 bit kernel; I'm sure it won't work there without more mods. It may not work on PA 2 architectures; I've only tested it under PA 1 and a separate, busy tester reported PA 2 problems that I've been unable to investigate.

In anticipation of getting access to a 64 bit HP-UX kernel and the pending start of the Solaris 2.7 Beta test (It will have 64 bit kernel addressing.), started adding support for 64 bit kernel pointers. This includes: ubiquitous use of the KA\_T cast for kernel pointers; a format to print them, KA\_T\_FMT\_X; a function to print them, print\_kptr(); and modifications to most kernel-related functions -- e.g., process\_file(), process\_node(), process\_socket(), readvfs() -- to process kernel addresses as KA\_T types.

Fixed minor bug in handling path name arguments that end with a '/'.

Removed support for RISC/os; its test system is no longer available.

Made modifications to insure that lsof output doesn't contain non-printable characters. All such characters are now printed in the printf form "%02x". Several new common functions were installed in misc.c to support "safe" printing. This second major modification in 4.27 to common and dialect code could have introduced bugs not yet detected.

4.28 March 10, 1998

Refined unprintable format to use \b, \f, \r, \n,

\t, and ^\* (for CTRL) forms. Corrected omission of safestrprt() use for field output command name. These changes were offered as patches to 4.27.

Made space an unprintable character (\x20) in the COMMAND column; printable elsewhere, including the NAME column, field output, and error messages.

Made sure FD column is parseable as a single entity -- i.e., has no embedded space. Thus, if the access mode is unknown but there is a known lock mode, (a very rare case) the access mode will be printed as `-'.

Picked lint with gcc 2.8.0 under Solaris 2.6.

With the help of Dave Olson of SGI identified a proc struct element that should have been added to <sys/proc.h> by IRIX 6.4 patch 2536. Added a work-around for it to the lsof Configure script.

Igor Schein <ischein@air-boston.com> identified that the patch caused a proc structure length complaint from lsof. Removed an obsolete 00FAQ item on the patch, installed at lsof 4.26, explaining that no solution was yet available.

Added a 00FAQ item on how BIND installs its own header files, including <netdb.h>, which may cause the rpcent struct definition to vanish. Solaris has an automatic lsof work-around, but that hasn't been (and probably can't be) propagated to all dialects supported by lsof. The 00FAQ item recommends re-installation of the vendor header files that BIND has replaced. (Others include <rpcent.h>, <sys/bitypes.h>, and <sys/ctypes.h>.)

Made AIX AFS fixes.

#### 4.29 March 26, 1998

Corrected bug in Internet address matching. The matching formerly stopped if the foreign address matched, thus failing to check the local address for a match. That led to a possible false "Internet address

not located" warning (i.e., in response to -V) about the local address, when both foreign and local addresses were specified with -i. This

correction was offered as a patch to 4.28.

Changed readmnt() usage in an attempt to defer mount readlink() and stat() delays until they are necessary.

Corrected two bugs in the Digital UNIX readdev() function. Made the correction available as a patch to 4.28 and regenerated the 4.28 DU binaries.

Added a missing argument to a print-kptr() call in the HP-UX dsock.c. The missing argument causes a fatal gcc error. The problem was reported by Eyal Shaynis <eyal.shaynis@telrad.co.il>. The fix was offered as a 4.28 patch.

Adjusted for Digital UNIX 4.0D; the spec\_node structure is now defined in <sys/specdev.h>. Kris Chandrasekhar <Kris.Chandrasekhar@digital.com> identified the need for the adjustment.

Incorporated a bug fix from Brian McAllister <mcallister@mit.edu> to the DU readmnt() function. This fix was offered as a patch to 4.28.

Added "safe" printing to a SunOS clone device error message.

Corrected bug in tabling of Linux /proc-based lock info.

Corrected bug in handling of SunOS TLI streams. Dan Farmer <zen@trouble.org> reported the problem.

Added a Solaris 2.6 work-around to keep the BIND <sys/bitypes.h> from colliding with the Solaris <sys/int\_types.h>.

Strengthened the Configure test for /proc-based Linux lsof, based on a report from Marty Leisner <leisner@sdsp.mc.xerox.com>.

Tested on OpenBSD 2.3.

Made AIX changes that allow use with 3.2.5. The changes were suggested and tested by Brett Hogden <hogden@rge.com>.



Added Solaris 2.6 AFS support. Disabled reporting of some node numbers for Solaris 2.5 and above open AFS files. The node number computation algorithms used for SunOS 4.1.x and Solaris less than 2.5 no longer always work under Solaris 2.5 and above.

4.30 April 9, 1998

Corrected a pid structure member naming error for

UnixWare < 2.1.2. The problem was reported by Richard van Meurs <vanmeurs.anva@atriserv.nl>. He supplied the correction. This was offered as a patch to 4.29.

Had a report from Igor Schein <ischein@air-boston.com> that IRIX 6.4 patch 2839 is another SGI kernel patch, along with 2536, that changes the size of the proc structure in the kernel without changing the proc structure in <sys/proc.h>. Upon further investigation found that the effect of these patches on the proc structure is not consistent. Therefore, dropped the Configure patch test for IRIX 6.4 and made the code in irix/dproc.c slightly more tolerant of proc structure size differences for IRIX 6.4. Igor help test the change.

Corrected Solaris >= 2.5 AFS inode number generation. Craig Everhart <Craig\_Everhart@transarc.com> helped find the cause of the problem. This was offered as a patch to 4.29.

Refined the Linux /dev/kmem-based glibc evasion for the timeval structure to make it work with glibc version 2.0.7. This required defining a new global symbol, TIMEVAL\_LSOF, default timeval, that the /dev/kmem-based Linux lsof can set to its private glibc timeval name, distinct from the kernel timeval name.

Added support for Alpha to the /dev/kmem-based Linux lsof. Alexandre Oliva <oliva@dcc.unicamp.br> provided a test system. Added an item to 00FAQ about lsof, the Alpha processor, and Linux.

Added a 00FAQ item about lsof year 2000 compliance. Basically it says lsof is probably compliant,

because its only date or time computations are done with time\_t values, but I haven't done any specific Y2K validation. I don't have plans to do any.

Added support for UnixWare 7. Chris Daniels <chrisd@dlpco.com> provided a test system and Don Draper <dond@sco.COM> provided technical information. Added BFS and SFS file system support to lsof for UW 2.1.[12] and 7.

Updated Solaris VxFS support for VxFS 3.2.1. Greg Earle <earle@netbsd4me.jpl.nasa.gov> reported the need for the update. Greg and Roger Klorese <rogerk@veritas.com> provided technical information. Scott McClung <mcclung@primenet.com> tested.

Changed IRIX XFS patch detection in anticipation of learning there are multiple XFS patches for IRIX 6.4 that require different versions of the lsof-invented xfs\_inode structure.

#### 4.31 April 21, 1998

Added a VxFS #if/#endif wrap to a section of the HP-UX dnode.c that wasn't properly protected. The problem was reported by Peter Klosky <PKlosky@bdm.com>. This was offered as a patch to 4.30.

Added support for Solaris 2.7 (first Beta release). Mike Sullivan <Mike.Sullivan@Eng.Sun.COM> provided technical advice and helped test. Charles Stephens <cfs@jurassic.eng.Sun.COM> also helped test.

Fixed bug in /proc-based Linux that caused it to access /proc/mounts excessively. Marty Leisner <leisner@sdsp.mc.xerox.com> provided a syscall trace that identified the bug. The fix was offered as a patch to 4.30.

Adjusted the IRIX 6.4 private structure definition for the XFS node to accommodate patch 2970. Igor Schein <ischein@air-boston.com> identified the patch and the required adjustment.

#### 4.32 May 11, 1998

Corrected Solaris 2.7 code for reporting PCFS (floppy disk) node numbers. Casper Dik

<casper@holland.sun.com> supplied the fix. The fix was offered as a patch to 4.31.

Corrected a bug in conditional repeat mode handling pointed out by Igor Schein <ischein@air-boston.com>. This was offered as a patch to 4.31.

Improved reporting of AIX open(/dev/memory device) errors.

Corrected a Solaris < 2.5 KA\_T declaration error, pointed out by Robert Kiessling <robert@easynet.de>. Changed KA\_T from a #define to a typedef for all dialects to prevent future problems of this kind.

Changed the sample Perl 5 script big\_brother.perl5 to report a four digit year from localtime().

Added support for AIX 4.3[.1]. Bill Pemberton <wfp5p@tigger.itc.virginia.edu> provided a test system. Andrew Kephart <akephart@austin.ibm.com> and Tom Weaver <tvweaver@austin.ibm.com> provided technical assistance. Niklas Edmundsson <nikke@ing.umu.se> did 4.3.1 testing.

Added -qmaxmem option to CFLAGS for an AIX compilation with an xlc version 4.x compiler.

Adjusted Linux socket handling for changes in the AX25 members of the sock struct. Richard Green <rtg@tir.com> pointed out the problem. Tested /dev/kmem-based lsof under Linux 2.0.34.

#### 4.33 May 22, 1998

Added generic IPv6 support to common lsof sources and specific IPv6 support to AIX sources. Andrew Kephart <akephart@austin.ibm.com> supplied the additions and helped with testing. Bill Pemberton <wfp5p@tigger.itc.virginia.edu> provided a test system. The modification affected sources for every dialect, whether it supports IPv6 or not, by changing the interfaces to the common Internet address function `ent_inaddr()`.

Added support for the NetBSD UVM virtual memory system. Paul Kranenburg <pk@cs.few.eur.nl> supplied

technical details.

Bracketed HP-UX 11 use of <sys/spinlock.h> with  
#if/#endif \_KERNEL.

Corrected printing of PCB address in DEVICE column  
for IRIX.

#### 4.34 June 26, 1998

Updated 00FAQ to discuss TCP and UDP ports private  
to the AIX kernel and 00README to describe how ACLs  
can be used to give lsof permission to read the  
kernel memory devices. Add information to 00FAQ  
and 00README about other OpenBSD architectures  
where lsof is reported to compile and run. Added  
section to 00FAQ discussing how an incorrect loader  
path environment variable value can prevent lsof  
from loading correctly.

Improved Solaris namefs and doorfs support so that  
it is now possible to search for an open VDOOR file  
by the path name of its fattached file system  
object. Igor Schein <igor@txc.com> requested the  
ability to do such a search. Even with the change,  
lsof can't always  
identify path names for open  
VDOOR files.

Also at Igor's request, improved reporting of  
information on open Solaris VCHR files that share  
a common vnode, and Solaris UNIX domain socket  
files.

Corrected print\_kptr() argument error in PTX dnode.c,  
reported by Mark Price <mprice@sequent.com>.  
Compensated for ncache element naming differences,  
introduced at PTX 4.4.2; Kurtis D. Rader  
<krader@sequent.com> reported the problem.

Changed output column title from INODE to NODE to  
better reflect the column's contents of node IDs  
for more than just inodes.

Improved Configuration and processing for Solaris  
AFS. Corrected AIX AFS 3.4 afs\_rwlock\_t simulation.

Corrected a cast problem with two AIX knlist()  
calls, thus quieting an AIX 4.2.1 compiler argument

type warning. Jon Champlin <champlin@us.ibm.com> reported the problem.

Added support to most dialect versions (exception: /proc-based Linux) to warn when the identity of the kernel where lsof was compiled doesn't match the running identity. The warning can be suppressed with -w. Note: determining AIX state requires calling oslevel, a potentially slow operation. Jon Champlin <champlin@us.ibm.com> suggested this addition.

!!!! WARNING !!!!   !!!! WARNING !!!!   !!!! WARNING !!!!

Those using the lsof cross-configuration capability (see 00XCONFIG), should be aware that the kernel identity test feature introduces two new basic cross configuration environment variables, LSOF\_ARCH and LSOF\_VSTR.

!!!! WARNING !!!!   !!!! WARNING !!!!   !!!! WARNING !!!!

Identified a situation where a Solaris UNIX domain socket name is known and can be searched for by name; added the necessary code.

4.35 July 17, 1998

Made the kernel identity check an option with the HASKERNIDCK #define in machine.h. Enabled altering of HASKERNIDCK with the Customize script. Added a clause to the help output that indicates the build-time HASKERNIDCK status.

Added more information to the NAME column for Solaris UNIX domain sockets. Made them searchable by their clone device path name. Igor Schein <igor@txc.com> requested this.

Completed the HP-UX 11 port with support for its optional 64 bit kernel. Rich Rauenzahn <rrouenza@cup.hp.com> provided a test system. Corrected errors with HP-UX 11 lock reporting and private kernel structure and type definitions. Added support for HP-UX NFS3 files.

Limited mount table warnings -- e.g., when -b is

used -- to one set per mount point.

Fixed some mount table scanning and usage bugs, including one in Solaris, reported by Kjetil Torgrim Homme <kjetilho@ifi.uio.no>.

#### 4.36 August 4, 1998

Made corrections and additions to IPv6 support and to AF\_ROUTE socket handling, supplied by Jean-Luc Richier <Jean-Luc.Richier@imag.fr>. Jean-Luc's additions provide IPv6 support for the Inria IPv6 implementations on FreeBSD and NetBSD.

Fixed two Solaris 2.5, 2.5.1, 2.6 and 2.7

TCP and

UDP host name or IP address reporting bugs, reported by James Mathiesen <James-Mathiesen@deshaw.com>. This fix was offered as a patch to 4.35.

Updated the Customize script to cause ENTER to use all defaults. Amir J. Katz <amir@ndsoft.com> suggested this and helped test the changes.

Updated Solaris ICMP and IP stream handling, based on a report from Igor Schein <igor@txc.com>.

Fixed a bug in the Digital UNIX mount table handling, reported by Bob Ward <bward@thehartford.com>. While working on the bug, found and updated some obsolete AdvFS code. This fix was offered as a patch to 4.35.

#### 4.37 September 15, 1998

Deactivated SGI IRIX support and archived revision 4.36 sources and binaries in pub/tools/unix/lsof/OLD.

Improved performance of FD searching. This was offered as a patch to 4.36.

Amir J. Katz <amir@ndsoft.com> pointed out that ranlib isn't needed for AIX or Solaris. Made appropriate Configure script changes.

Fixed a file offset reporting bug for HP-UX VCHR and VBLK device nodes located on a VxFS root. Doug Siebert <douglas-siebert@iowa.edu> reported the bug. The fix was offered as a patch to 4.36.

Resolved an HP-UX root device name reporting bug, partly caused by an out-dated local copy of the <sys/mount.h> mount structure, by generating a local header file with the structure that can be compiled without needing \_KERNEL defined. Doug Siebert also reported this bug.

Changed some dialect source code -- Digital UNIX, Solaris, SunOS, and UnixWare -- to make more consistent with ps the user ID lsof reports in the USER column. Added a 00FAQ entry about it. Igor Schein <igor@txc.com> reported the Solaris and SunOS lsof inconsistencies with what ps(1) reports.

Ported lsof to Pyramid ReliantUNIX 5.44.

Added brackets as comments to case, do, done, else, endif, esac, if, and while statements in Configure to assist in navigating its clauses.

Added more Linux 2.0.x glibc work-arounds.

Added support for UnixWare 7.0.1.

Ralph Forsythe <ralph@contact-paging.com> provided a new FreeBSD test system.

4.38 November 25, 1998

Added support for recent FreeBSD 3.0 distributions. A 3.0 test system was provided by David O'Brien <obrien@NUXI.com>. This was offered as a patch to 4.37.

Updated the scripts/ldrlogin.perl\* files to look for sshd processes in addition to rlogind and telnetd ones.

Added support for DU 5.0 Beta. Berkley Shands <berkley@cs.wustl.edu> provided a test system.

Added support for OpenBSD 2.4 with changes supplied by Kenneth Stailey <kstailey@disclosure.com>.

Changed the Solaris 2.7 tests and documentation to Solaris 7.

Made some changes to the header files for NEXTSTEP 3.3 and added support for OPENSTEP 4.x with help from Michael A. Hovan III <mhovan@BLaCKSMITH.com> and Carl Lindberg <Carl\_Lindberg@BLaCKSMITH.com>. The combined dialect subdirectory is named n+os. One of Carl's changes propagates RC\_CFLAGS to the library Makefile. Timothy J. Luoma <luomat@peak.org> helped test under NEXTSTEP 3.3 and OPENSTEP 4.2.

Made UW 7.x version sensitive to the presence of ptf7038. Added peer PCB address to Unix domain socket Name column, even when a path name has been located. Information for these changes was supplied by Francis Le Bourse <flebourse@intelcom.fr>. Lee Penn <lee@dlpco.com> provided a test system.

Tested lsof under OSR 5.0.5 on a test system also provided by Lee Penn.

Made path name argument processing more tolerant of errors per a suggestion from Julian Gordon <julian@cadence.com>.

Acquired a new UnixWare 2.x test system, generously provided by Computer Classroom, Inc. -- Matthew Thurmaier <matt@compclass.com>, Ken Laing <ken@compclass.com>, and Andrew Merrill <andrew@compclass.com>. Updated Configure to accept a UnixWare version of 2.1.3.

Updated kmem-based lsof for Linux 2.0.36.

Updated NetBSD sources for a change in a UVM virtual mapping header file.

Corrected a cache allocation bug in Sun format kernel name cache handling. The bug only shows up when the kernel name cache is inaccessible.

4.39 December 29, 1998

Corrected problems with large device number handling for 64 bit Solaris 7. The problems were reported by Steve Bellenot <bellenot@math.fsu.edu>. Steve helped test the fixes. The fixes were offered as two patches to lsof 4.38.



Improved FreeBSD Configure operations for header files that must be obtained from the kernel source tree, based on a suggestion from David O'Brien <obrien@NUXI.com>.

For Bela Lubkin <filbo@deepthought.armory.com> made optional with +f[cfn] the display of file structure address, shared use count, and node structure address. /proc-based Linux doesn't implement this feature, because it doesn't read kernel structures from kernel memory. Modified the PTX -X option to take advantage of the new file structure display option.

Added shared.perl5 to the scripts/ subdirectory to provide an example of how +f[fn] might be used to track shared file descriptors and files.

Added more /dev/kmem-based Linux glibc evasions, provided by Jeff Johnson <jbj@redhat.com> and Maciej Lesniewski <nimir@kis.p.lodz.pl>. Jeff helped test them on various Linux architectures.

Tested on AIX 4.3.2; no changes were required. Doug Crabill <dgc@purdue.edu> provided a test system.

Fixed -c option to detect missing command name when following option begins with `+'.

#### 4.40 January 25, 1999

Added support for using the CDS compiler for Reliant Unix 5.44 and above. Made Reliant Unix MIPC support optional, dependent on the presence of <sys/mipc.h>.

Based on a report from Michael Schmitz <MSchmitz@lbl.gov> that /dev/kmem-based lsof misbehaves on a Linux 2.0.x m68k kernel without module support, made the absence of query\_module() or get\_kernel\_syms() Linux kernel support a fatal error.

Updated relevant sections of 00FAQ to reflect the change.

Added the ability to force the Linux Configure stanza to use the /proc or /dev/kmem source base via a LINUX\_BASE environment variable specification. This is a cross-configuration assist.

Added "+D <dir>" and "+d <dir>" options for directory searching. +D searches the entire tree, starting at <dir>, including <dir>, its contents, and its subdirectory branches; +d searches only <dir> and its contents, but not its subdirectory branches. Improved lsof's searching of the specified name list to compensate for anticipated long lists from +d and +D.

Made an egrep in the Solaris Configure stanza usable by the standard and XPG4 egrep's. Kenneth Stailey <kstailey@disclosure.com> pointed out the improvement.

Fixed bugs in /dev/kmem-based Linux and UnixWare Unix domain socket name searching.

Changed a Linux Alpha #include to be conditional on the presence of its named header file, so that lsof will compile on Red Hat 5.1 and 5.2 (Linux kernel 2.0.35) where the header file is absent. The problem was reported by Alexandre Oliva <oliva@dcc.unicamp.br>.

Fixed an AIX 4.3+ bug in procinfo struct space allocation, reported by Jeff Stewart <jws@purdue.edu>. This was offered as a patch to 4.39.

Added an lstatsafely() function to offer the same isolation for lstat() calls that statsafely() offers for stat() calls. This made DOSTAT\_FUNCTION no longer necessary, so deleted it.

With help from Laurent P. Montaron <lpm@sequent.com> ported lsof to PTX 4.4.4. Laurent did a monumental job of identifying TCP/IP changes by their TCP version, rather than by their PTX (With mix 'n match PTX and TCP/IP versions, the PTX version often has no bearing on the TCP/IP version.), and changed the Configure script and pre-processor #if/#else/#endif blocks to match. He also updated Unix domain socket handling for PTX TCP/IP versions 4.5 and above.

Updated CLIENT handle acquisition of fill\_portmap() in print.c to use the more modern RPC function clnt\_create() in place of clnttcp\_create() where

possible. PTX 4.4.4 requires clnt\_create().

4.41 February 27, 1999

Added FreeBSD 3.1 and 4.0 support with help from Sheldon Hearn <axl@iafrica.com>, David O'Brien <obrien@NUXI.com>, and John Polstra <jdp@polstra.com>.

Corrected bungled AIX 4.3+ patch that went into lsof 4.40.

Reorganized the Configure script to improve Makefile construction. A specific impetus for this was to allow FreeBSD system-wide make flags to be propagated to the lsof Makefiles, but other goals were to make sure that the DEBUG= make entry can over-ride standard CFLAGS values, and to better manage the identification of compilers and their versions. Two compiler-related values may now be supplied in environment variables: 1) the compiler path in LSOF\_CC; and 2) the compiler version in LSOF\_CCV. 00XCONFIG documents them.

Added support for Pyramid Reliant Unix bsdfs, mssockfs, and sockfs file systems.

Added an optional LSOF\_CINFO string to Configure, producing a CINFO string in selected Makefiles, producing a #define LSOF\_CINFO in selected version.h header files. The purpose of this is to allow Configure the option to propagate information to the lsof -v output. It is now used for Linux to identify the code base, and for HP-UX 10.30 and 11.0 and Solaris 7 to identify the kernel bit size.

Added system information to NEXTSTEP and OPENSTEP -v output, from the second line of hostinfo's output.

Fixed a login name buffer overflow problem in the processing of -u option values. This was offered as a patch to 4.40. **!!!THIS IS A SERIOUS STACK OVERFLOW BUG; A LINUX EXPLOIT EXISTS FOR IT THAT OPENS A BASH SHELL WITH LSOF'S AUTHORITY -- E.G., SETGID(KMEM) POWER!!!**

Improved the Solaris mount table filter so the volume manager's fake mount point, "/vol", is

ignored and doesn't supplant

"/" in NAME column

path assemblies. Igor Schein <igor@txc.com> reported this bug and provided important help in finding it. This was offered as a patch to 4.40.

Changed the Linux /dev/kmem-based lock ownership test to answer a problem reported by Tom Christiansen <tchrist@jhereg.perl.com>. This was offered as a patch to 4.40.

Installed an HP-UX 11 patch, suggested by Kevin Vajk <kvajk@cup.hp.com>, that adjusts a private lsof kernel header file, derived via Q4, to correspond to an HP-UX patch bundle.

Made NetBSD 1.3I sockproto structure adjustment.

4.42 March 30, 1999

Fixed a typo in the HP-UX dfile.c that caused +fF and +fN output controls to swap effect.

Enabled for OpenBSD 2.5 per notice from Kenneth Stailey <kstailey@kstailey.tzo.com>

Made more VM accommodations for FreeBSD 4.0.

Improved file system search reporting to include path name components when they're available, instead of mindlessly reporting the file system name in the NAME column. Guy Dallaire <gdallair@geocities.com> brought the need for this change to my attention.

Updated Solaris 2.6 VxFS for Veritas Oracle Database Edition 2.0, VxFS version 3.3, and VxVm version 2.5.4, based on a report from Chris Kordish <chris.kordish@East.Sun.COM>. Chris kindly provided a test system.

Improved HP-UX ipc\_s patch detection in Configure, response in ../dialects/hpux/hpux11/ipc\_s.h, and documentation in 00FAQ, Kevin Vajk <kvajk@cup.hp.com> helped test.

Added to Customize the option to suppress HASKERNIDCK selection for specified dialects. Suppressed it for /proc-based Linux lsof, and removed its test

and code from there. Tin Le <tin@netimages.com>  
alerted me to the need for this update.

Ported to official Digital UNIX 5.0 release.

Changed DU lsof to use the knlist(3) function when  
no kernel file has been specified with -k. This  
change was suggested by Erich Wimmer  
<Erich.Wimmer@digital.com>.

Updated Configure  
for latest NetBSD (1.3I?) with  
UVM support the default.

4.43 May 11, 1999

Corrected a typo in the Solaris gcc discussion in  
00FAQ. Made changes to the Solaris 2.5[.1] private  
tcp\_s structure. Both changes were done in response  
to reports from Igor Schein <igor@txc.com>, who  
tested the Solaris 2.5 change.

Made more IPv6 adjustments to lsof for Tru64 UNIX  
(Digital UNIX) 5.0, based on information obtained  
from Compaq by Berkley Shands <berkley@cs.wustl.edu>.

Corrected HP-UX error message about HP-UX 11 q4 usage.  
Amir Katz <amir@ndsoft.com> reported the correction.

Fixed a Glibc 2.1 conflict in /proc-based Linux lsof.

Fixed a man page typo reported by Vlad Harchev  
<hvv@hippo.ru>.

Changed some Solaris 2.7 references to Solaris 7  
in Configure and 00EXPORTING.

Added a Solaris example to the echo statements that  
are the install rule in the SunOS/Solaris Makefile.

Added a field to the file structure output --  
FILE-FLAG (file structure open  
flags, f\_flag[s],  
and process file flags, typically u\_pofile)) --  
enabled with +f[gG]. Its field output character  
is 'G'.

Figured out another piece of the HP-UX 11 patched  
ipc\_s structure puzzle with the help of Keith Kalet

<KEITH\_KALET@HP-USA-om41.om.hp.com>.

Fixed a PTX real vnode to real inode interpretation bug.

Added link count to lsof output. Eric Dumazet <dumazet@risgw.ris.fr> requested and helped test it. The new +L option enables and filters it. Its field output character is `k'.

Updated Configure script to recognize NetBSD 1.4.

Updated AFSSConfig to handle default answers to questions.

Incorporated patch from Jonathan Sergent <sergent@io.com> that enables /proc-based Linux lsof to run on both 32 and 64 bit kernels.

Updated Configure script with a patch from David O'Brien <obrien@NUXI.com> that recognizes FreeBSD 3.2.

#### 4.44 June 24, 1999

Corrected use of nlink member of hsnodet for SunOS

4.1.x High Sierra File System files.

John Dzuber

<zube@tlaloc.stat.colostate.edu> reported the problem and helped test the fix. Also fixed a SunOS segmentation fault bug. These fixes were offered as a patch to 4.43.

Improved handling of /proc-based Linux UNIX PCB address.

Fixed a NEXTSTEP and OPENSTEP bug that made repeat option (-r) processing malfunction. This fix was offered as a patch to 4.43.

Fixed Configure so it doesn't use -O in the Cflags for the bundled HP-UX C compiler. Jim Ankenbrandt <jankenbrandt@penton.com> reported the problem.

Corrected output ordering of parent PID and process group ID when both -R and -g are specified.

Enhanced the pdev.c and pdvn.c library modules for wider use. These dialect versions use the new library modules: DEC OSF/1, Digital UNIX, and Tru64

UNIX; Pyramid DC/OSx and Reliant UNIX; SCO OSR and UnixWare; and Sequent PTX.

Added basic clone device support to /dev/kmem-based HP-UX lsof for HP-UX 10.30 and higher.

Added raw socket support to /proc-based Linux lsof.

Changed NODE-ADDR column title to NODE-ID in anticipation of using more general identification information in the column.

Ported to UnixWare 7.1, using a test system kindly provided by Matt Thurmaier <matt@compclass.com> and Don Draper <dond@sco.com>.

Updated for NetBSD 1.4C VM changes, and a new current and root working directory structure.

Made minor adjustment for latest Tru64 UNIX 5.0 Beta release.

#### 4.45 July 30, 1999

Fixed quoting problem in DEC OSF/1, Digital Unix, and Tru64 UNIX Makefile's install rule. The problem was reported by Berkley Shands <berkley@cs.wustl.edu>. Fixed bug in Tru64 UNIX 4 lsof that caused FDs to be skipped. These fixes were offered in a patch to 4.44.

Fixed a repeat-mode /proc-based Linux lsof bug, reported by Sami Farin <sfarin@ratol.fi>. This was offered as a patch to 4.44.

Picked lint, some reported by Sami Farin.

Corrected a 00DCACHE documentation error in a sample shell script. The problem was reported by Chad R. Larson <chad@larsons.org>. Changed commented-out entries in machine.h files so they require more thought and work when the comments are removed, based on a remark by Chad.

Compensated for the practice of Solaris 7 and above to record the dev= value in /etc/mnttab in 32 bit mode, even on 64 bit systems. This was offered as

a patch to 4.44.

Added a C library test for /proc-based Linux lsof, so that the #include files can be adjusted for a non-Glibc environment. The need for this was reported by Andrew Hill <andrewh@tirin.openworld.co.uk>. This was offered as a patch to 4.44.

Added support for Auspex LFS 1.8.1 and 1.9.2 to SunOS 4.1.4 lsof. The support was requested by Quentin Fennessy <quentin@dvorak.amd.com>, who provided information and did testing.

Enabled IPv6 support code for NetBSD and OpenBSD, conditional on Configure script tests. Wolfgang Rupprecht <wolfgang@wsrcc.com> supplied the NetBSD code and tested it. The OpenBSD code I constructed has been compiled but not tested.

Updated the identd Perl 5 script, based on a report from Wendy Lin <af5@taiyang.cc.purdue.edu> that the space in its response line in front of the user name violates RFC 1413.

Added IPv6 support to /proc-based Linux lsof. Jonathan Sergeant <sergent@ETLA.NET> and Andrew Thomas Sydelko <sydelko@ecn.purdue.edu> kindly provided a test system.

Updated man page description of AIX multiplexed files to indicate that they might be /dev/ptc or /dev/pts, depending on the AIX version. The correction was suggested by Onno van der Linden <onno@simplex.nl>.

Sylvain Robitaille <syl@alcor.concordia.ca> reports lsof passes his Y2K tests.

#### 4.46 October 23, 1999

Corrected /proc-based Linux lsof to detect that an IPv6 address is a mapped IPv4 address. The problem was reported and analyzed by Arkadiusz Miskiewicz <misiek@misiek.eu.org>, who also tested the fix.

Added a libc5 library /dev/kmem-based Linux lsof circumvention, supplied by Jason Lingohr



<lingman@lucid.net.au>.

Corrected a bug in -t (terse) AIX output, reported by Wendy Lin <af5@taiyang.cc.purdue.edu>. I introduced the bug at revision 4.43 when adding FILE\_FLAG reporting. This was offered as a patch to 4.45.

Added a work-around for a problem in the OpenBSD 2.3 <sys/pipe.h> header file. Volker Borchert <bt@tekon.de> provided and tested it.

Improved description of cross-building lsof for a 64 bit Solaris 7 system on a 32 bit system with suggestions from Phillip Edwards <Philip.Edwards@sn.wpafb.af.mil>.

Fixed a gawk POSIX-mode pattern error in the Linux /dev/kmem-based Mksrc script, based on a tip from Ambrose C. Li <acli@mingpaoxpress.com>.

Fixed a bug in the Tru64 UNIX IPv6 handling, courtesy of a report from Casper Dik <casper@holland.sun.com>.

Enabled support for OpenBSD 2.6.

Enabled support for BSDI BSD/OS 4.1, based on a report from Jeffrey C Honig <jch@bsd.com> that only a Configure script change is necessary.

Enabled Configure script to use gcc for building lsof for a 64 bit Solaris 7 and 8 kernels, if the gcc version is 2.95 or above.

Improved -i option handling for systems with IPv6 support so that it will search for a host name in both IPv4 and IPv6 families, when that is possible. As a companion modification, changed -V processing to report a single error when a multiple host name match is requested. Casper Dik <casper@holland.Sun.COM> helped test.

Fixed a DEC OSF/1, Digital UNIX, Tru64 UNIX repeat mode bug, reported by Mayer Ilovitz <mayer@cooper.edu>. Mayer helped test the fix. The fix was offered as a patch to 4.45.

Changed Solaris socket file recognition scheme, so it is (nearly) the same through Solaris 8, where the previous clone device scheme no longer works.

With significant assistance from Casper Dik, added support for Solaris 8 Beta and

Beta refresh. The

IPv6 support in Solaris 8 is still in some flux, so there are temporary compensations for the differences between Beta IPv6 support and Beta refresh IPv6 support. Casper and I hope those differences disappear by FCS.

Improved the delivery of information on Solaris 2.5.1, 2.6, 7, and 8 door files.

Fixed a repeat mode bug that surfaces when /etc/passwd changes between cycles. The bug report and diagnostic help were supplied by Igor Schein <igor@txc.com>. The fix was offered as a patch to 4.45.

Added support for INRIA IPv6 to NetBSD. Jean-Luc Richier <Jean-Luc.Richier@imag.fr> provided patches and a test system on which to verify them.

Added support for AIX 4.3.3. Jeff W. Stewart <jws@anaconda.cc.purdue.edu> provided a test system.

Made adjustments for FreeBSD 4.0-current.

Improved reporting of information for AIX sockets that lack protocol control blocks.

4.47 November 29, 1999

Based on a query from Jean-Pierre Radley

<jpr@jpr.com>,

changed the lsof top-level Makefile to propagate CFGF to the library Makefile. (DEBUG was already being propagated.) Added osrgcc and scogcc Configure abbreviations (to use gcc) for Jean-Pierre.

In response to a query from Igor Schein <igor@txc.com>, improved the Configure script test for Solaris 7 and 8 that decides if the compiler can produce 64 bit executables.

Made an ugly hack, based on making a private rnode structure definition from q4 output, to compensate

for HP-UX 10.20 and lower recent NFS3 patches. HP didn't supply an updated <nfs/rnode.h> with the patches. The problem was reported by Will Partain <partain@mekb2.sps.mot.com>. Elias Halldor Agustsson <elias@hi.is> helped identify the patches as PHNE\_18173, PHNE\_19426, PHNE\_19937, and PHNE\_20091, and provided a test system.

Switched BSDI test system from 2.1 and 3.1 to 4.0.1, courtesy of Terry Kennedy <terry@tmk.com>.

Added some more dev\_t hacks for Alpha FreeBSD 4.0.

Added support for IPv6 on BSD 4.x. The support hasn't yet been tested, just compiled.

Added support for the mnt file system (mntfs or /etc/mnttab) on Solaris 8. Tested on Solaris 8 BETA-Refresh.

Made selection of optional fields (e.g., PPID with -FR) in a field output specification select the optional field, too, so that the option selector for the field (e.g., -R) isn't also required. This change was made in response to an inquiry from John DuBois <spcedt@armory.com>. This may require some revision to scripts that parse all field output; two scripts in the lsof distribution's scripts/ subdirectory had to be updated.

Corrected handling of Linux IPv4 addresses mapped in IPv6 addresses.

Tested under OpenBSD 2.6.

4.48 January 14, 2000

Modified -i argument processing of colon-separated IPv6 addresses to recognize an IPv4 address mapped in an IPv6 address and handle it as an IPv4 address. This was offered as a patch to 4.47.

Added a defined symbol (NOWARNBLKDEV) to control (inhibit) the issuance of a warning when no block devices are found. This was done anticipating its need in FreeBSD 4.x, but that dialect version no longer has any block devices, so HASBLKDEV was

disabled for it instead. NOWARNBLKDEV was left in place for possible use in the future.

Enabled KAME IPv6 Configure support for FreeBSD when `<netinet6/in6.h>` is found.

Disabled use of gcc to compile lsof for 64 bit HP-UX 11.

Updated Configure to recognize FreeBSD 3.4.

Based on suggestions from Bernt Christandl `<beb@MPA-Garching.MPG.DE>` improved AFS configuration for AIX and Solaris, and updated AIX AFS 3.5 support. Johannes Tax `<tax@bluedog.oit.unc.edu>`, Hung T. Pham `<hung_pham@unc.edu>`, and Curt Freeland `<curt@grumpy.cse.nd.edu>` provided test systems.

Updated lsof's private rnode definition for AIX 4.3.3, since IBM still doesn't ship the `<oncpus/nfs/rnode.h>` header file and the rnode structure definition in `<nfs/rnode.h>` doesn't match what the kernel uses. This was offered as a patch to 4.47.

Weakened the test in the Linux /proc-based lsof of the field count of data lines in `/proc/net/{tcp,udp}`. It appears that recent 2.3.x Linux kernels have added untitled fields to these files. The bug report came from Gabor Liptak `<gaborliptak@usa.net>`.

Adjusted for a FreeBSD 4.0 change in the definition of `[_]KERNEL`. David O'Brien `<obrien@NUXI.com>` reported the problem and provided a test system.

Removed the HASPPID bracket from Fppid (the -R option state variable) so that the field select table will compile even when HASPPID is not defined. This problem was introduced at revision 4.47 with code that causes some field output characters to set option states. The problem was reported by David Bacon `<bacon@birch.eecs.lehigh.edu>`.

4.49 April 3, 2000

Made clearer in man page that "Lxx" FDs are AIX loader table references. Also updated the 00FAQ discussion

of the Stale Segment ID bug to include

AIX 4.3.x.

Modified support for NetBSD 1.4Q to include the  
<sys/buf.h> header file to cope with an MFS change.

Added support for OpenBSD UVM virtual memory.

Added support for AIX systems with > 2GB of memory.

Chris Sylvain <csylvain@itg.ummcc.umd.edu>

reported the problem and provided the solution.

Chris also supplied some minor code cleanup. This  
was offered as a patch to 4.48.

Based on new information from Igor Schein <igor@txc.com>

made additional compensation in Configure script

for 64 bit Solaris 7 and 8 gcc.

Added some 00FAQ info on the effect ordering of  
the +fg and -FG options has on output format.

Improved NetBSD IPv6 configuration, based on a  
suggestion from Thomas Klausner

<wiz@danbala.ifoer.tuwien.ac.at>. Added code to

convert IPv4-mapped-in-IPv6 addresses to IPv4  
addresses.

Updated the information in 00FAQ and the HP-UX 11

binary directory README files on the HP-UX 11

ipis\_s

patch with new information supplied by Eric McWhorter

<emcwhorter@xsis.xerox.com>.

Added documentation on changes to HASFSTYPE and  
HASNCACHE, and the new HASPRIVPRIPP.

Adjusted Configure for FreeBSD 5.0. Made additional,  
necessary changes to Configure and the BSDI sources  
to eliminate load errors.

Added KAME IPv6 support to FreeBSD at the request

of Ollivier Robert <roberto@eurocontrol.fr>, who

provided a test system.

Corrected the script that generates the CHECKSUMS

files for binaries to correctly name the detached

PGP certificate. The documentation bug was reported

by Michael Hennecke <hennecke@rz.uni-karlsruhe.de>.

4.50 June 29, 2000

Added a NetBSD alpha test host, courtesy of Ray Phillips <r.phillips@mailbox.uq.edu.au>. An lsof 4.49 binary, built on Ray's 1.4.1 system was made available prior to the 3.50 release.

Upgraded the system map file tests in /dev/kmem-based Linux lsof, making the use of DEBIAN\_LINUX\_LSOFF unnecessary.

Tested the changes on a system made available by Vincent Kujala <kujala@geog.ubc.ca> and Jim Mintha <jim@ic.uva.nl>.

Forced AIX to use the large-file-enabled versions of lstat (lstat64) and stat (stat64) if <sys/stat.h> contains stat64. This should allow lsof to stat() AIX files > 2GB even when the builder has not defined the "large file enabled programming environment." Configure tests <sys/stat.h> and puts -DHASSTAT64 in the Makefile's CFLAGS to make this happen. Fernando A.B. Whitaker <whitaker@cenapad.unicamp.br> reported the problem. This was offered as a patch to 4.48.

Enabled Configure script to handle OpenBSD 2.7. Angelos D. Keromytis <angelos@dsl.cis.upenn.edu> reported the availability of OpenBSD 2.7 and supplied the Configure script patch.

Improved handling of DOOR and fattach()'d files in Solaris.

Changed message about missing kernel symbol file from "not yet determined" to "none found".

Updated FreeBSD, NetBSD, NEXTSTEP, OpenBSD, and OPENSTEP support to report "no PCB" and the values of the SO\_CANTSENDMORE and SO\_CANTRCVMORE state flags when a socket structure has no inpcb pointer. This modification was made to AIX lsof at revision 4.46. Added an entry to 00FAQ about sockets that have no inpcb pointer.

Upgraded support for FreeBSD 5.0-CURRENT. Ben Smithurst <ben@scientia.demon.co.uk> supplied patches and did testing. David O'Brien <obrien@Nuxi.com>

supplied a test system. The update included dropping the Fctty part of file descriptor file system support, conditional on a Configure script test. I propagated those changes to BSDI, NetBSD, and OpenBSD in anticipation of their having the modification in the future. David also arranged with Michael Haro <mharo@area51.fremont.ca.us> for a FreeBSD 3.4 test system.

In response to an lsof 3.72 bug report from Jim Mewes <jim@corp.phone.com>, added more kernel address filtering to the lsof function, kread(), that reads Solaris kernel data.

In response to a report from Marc Duponcheel <marc@offline.be>, added tests to the /proc-based Linux lsof to ignore file systems of types "autofs" and "pipfs".

Based on a report and information supplied by Casper Dik <casper@holland.Sun.COM>, updated the ncache\_load() function in lib/rnch.c with new code that deals with a post Solaris 8 change in kernel name cache (DNLC) handling. Casper tested the update, which should be invisible to Solaris versions without the new DNLC code.

Added support for Solaris VxFS QIO files, based on a report from Kieran Broadfoot <kieran.broadfoot@gs.com>. Kieran help test the support.

Added support for PTX 4.4.6 and 4.5[.1] with help from the usual cast of good people at Sequent.

Added support for 64 bit file sizes and offsets on BSDI, FreeBSD, NetBSD, and OpenBSD, based on a report from Dan Nelson <dnelson@emsphone.com>. Dan supplied a patch and did FreeBSD testing.

Added Configure script recognition of NetBSD 1.5, based on a report from Andrew Brown <atatat@atatdot.net>. Thomas Klausner <wiz@danbala.ifoer.tuwien.ac.at> updated the NetBSD port package to use a pre-release of this addition.

At the last minute saw a notice via deja.com's

UseNet search service that FreeBSD 3.5 had been released and lsof didn't grok it. Added recognition of 3.5 to lsof's Configure script, but didn't have the opportunity to test lsof on 3.5.

4.51 August 21, 2000

Added Configure script support for the upcoming Solaris 9 release based on suggestions from Casper Dik <Casper.Dik@holland.sun.com>.

Changed sample Perl scripts to assume that /usr/local/bin/perl is Perl 5 and Perl 4 may be found in /usr/local/bin/perl4.

Updated Configure to recognize FreeBSD 4.1 and made a FreeBSD pre-release distribution available.

Bela Lubkin <belal@sco.COM> tested lsof on the upcoming SCO OSR 5.0.6 release and reports that lsof appears to work properly.

Updated  
the AIX compiler test in Configure to  
recognize its version 5.

Updated AIX 4.3.3 support with automatic recognition of the proper rnode structure, based on machine bit width. Also added code to detect when processing the -X option that lsof has been compiled with the "other" AIX 4.3.3 user structure and to apply compensations. When a compensation method works, it's applied during subsequent -X processing; when none works, further -X processing is disabled.

Added Tru64 UNIX 5.1 support. Updated Tru64 UNIX library text file support to recognize new kernel support for AdvFS library files. Berkley Shands <berkley@cs.wustl.edu> and Klaus Saggerer USG [saggerer@zk3.dec.com] helped put me in contact with Chang Song <song@zk3.dec.com>, the developer of 5.1's new kernel name cache and he helped me develop new code in lsof to access it.

Corrected reporting of PTX fattach()'d address.

Changed Configure and dlsof.h for NetBSD and OpenBSD to



use /usr/include/uvm header files when available.

Andrew Brown <atatat@atatdot.net>, Thomas Klausner <wiz@danbala.ifoer.tuwien.ac.at>, and Wolfgang Rupprecht <wolfgang@wsrcc.com> pointed out the need to do this for NetBSD. Andrew provided access to a NetBSD 1.5 system for verifying the changes.

Installed snprintf() support, including a private version in the lsof library for those UNIX dialects without the function. Changed all sources to use it instead of sprintf() and strcpy().

Fixed a memory leak in the readvfs() functions of BSDI, DEC/OSF1, Digital UNIX, FreeBSD, NetBSD, OpenBSD, and Tru64 UNIX.

Tested on Linux 2.4.

Modified the Pyramid MkKernOpts script to compensate for `uname -s` configuration alternatives. Robert Dahlem <Robert.Dahlem@ffm2.siemens.de> supplied the modification.

Obtained access to an FCS Solaris 8 64 bit system and built lsof on it, using Sun Workshop C 5.0 and gcc 2.96 20000814 (experimental). Both compilers produce a working lsof.

#### 4.52 November 8, 2000

Completed work on an HP-UX 11.11 port that uses a pstat(2) interface provided by HP. To distinguish it from its predecessors for HP-UX, this lsof version is called PSTAT-based and the predecessor versions are now called /dev/kmem-based. I am indebted to the far-sightedness and support of these good people at HP for making PSTAT-based lsof possible: Carl Davidson, Louis Huemiller, Rich Rauenzahn, and Sailu Yallapragada. The PSTAT-based sources are in lsof\_4.52/dialects/hpux/pstat, the /dev/kmem-based ones in lsof\_4.52/dialects/hpux/kmem.

Ported to IBM Monterey for Merced/Itanium, aka AIX 5L. It configures via the Configure script's "aix" abbreviation and has been tested on AIX 5L Beta 3. Jay Beck, Steve Dibbell, Loc Le, Nasser Momtaheni, and Malcom Zung of IBM provided generous support.

Since AIX 5L is still in Beta testing, this port can't be considered complete.

Added Configure support for OpenBSD

## 2.8. David

Mazieres <dm@cs.nyu.edu> provided a test system.

Based on a report from Marc Christensen

<marc@mecworks.com> added sockfs to the mount scan exemption list for /proc-based Linux lsof.

Added large file, CDFS, and DOSFS for UnixWare 7.x.

Added UnixWare device memory mapping support. All

UnixWare changes were supplied by Eric Dumazet

<edumazet@cosmosbay.com> Eric also supplied some miscellaneous bug fixes.

Deferred name cache loading until printname() needs to use the name cache.

Terminated Pyramid, SunOS 4.1.x, and Ultrix support, because test systems are no longer available.

Final Pyramid and Ultrix source code distributions

for lsof revision 4.51 may be found on lsof.itap.purdue.edu

in pub/tools/unix/lsof/OLD/src. The no longer

supported SunOS 4.1.x source code is still distributed

with the Solaris source code.

Added code to set Solaris node address to real vnode address, when applicable.

John Speno <speno@lopan.isc-net.upenn.edu>

provided

information that enabled me to update the Tru64

AdvFS (MSFS) node definition for AdvFS version 5.

Added Tru64 5.x CFS support with help from Kris

Chandrasekhar <Kris.Chandrasekhar@compaq.com>,

Diane Lebel <lebel@zk3.dec.com>, and John Speno.

The support only provides information about cached file attributes.

Installed a Configure patch for HP-UX 11 supplied by

Kenneth Stailey <kstailey@disclosure.com> that adds

another command to q4 input.

Tested on FreeBSD 4.2.

Will Day <willday@rom.oit.gatech.edu> and Frank Winkler <frank.winkler@germany.sun.com> graciously supplied Solaris 8 binaries.

Added Solaris 9 text file support, supplied by Casper Dik <Casper.Dik@holland.sun.com>.

#### 4.53 December 6, 2000

Added the AIX 5L j2\_lock.h to the distribution with a Configure script step to use it when it's missing from /usr/include/j2.

Removed SunOS 4.1.x support.

Removed Linux 2.0.x /dev/kmem support.

Fixed VBLK and VCHR special device file reporting to handle /dev information more accurately.

Added a Apple Darwin / Mac OS X 1.2 port, provided by Allan Nathanson <ajn@apple.com>. Allan also arranged for a test system so I can maintain this port. An additional test system was provided by Dale Talcott.

Dropped claims of support for all UnixWare versions except 7.1.0, since that is the only version on which I can test lsof. Even though lsof 4.53 is deprecated for UnixWare 2.1.3, installed a patch for it with testing done by A. Channing Clark <clark.channing@heb.com>.

Dropped claims of support for all SCO OpenServer versions except 5.0.5, since that is the only version on which I can test lsof.

#### 4.54 January 19, 2001

Added compensation for a change that made the FreeBSD mount structure invisible. I can only test back to 3.2 and the compensation works there, so it's been #ifdef'd for 3.2 and above. David O'Brien <obrien@FreeBSD.org> provided the necessary clue.

Based on a report from Valdis Kletnieks <Valdis.Kletnieks@vt.edu>, changed all IPv6 support to report a TYPE of IPv6 for sockets with IPv4

addresses mapped in IPv6 addresses. The previous lsof behavior was to report their TYPE as IPv4.

Restored the Linux Glibc test to Configure, removed at revision 4.53, based on a report from John Dzuber <zube@cs.colostate.edu>, that RedHat Linux 6.0 still needs the test.

Made setting of link count for Solaris more selective.

Limited Readlink() recursion to MAXSYMLINKS. The bug was reported by Jan Dvorak <johnydog@go.cz>.

Dropped the \*claim\* that lsof runs on Solaris 2.5.1. It may well do so, but I no longer have access to a test system.

Fixed an #endif comment typo, reported by Igor Schein.

Fixed a typo in a cast for a Tru64 UNIX 5.1 function and updated Configure for Tru64 UNIX 5.0 and 5.1 with information from Jesse Perry <jesse.perry@compaq.com>.

Corrected non-fatal typos in the AdvFS support in dnode.c for Tru64 UNIX.

Added msdos file system support for NetBSD and OpenBSD. Andrew Brown <atatat@atadot.net> requested and helped test it.

#### 4.55 February 15, 2001

Based on a report from Bernd Eckenfels <eck@lina.inka.de> added support in lsof for files in /proc/<PID>/maps that have been deleted.

Changed PGRP output title to PGID, conforming to the most common current abbreviation for Process Group ID (PGID). While some systems continue to use \*pgrp for internal kernel variable names, most systems that support the display of PGID via ps(1) now title it PGID. The lsof -g and -Fg options operations are unchanged in function; only titles and descriptions have changed. Also changed internal variable names from \*PGRP and \*pgrp to \*PGID and \*pgid where possible.

Dropped the \*claim\* that lsof runs on HP-UX 9.x.

It may well do so, but I no longer have access to a test system.

In response to a suggestion from Jeff Howie <jeff.howie@federated.ca> added support for command name selection by regular expression. A new form of the -c option value is use to identify and specify a regular expression.

Restore the \*claim\* that lsof works on UnixWare 7.0, since I re-acquired a test system.

4.56 May 3, 2001

Corrected some problems Amir Katz <Amir\_Katz@bmc.com> found with Insure++, one in lib/dvch.c, the rest in Solaris sources. Amir's report also helped me find an error in an snpf() call that caused (the unsupported) Solaris 2.5.1 lsof to crash. Wally Winzer, Jr. <wally.winzer@ChampUSA.COM> helped test.

Added support for UnixWare 7.1.1 and above in-kernel UNIX sockets. John Hughes <john@Calva.COM> kindly provided code and access to a test system. John also provided a test system and advice for adding UnixWare 7.1.1 NonStop Cluster and CFS support. More help with that effort came from Kurt Gollhardt (SCO), Barbara Howe (SCO), Bela Lubkin (SCO), and Dewan Rashid <Dewan.Rashid@ir.com>.

Archived a set of compilation hints (patches) from Bill Melvin <Bill.Melvin@esc.edu> that make it possible to compile the old, unsupported lsof 3.08 sources on UnixWare 1.x without NFS or CDFS support.

Installed support supplied by Allan Nathanson <ajn@apple.com> for the Darwin "Gold Master" release, Mac OS X 10.0 (aka Darwin 1.3 in its public source version). Added Allan's CVS repository suggestions to the script that gets additional header files from an open source repository.

Tested an HP-UX 11.11 kernel patch from Sailu Yallapragada that enables reporting of TCP/IP information for telnetd processes that use the telnet multiplexor. I don't yet know the kernel patch ID.

Made the Solaris inclusion of <inet/mi.h> conditional on the Solaris version. (It's apparently not needed at 2.6 and above.) Bill Watson <bill.watson@uk.sun.com> brought this to my attention.

Added alternate Linux 2.4.x lock extent test, supplied by Jim Mintha <jim@ic.uva.nl>.

Rearranged the lines and pre-processor tests in regex.h, lib/regex.c, and lib/snpf.c so that undef can be used to eliminate copyright and GPL statements when the files aren't being used for a particular dialect. (USE\_LIB\_\* definitions in a dialect's machine.h header file determine if one or more of those three files are to be used.)

Added preliminary support for Solaris 8 with VxFS 3.4. This support will be refined as I get information from Veritas about how they will distribute the kernel header files lsof needs. Those header files were omitted from the standard VxFS 3.4 distribution. Technical assistance and testing were provided by Calle Dybedahl <cdy@algonet.se>, Gary Millen <gary.millen@veritas.com>, Rainer Orth <ro@TechFak.Uni-Bielefeld.DE>, Peter C. Vernam <pvernam@draper.com>, and Donna Yobs <Donna.Yobs@veritas.com>

Tested on FreeBSD 4.3-STABLE.

Dropped the \*claim\* that lsof works on UNIX dialects where I no longer have test systems: BSDI 2.1, 3.[01] and 4.0; DEC OSF/1, Digital UNIX and True 64 UNIX 2.0 and 3.2; FreeBSD 2.1.[67], 2.2[.x], 3.[012345] and 4.[01]; HP-UX 10.20; NetBSD 1.[234]; SCO OpenServer 5.0.5; and SCO UnixWare 7.0

Tested on Solaris 9 BETA, s81\_36.

4.57 July 19, 2001

Help (-h) and version (-v) output now have URLs for the newly created and timeliest lsof FAQ (00FAQ in the lsof distribution) at:

<ftp://lsof.itap.purdue.edu/pub/tools/unix/lsof/FAQ>

and the man page for the current lsof distribution  
at:

[ftp://lsof.itap.purdue.edu/pub/tools/unix/lsof/lsof\\_man](ftp://lsof.itap.purdue.edu/pub/tools/unix/lsof/lsof_man)

Based on a report from Steve Laubscher  
<slaubs@woodward.com>, modified dlsof.h for PTX  
4.6[.1] to avoid a temporary dnlc\_t definition  
needed at PTX 4.5.1.

Corrected test for old Linux kernels in Configure.  
Henri Karrenbeld <ishtar@cal044202.student.utwente.nl>  
brought the error to my attention. Limited Linux  
claims to 2.1.72 and above in the documentation.

Improved HP-UX 11 Configure  
stanza and stream socket  
handling.

Constructed a work-around for the HP-UX 11 optional  
OnlineJFS package. The work-around sadly requires  
lsof to have a private version of the vx\_inode  
structure, since the OnlineJFS package doesn't  
update <sys/fs/vx\_inode.h>. Troyan Krastev  
<Troyan.Krastev@ricoh-usa.com> brought the bug to  
my attention and Michael Bracewell  
<michael@ra.TSS.PeachNet.EDU> provided a test system  
where I developed the work-around.

Added locale support to lsof's isprint() test,  
based on a suggestion from Dan Mercer <damercher@mmm.com>.  
lsof will use setlocale(), when that function and  
its supporting <locale.h> header file are available.

Added OpenBSD 2.9 support.

Based on a report from Aaron Rhodes <arhodes@psionic.com>  
and with testing help from Aaron, made the lsof  
4.56 revision compile and work on OpenBSD 2.6.  
While that OpenBSD version is no longer supported,  
Aaron's report exposed a Configure script bug  
affecting OpenBSD versions  
lsof does support.

Updated for FreeBSD 5.0-CURRENT. Szilveszter Adam  
<sziszi@petra.hos.u-szeged.hu> help test. The lsof  
FreeBSD ports packager, David O'Brien <obrien@FreeBSD.org>.

assisted.

Tested on AIX 5.1. Loc Le and Nasser Momtaheni of IBM provided test systems.

4.58 September 13, 2001

Added options to safestrprt() and safestrprtn() to surround the string with "" and to suppress the printing of an ending '\n'. Use of these functions in device cache file error message reporting answers a suggestion for better error reporting from John Jackson <jrj@purdue.edu>.

Fixed a Solaris 2.6 and above problem related to searching for "large" (O\_LARGEFILE) files by name; lsof was using the wrong version of [l]stat(2). The bug was reported by Daniel Trinkle <trinkle@cs.purdue.edu>.

Added AIX 4.1.4 and above XTI socket support.

Added OSR Xenix Shared Data and Semaphore file type support with modifications supplied by Bela Lubkin.

Updated  
OPENSTEP support with modifications from Carl E. Lindberg <lindberg@clindberg.org>. The changes enable the correct reporting of executable and library open files ("txt" type).

Limited claims of OpenServer support to the versions where I currently test, 5.0.4 and 5.0.6. (Lsof probably works on 5.0.5.)

Enabled processing of -C option for PSTAT-based HP-UX lsof.

Enabled and tested on FreeBSD 4.4.

Corrected a file system test example in 00QUICKSTART, based on a report from Jun Biao WANG <>wangjunb@cn.ibm.com>.

Made available for re-distribution a user-contributed port of lsof 4.51 to Reliant UNIX 5.45. Thomas Mauterer <Thomas.Mauterer@philosys.de> contributed the port.

4.59 October 20, 2001



With the closing of the Sequent Synergy Links Lab by IBM, terminated lsof support for PTX. The last tested PTX lsof revision, 4.58, is available on lsof.itap.purdue.edu in .../lsof/OLD/src.

Adjusted for FreeBSD 5.0-CURRENT NFS header file changes, based on a report from Jos Backus <josb@cncdsl.com>.

Corrected a bug in the way Linux lsof identifies the owner of a process. Lionel Cons <lionel.cons@cern.ch> reported the problem and tested the fix. Added code to avoid stat(2) calls on regular Linux files whenever possible. Lionel reported the need to do this (AFS files) and tested the new code.

Added new output field for raw device number in hex. The field is identified with 'r'. This field is NOT selected when -F or -F0 is specified so that its appearance won't disturb existing scripts that process field output.

Added support for OpenUNIX 8. A test system was provided by Larry Rosenman <ler@lerctr.org>. Matthew Thurmaier <matt@compclass.com> and many people from Caldera provided technical assistance.

Added an additional UVM test to the NetBSD Configure stanza. Andrew Brown <atatat@atatdot.net> supplied the test; it recognizes NetBSD 1.5Y UVM changes to the vnode structure recently committed by Chuck Silvers.

Applied Configure and get-xnu-headers.sh script changes supplied by Allan Nathanson <ajn@apple.com> for Darwin 1.4.

Added for Bela Lubkin <belal@mammoth.ca.caldera.com> OSR-specific environment variables to supply values to the Configure script. The variables are described in 00XCONFIG.

Added an IP version selector to the -i option parameters.

4.60 November 9, 2001

Added special handling to and corrected bugs in the matching of IPv4 in IPv6 addresses to -i6:<...> selectors.

Made 00FAQ corrections and updates, based on discussions with Igor Schein <igor@txc.com>.

Modified Configure script to detect a 64 bit capable gcc compiler and permit it to be used to build 64 bit (PA-RISC 2) lsof for HP-UX 11.00. Tested with HP's gcc package, which Rich Rauenzahn of HP kindly installed on a test system at HP. Stefan Marquardt <stefan.marquardt@hagebau.de> helped test.

Made lsof's method of killing its child process more robust, based on a suggestion from Bela Lubkin <belal@caldera.com>.

Modified all dialect Makefile segments to accept select -v #define's from the environment -- a builder's comment, host, logname, system information and user name. This was done for Bela Lubkin, so he can "tune" the -v output when he packages lsof in the upcoming Caldera OSR 5.0.7 release.

Changed Perl scripts in scripts/ to put the lsof path consistently in \$LSOF. Also added a fix from Bela Lubkin to scripts/big\_brother.perl5 that allows it to tolerate SCO OSR "ago" clauses in open UDP file information. Strengthened emphasis in scripts/00README that the scripts are examples that shouldn't be expected to run on all UNIX dialects without modification.

At Bela Lubkin's suggestion changed the device cache file format examples in 00DCACHE and 00FAQ to avoid "%U%". That's an SCCS escape sequence.

Added support for OpenBSD 3.0.

Added +DAportable to CFLAGS for 32 bit HP-UX 11. Amir Katz <Amir\_Katz@bmc.com> suggested the addition.

4.61 January 22, 2002

Updated field output example Perl scripts in the scripts/ subdirectory to discover the lsof path,

starting at .. and proceeding through the PATH environment variable's directories.

Added minor OSR Configure script fixes, provided by Bela Lubkin <belal@caldera.com>.

In response to a report from Joshua Wright <Joshua.Wright@jwu.edu> modified NetBSD and OpenBSD Configure stanzas and sources so that lsof can be built when there is no system source tree (e.g., /usr/src/sys).

In response to a report from Peter Valchev <pvalchev@openbsd.org> improved the UVM test in the OpenBSD Configure stanza.

Updated Configure script to recognize FreeBSD 4.5.  
Updated for FreeBSD 5.0 procfs and pseudofs changes.

Updated HP-UX stanza to see if the compiler named in the LSOF\_CC environment variable is the bundled compiler. If it is, "-O" is omitted from the compiler flags.

Updated  
Digital UNIX 4.x and Tru64 UNIX error message related to kernel name list failures. Added an FAQ section about how a kloadsrv daemon failure can cause knlist(3) to fail. The condition was reported by Douglas B. Jones <douglas@gpc.peachnet.edu>

Based on a report from Mark W. Eichin <eichin@thok.org> made Linux lsof capable of handling and reporting file sizes greater than 32 bits.

Tested on Solaris 9 BETA-Refresh.

Corrected a bug in the matching of IPv4 addresses, mapped in IPv6 addresses, to an IPv4 parameter to an -i option.

Ported to 64 bit Power AIX 5.1 kernel with advice from David Clissold <cliss@austin.ibm.com> and Marc Stephenson <marc@austin.ibm.com>, and on a test system provided by Loc Le <lple@us.ibm.com>.

4.62 March 7, 2002

Updated README to reflect the usefulness of gcc

for building AIX lsof. Documented a report from Brian L. Gentry <BGentry@nationsrent.com> of success on AIX 4.3.3. I documented my success on 32 bit Power AIX 5.1 and my lack of success on ia64 AIX 5.1 and 64 bit Power AIX 5.1.

Improved UnixWare >=7.1.1 reporting of UNIX socket NAME field information for NonStop Cluster systems with a patch provided by John Hughes <john@Calva.COM>. Offered John's improvement as a patch to lsof 4.61.

Corrected bugs in handling of open files on block devices by OSR lsof. The bugs were reported by Bela Lubkin <filbo@deepthought.armory.com>.

Fixed bug in writing >32 bit device numbers for block devices to the device cache file.

Added support for reporting block special nodes not in /dev (or /devices). That required "like device special" be changed to "like block special" and "like character special". (00FAQ was updated.)

Based on a report from Peter Valchev <pvalchev@openbsd.org> improved the definition of the source for NetBSD and OpenBSD kernel symbols (the nlist() source file). NetBSD now defaults to getbootfile(3) if it is available, /netbsd otherwise. OpenBSD now defaults to /dev/ksyms if it is available, /bsd otherwise.

Made possible compilation under BSD/OS (BSDI) 5.0 with changes to Configure, dialects/bsdi/dlsof, dialects/bsdi/dproc.c and lib/rnmh.c. The changes were suggested by Steven Hinkle <hinkle@bsdi.com>. Note that these changes do not substantiate a claim that lsof works on BSDI 5.0, because I haven't tested it there.

Updated OpenUNIX private <sys/fs/memfs\_mnode.h>, based on a report from Larry Rosenman <ler@lerctr.org> that it had been updated by Caldera patch OU800PK3. Unfortunately the patch only corrects some of the problems with the header file, so it is still necessary to distribute a private patched version of it with the lsof sources.

Applied a man page correction reported by Frederic Delanoy <max\_ok@yahoo.com>.

Corrected cast bugs related to using the HP-UX bundled C compiler on HP-UX 11.11.

#### 4.63 April 23, 2002

Added HPUX\_BOOTFILE environment variable for use by the Configure script in determining HP-UX kernel configuration information -- e.g., the state of the ipis\_s structure in the HP-UX 11 kernel. The change was suggested by Marc Bejarano <beej@alum.mit.edu>. Marc also suggested some changes to the HP-UX section in 00FAQ that discusses Configure's use of q4 for HP-UX 11.

Fixed a bug in the Solaris lsof file system matching code. It was not reporting that VCHR files in /devices were in / when /devices was in /, too.

Corrected bugs in device number, file size, file offset, and raw device number field output generation.

Added recognition of OpenBSD 3.1 to the Configure script with a suggestion from Peter Valchev <pvalchev@sightly.net>. Note that this change does not constitute a claim that lsof works on OpenBSD 3.1, because I haven't tested it there.

Built an automated test suite. (See 00TEST and the tests/ sub-directory of the lsof main directory). Bela Lubkin requested it. Dale Talcott, John Hughes, and Larry Rosenman helped me validate it on their systems.

During the development of the test suite I discovered the following lsof bugs or missing features, and corrected or supplied them.

- \* Corrected the reporting of locks for:
  - o Digital UNIX 4.0d and Tru64 Unix 5.[01];
  - o HP-UX 10.30 and 11.00;
  - o OpenUNIX 8;
  - o UnixWare 7.1.1.

\* Enabled HP-UX 10.30 and 11.00 to report open NFS file link counts.

\* Corrected the reporting of UNIX domain socket names for Apple Darwin, FreeBSD 4.5 and above, NetBSD 1.4.1 and above, and for OpenBSD 3.0 and above.

\* Enabled HP-UX 11.11 to stat(2) large files.

\* Fixed handling of combination 32 and 64 bit device numbers in AIX 64 bit architectures.

Updated the AIX 4.3.3 NFS rnode recognition code, first installed at revision 4.51. It looks like some IBM update has restored a single rnode structure independent of the machine bit width.

Updated the NetBSD and OpenBSD sources so NetBSD can process DTYPE\_PIPE files, as OpenBSD was already able to do.

Updated Darwin get-xnu-headers.sh script to reflect information about a recent reorganization of the Darwin CVS hierarchy, supplied by Allan Nathanson <ajn@apple.com>.

Added defense against the standard I/O descriptor attack.

4.64 June 26, 2002

Corrected some FreeBSD pre-processor directives. David O'Brien <obrien@NUXI.com> pointed them out.

Updated lsof's main() function to: 1) close all open file descriptors above 2 before starting; and 2) to set a non-interfering umask. Moved GET\_MAX\_FD test from misc.c to proto.h, so that main() could use it. Added multiple-include protection to proto.h.

Moved FAQ's test suite Q's & A's to a more appropriate section. Added a Q&A on HASSECURITY option and its affect on searching for open files. (That was already in the man page.)

Updated hpux/kmem/dnode.c for HP-UX < 11 compilation

with information from John Dzuber <Zube@CS.ColoState.EDU>.

While

Isof doesn't support HP-UX < 11 any more, I try to avoid disabling it there when possible, and a locking fix for HP-UX >= 11 in Isof 4.63 inadvertently disabled compilation of Isof for HP-UX < 11. Fixed long-standing bug in HP-UX 10.20 lock reporting.

Removed language from the test suite programs that requires an ANSI-C compiler. This allowed the test suite to be validated with cc and gcc on the unsupported HP-UX 10.20.

At the suggestion of Manuel Bouyer <bouyer@antioche.eu.org> switched NetBSD and OpenBSD Isof from using nlist() to using kvm\_nlist(). Made the same change for BSDI, Darwin, and FreeBSD.

Validated test suite on OPENSTEP 4.2.

In response to a suggestion from Jeff Stoner <jstoner@blackboard.com> enhanced support for the FD list of the -d option to allow it to be either an exclusion or inclusion list, using the '^' prefix to denote exclusions.

Made adjustments for FreeBSD 4.6 and 5.0-CURRENT.

Fixed a

FreeBSD /etc/make.conf CFLAGS extraction bug, reported by Kris Kennaway <kris@obsecuity.org>, and new a bug in the fix, reported by Eric Cronin <ecronin@eecs.umich.edu>

Added nullfs support for FreeBSD, NetBSD, and OpenBSD at the request of Andrew Brown <atatat@atadot.net>.

Modified all readmnt() functions to ignore mounted-on directory names that don't begin with '/'.

Tested on NetBSD 1.6A and OpenBSD 3.1.

Upgraded to Solaris 9 FCS with two changes to the BETA-Refresh support: 1) an adjustment to dnode.c for a change in the so\_so (sonode) structure; and 2) addition of Solaris 9 FCS specific DNLC code.

David Comay <David.Comay@Eng.Sun.COM> sent me the dnode.c change and Casper Dik <Casper.Dik@sun.com>

helped with the new DNLC support code.

Applied OpenUNIX changes that permit lsof to compile and run on the upcoming 8.0.1 release. The changes were supplied by Robert Lipe <robertl@caldera.com>. Larry Rosenman <ler@lerctr.org> provided a test system.

Added  
Solaris fd file system support.

4.65 October 10, 2002

Adjusted for change in FreeBSD 5.0-CURRENT inode structure, reported by David O'Brien <obrien@NUXI.com>. Adjusted for changes in FreeBSD 5.0-CURRENT <sys/vnode.h>. One change was reported by Anders Nordby <anders@FreeBSD.org>. Adjusted for FreeBSD 5.0-CURRENT on sparc64 architecture.

Enhanced the error reporting of Solaris lsof when it detects a kvm\_open() failure, and added a 00FAQ entry on the cause, based on a report from Peter J. Bertoncini <pjb@anl.gov>.

Enabled compiling of lsof for NetBSD 1.5 with the NULL file system, using a patch from Andrew Brown <atatat@atadot.net>.

Removed a hack in the LTbigf test program that was once needed when it was compiled on Solaris 9 BETA-Refresh with gcc. The hack isn't needed on Solaris 9 FCS. Janet Hempstead <jan@library.carleton.ca> brought the need for this change to my attention.

Applied a patch, supplied by Andrew Brown <atatat@atadot.net>, that updates lsof for NetBSD version 1.6F. Corrected handling of the NetBSD nullfs.

Updated to BSDI BSD/OS 4.3 on a test system kindly provided by Terry Kennedy <terry@tmk.com>.

Updated to FreeBSD 4.7.

Updated to Apple Darwin 1.5, 5.x and 6.x with patches supplied by Allan Nathanson <ajn@apple.com>. The patches include IPv6 support.



Updated Configure to use the -bnolibpath loader option when building lsof on a PowerPC, running AIX 5 or greater. Valdis Kletnieks <Valdis.Kletnieks@vt.edu> informed me this was needed. Lsof for AIX 5.x was initially developed on the IA64, where -bnolibpath can't be used and I didn't think to restore it to PowerPC loads when AIX 5.x became available for that architecture.

Updated to UnixWare 7.1.3 on a test system provided by Larry Rosenman <ler@lerctr.org>. Removed claims that lsof works on OpenUNIX 8.0.1, because UnixWare 7.1.3 is the release name of OpenUNIX 8.0.1.

Based on a comment that his e-mail address was wrong in the lsof distribution from Kenneth Stailey <kstailey@disclosure.com>, removed all e-mail addresses from lsof documentation files except this one, 00DIST. The addresses in 00DIST are used to send revision release notices to those who contributed to a revision, but the addresses in this file for previous revisions and in other documentation files sometimes grow stale and are never validated.

4.66 December 22, 2002

Acquired Solaris 7 and 8 test systems, courtesy of John Dzuber <Zube@CS.ColoState.EDU>. Updated 00TEST and tests/TestDB accordingly.

Clarified FreeBSD 5.0 architecture claims at the suggestion of David O'Brien <obrien@NUXI.com>. Also implemented David's suggestion to change Intel to x86.

Installed changes to DNLC handling in OSR lsof in preparation for handling changes in the OSR 5.0.7 DNLC cache. Information about the changes and patches to handle them were supplied by Bela Lubkin <filbo@deepthought.armory.com>.

Upgraded True 64 UNIX support to the 5.1B release on a test system provided by Berkley Shands <berkley@cse.wustl.edu> Had to use relaxed ANSI compilation because of an error in a system header file and other lsof source usages.

Implemented the HASNOSOCKSECURITY compile-time option. When it and HASSECURITY are defined, lsof will be built to list only the user's open files, but will also list anyone else's open socket files, provided the "-i" option selects their listing. Updated the Customize script to ask about setting HASNOSOCKSECURITY. Left it undefined in all dialect machine.h header files. This change was requested by Kenneth Stailey <kstailey@speakeasy.net> for use with ntop.

Added support for OpenBSD 3.2 and its kernel trace file.

Improved lsof help (-h) and version (-v) information reporting.

Fixed a FreeBSD 4.7 and above off-by-two UNIX domain socket path termination bug, reported by Ken Stailey <kstailey@speakeasy.net>

4.67 March  
27, 2003

Began the transition of the lsof ftp server host name from vic.cc.purdue.edu to lsof.itap.purdue.edu. That reflects Purdue organizational changes. This first step makes the new name an alias to the old one. The old name, vic.cc.purdue.edu, will remain usable for an extended period.

Corrected a revision number reference in section 17.17 of 00FAQ on the appearance of Solaris negative DNLC caching handling.

Updated 00FAQ discussion of compilers for 64 bit Solaris.

Validated test suite for 64 bit Solaris 8 and gcc.

At the request of Alek O. Komarnitsky <alek@komar.org> added the "+c <width>" option to enable optional changing of the COMMAND column output maximum width from the default to <width>. The default maximum width remains CMDL, as defined in lsof.h.

Fixed three AIX kernel bit size detection bugs, one in the AIX Configure script stanza, the second

and third in the AIX dproc.c get\_kernel\_access() function.

The bugs were reported by Pierre-Yves Fontaniere <pyf@cc.in2p3.fr>, who tested the fixes.

Added kernel event queue file support for FreeBSD, NetBSD and OpenBSD. Andrew Brown <atatat@atadot.net> supplied the code.

Updated to AIX 5.2 on a test system provided by Dale Talcott <dtalcott@purdue.edu>. Had to build work-arounds for two missing AIX 5.2 header files, <j2/j2\_snapshot> and <proc/proc\_public.h>. Corrected an off-by-one UNIX socket addressing bug. Taught AIX lsof to handle both jfs and jfs2 files at the same time. Adjusted for an IBM mistake in the sizing of the fdsinfo structure in <procinfo.h> Toshiya Nakamura <TOSHIYAN@jp.ibm.com> helped test,

Updated to FreeBSD 4.8. Corrected another bug in FreeBSD UNIX domain socket name handling.

Corrected gcc build problems on HP-UX 11i, reported by Yuliy Minchev <yuliy@mobiltel.bg>.

Updated BSDI BSD/OS support to 4.3.1.

Augmented a lock ID test on NetBSD to check if the ID is an LWP pointer.

4.68 June 18, 2003

Enhanced Configure script's cleanup operations.

Added support for OpenBSD 3.3, based on a report from Peter Valchev <pvalchev@sightly.net>.

Improved the description of the detached PGP signature certificate file in the main lsof README file, based on a suggestion from Diana Stockdale <diana@mpl.ucsd.edu>.

Installed a work-around for FreeBSD 5.0-CURRENT on Alpha to avoid a compiler register use complaint.

Corrected a 'c' option error message. Gnele <blaadeleng@yahoo.com> reported the problem.

Upgraded EXT2FS and UFS support for NetBSD and OpenBSD to handle new inode information, and the fast UFS1 and UFS2 file systems.

With the help of Andrew Brown <atatat@atadot.net> determined the NetBSD snapshot (1.6F) at which <sys/mount.h> could be included under \_KERNEL, thus eliminating the lsof netexport.h hack. The same change applies to OpenBSD versions 3.3 and above.

Applied a patch from Armin Gruner <ag@muc.de> that corrects the use of the HASPROCFS definition in the FreeBSD dialect sources.

Corrected spelling errors in 00FAQ and in the generated 00.README.FIRST\_<version> file of the distribution archive. John Jackson <jrj@purdue.edu> and Ray Phillips <r.phillips@jkmrc.uq.edu.au> spotted and reported the errors.

Corrected a spelling error in a comment and incorrect use of an alarm function in the LTsock test program.

At the suggestion of Stuart Anderson <sba@srl.caltech.edu> added preliminary (and incomplete) SAM-FS file system support to Solaris lsof. Completion awaits availability of SAM-FS internals.

Fixed a Solaris device name printing bug, reported by Ric Anderson <ric@tick.Telcom.Arizona.EDU>, only visible when HASDCACHE is not defined. Ric helped test the fix.

Fixed an AIX kernel bit size handling bug related to the NFS node (rnode) structure.

Corrected a print\_kptr() function call error in the AIX AFS code, reported by David Steiner <david.r.steiner@Dartmouth.EDU>. Upon further reflection and because I no longer have appropriate AIX AFS test systems, disabled AIX AFS support in the Configure script for AIX versions above 4.3.3.0 or AIX AFS versions above 3.5.

Added support for FreeBSD 5.1.

With advice from Allan Nathanson <ajn@apple.com> adjusted

the Darwin get-xnu-headers.sh script to access the kernel header files needed by lsof from a new form of the Apple open source repository.

Installed Linux and lsof library bug fixes and improvements, supplied by Marian Jancar <mjancar@suse.cz>. One Linux improvement handles mount strings that have octal escapes in them, eg., \040 for embedded blanks. Marian tested the changes.

4.69 October 16, 2003

Received and applied an OpenBSD patch from Peter Valchev <pvalchev@sightly.net> that replaces a ctob() call with a sysconf() call. Peter claims sysconf() is needed for OpenBSD on SPARC. (It is not needed for NetBSD on SPARC.)

With the upgrade of my only Solaris 7 test system to, Solaris 8, dropped the \*claim\* that lsof works on Solaris 7. That doesn't mean it won't work there, so those who want lsof for Solaris 7 probably should be able to build it there and it probably will work there.

Revised lsof's DNLC handling for BSD derivatives, including: BSDI; Darwin, DEC OSF/1, Digital UNIX and Tru64 UNIX; FreeBSD; NetBSD; and OpenBSD. The latest NetBSD distribution's dropping of the vnode capability ID (v\_id) required the revision.

Adjusted to the latest FreeBSD 5.1-CURRENT.

Added NetBSD support for using kvm\_getproc2().

Added a patch from Andrew Brown <atatat@atadot.net> to handle NetBSD enum conflicts and changes in the <miscfs/kernfs/kernfs.h> and <miscfs/procfs/procfs.h> header files.

Added a "#define \_KERNEL" to the AIX dnode2.c source file for compatibility with a new <j2/j2\_inode.h> AIX 5.2 header file version. The addition was supplied by Dick Dunbar <Dick.Dunbar@Siebel.com> and was offered as a patch to lsof 4.68/

Added support for a second type of Solaris SAMFS. Stuart Anderson <sba@srl.caltech.edu> provided the

support. SAMFS support in lsof SOLARIS remains scanty, because Sun won't release any details on its kernel structures.

Dropped the \*claim\* that lsof works on AIX 4.3.3, because I was unable to test it there. That doesn't mean it won't work there, so those who want lsof for AIX 4.3.3 probably should be able to build it there and it probably will work there.

Updated for Solaris 10 on test systems provided by Mike Miscevic <miscevic@hotpop.com>. Casper Dik <casper@holland.sun.com> provided significant help. During the Solaris 10 port found and fixed an lsofs handling bug that prevented reporting of open lsofs file lock status.

Updated the DNLC test, LTdnlc, to provide a possible explanation about file systems on which the test might fail.

Modified the procedure for obtaining missing Darwin XNU kernel header files. The new one requires more manual intervention, but is the best that can be done with the way Apple open sources are now organized. 00FAQ explains the new procedures for those not used to downloading Apple open source files.

Added support for Apple Darwin 7.0 (Mac OS X 10.3) with patches supplied by Allan Nathanson <ajn@apple.com>. Dropped the \*claim\* that lsof builds and works on Apple Darwin below 6.0.

Validated lsof on FreeBSD 4.9, using a test system provided by Ben Lewis <bl@purdue.edu>.

Validated lsof on FreeBSD 5.1-CURRENT for Amd64. David O'Brien <obrien@FreeBSD.org> provided a test system.

Changed the NetBSD Configure stanza to do header file searches in /usr/include by default. The LSOFS\_INCLUDE and NETBSD\_SYS environment variables may still be used to specify other search paths. Discussions with Andrew Brown and Wolfgang S. Rupprecht <wolfgang@wsrcc.com> led to the change.

4.70 January

16, 2004

Improved shell-portability of the linux stanza of the Configure script with a patch from Paul Jarc <prj@po.cwru.edu>.

Added a "silent" rule to tests/Makefile for Paul.

Updated, extended and clarified the test suite documentation in 00FAQ and 00TEST.

Fixed Solaris 10 dlsof.h typo, reported by Mike Miscevic <miscevic@hotmail.com>. The typo prevents lsof from loading cleanly in Solaris 10 builds past 40.

Fixed a Solaris HSFS node number reporting bug and added a structure definition work-around for Solaris 10.

Converted PGP signing to GPG. My previous PGP key can be used, but the gpg "--allow-non-selfsigned-uid" option may have to be used when it is imported into a GPG key ring.

Added bz2 compression.

Updated for OpenBSD 3.4.

Added a work-around for a missing header file in the s10\_44 Solaris 10 build.

Added support for FreeBSD 5.2-BETA and 5.2-CURRENT.

Updated Linux AX25 support with modifications supplied by Lutz Poetschulat <dl9cu@db0zwi.de>.

Added raw IPv6 support to Linux lsof.

Improved handling of parameters after "-i@".

Improved file name test in LTdnlc.c.

Added loop count controls to the reading of Solaris lock chains. The change was implemented as a result of a report from Steve Gonczi <steve@relicore.com>.

Based on a report from John Jackson <jrj@purdue.edu>.

enabled a Solaris 10 <sys/lgrp.h> work-around for Solaris 9, too. (Patch 112233 installs an lgrp.h on Solaris 9 that needs the work-around.)

With help from Andrew Brown <atatat@atadot.net> and John Heasley <heas@netbsd.org> added log-structured file system (LFS) support for NetBSD and OpenBSD.

Added AMD64 to the list of FreeBSD 5.x-CURRENT supported architectures. FreeBSD.org provides a test system, courtesy of (I believe) David O'Brien <obrien@FreeBSD.org>.

Added a cast to lseek() in the HP-UX /dev/kmem-based kread() function to make it work properly with the bundled HP C compiler.

4.71 March  
11, 2004

Added text file support to Apple Darwin lsof and enabled the lsof executable portion of the LTbasic test. Added support for Darwin kernel queue, POSIX semaphore and POSIX shared memory files. Tested on Darwin 7.2 (aka Mac OS 10.3.2).

Added process\_kqueue() function prototypes for FreeBSD, NetBSD and OpenBSD.

Picked some lint in AIX sources, lib/rnmh.c and tests/LTsock.c.

Added "-x [fl]" cross-over option, which enables +d and +D processing to cross over symbolic links and/or file system mount points. Discussion with Johan Lindquist <johan@smilfinken.net> and Eric Williams (aka The Ghost In The Machine) <ewill3@earthlink.net> on Linux news groups revealed the need for the option.

Updated support for UnixWare 7.1.4.

Added support for the optional reporting of socket options, socket states and TCP flags for most currently supported dialects. John Smith <lbalbalba@hotmail.com> and Tristan Nefzger <tn@bhtrader.com> requested the information.

The dialects and their versions for which this feature has become available include:



AIX 4.3.2 and 5.[12]  
Apple Darwin 7.2  
BSDI BSD/OS 4.3.1  
Digital UNIX and Tru64 UNIX 4.0  
FreeBSD 4.9 and 5.2  
HP-UX 11 and 11.11 (aka 11i)  
NetBSD 1.6ZH  
OpenBSD 3.4  
OPENSTEP 4.2  
OpenUNIX 8  
SCO OpenServer Release 5.0.6  
Solaris 2.6, 8, 9 and 10  
UnixWare 7.1.[134]

Modified the Configure stanza for HP-UX 11 with better q4 detection. Steve Bonds <3vhmxxm02@sneakemail.com> supplied the modification.

Applied a patch from Mike Miscevic <miscevic@hotpop.com> to enable lsof to compile with the zone support in the Solaris 10 s10\_b51 release. Added information on lsof zone behavior to 00FAQ.

Added a "-z [z]" option to Solaris 10 lsof. It enables the listing of zone name and can also be used to select the listing of processes and their files from specified zones.

4.72 July 13, 2004

Corrected

Solaris 10 ZONE column title display bug with a patch from Joep Vesseur <Joep.Vesseur@Sun.COM>. Joep's fix was offered as a patch to 4.71.

Based on a report from Jean-Pierre Radley <jpr@jpr.com> about an unexpected GNU uname Configure interaction on OSR, and working from information received from Bela Lubkin, changed the OSR Configure stanza to use /bin/uname instead of uname. Added an FAQ entry about Configure version detection problems.

Added the +m and "+m m" options in response to a dialog with Robert T. Brown <rbrown@netmentor.com>. The options allow the creation of a mount table supplement file which can be used on selected dialects to get device numbers when stat(2) and lstat(2) can't deliver them. (That's generally the result of an inaccessible NFS server.) Currently the new options are supported

only on Linux.

Made cpumask\_t typedef \_KERNEL compensation for FreeBSD 5.2-CURRENT. Refined it for 5.2.1-RELEASE with testing help from Scott Ellentuch <tuc@tts.com>.

Added support for FreeBSD 4.10. Larry Rosenmann <ler@lerctr.org> kindly provided a test system.

Added support for NetBSD 2.0 with patches supplied by Andrew Brown <atatat@atadot.net>. Andrew also provided two test systems.

Made handling of Linux maps file more robust, based on a report from Jan Blunck <J.Blunck@tu-harburg.de>. As a side benefit, made handling of generated stat(2) information more flexible.

As a result of a discussion with Jason Fortezzo <fortezza@mechanicalism.net>, adjusted lsof for Solaris to obtain the maximum user name length from ut\_name of the utmpx structure, if <utmpx.h> exists.

Tested under OpenBSD 3.5.

Updated 00README information about using gcc (via the Configure aixgcc abbreviation) to compile lsof on AIX. Ann Janssen <ajanssen@nebook.com> made me aware the information was out of date.

Added an AIX SIGDANGER handler and some 00FAQ sections on lsof memory usage after a discussion with Tom Qin <tom.qin@citigroup.com> about lsof memory usage.

Added scripts/sort\_res.perl5, contributed by Fabian Frederick <fabian.frederick@gmx.fr>. The script displays lsof output sorted by size and path name.

Improved handling of files on Linux NFS mount points that use the root\_squash option, based on discussions with Paul Szabo <psz@maths.usyd.edu.au>.

Updated FreeBSD 5.2-CURRENT support, based on a problem report from Filippo Natali <filippo@widestore.net>.

Corrected improper FreeBSD 5.x-CURRENT #if condition,

reported by Kim Culhan <kimc@kim.net>.

Added a Configure script work-around for AIX 5.2 lsof with JFS2, compiled by gcc >= 3.3. The work-around was supplied by Florian M. Weps <fmw@hactrn.ch>.

4.73 October 21, 2004

Added an `__XPG4_CHAR_CLASS__` #define before `#include'ing <ctype.h>` on Solaris to restore lsof's ability to display special characters such as acute-e.

Added wide-character (e.g., UTF-8) support where possible,

prompted by a request from Kyungjoon Lee <kjoonlee@gmail.com>. Some older dialects -- e.g., NetBSD 1.4.1 -- don't support wide characters, so the wide character support is enabled by definitions in each dialect's machine.h. Dialects with wide-character support are listed in 00FAQ.

Make a FreeBSD 5.2-CURRENT adjustment for `<sys/pipe.h>`, supplied by Sergey A. Osokin <osa@FreeBSD.ORG>.

Implemented a Linux feature request made by Jakub Jelinek <jakub@redhat.com> that enhances lsof's ability to locate UNIX domain sockets whose paths are named as arguments. Jakub supplied suggested code.

Dropped \*claims\* that lsof works on AIX below 5.1, SCO  
Dropped \*claims\* that lsof works on AIX below 5.1, SCO  
Openserver 5.0.4, Tru64 UNIX 5.0, and UnixWare below 7.1.4. Lsof will probably build and work on those UNIX dialect versions, but I no longer have any way to test lsof on them.

Added support for FreeBSD 5.3 and 6.0. The FreeBSD 5.3 support hasn't been tested.

Added FD test code that will allow dialect versions to test FD option selections. Used the new code in the PSTAT-based HP-UX lsof to enable it to avoid scanning the mount table when its information is not needed. The addition was made in response to a query from Harvey Garner <Harvey.Garner@championusa.com> about lsof performance in a busy NFS environment.

Upgraded lsof's AIX support level to AIX 5.3, based on

a report from Dick Dunbar <Dick.Dunbar@Siebel.com>. (I have not tested lsof under AIX 5.3.) Based on Dick's recommendation and local testing changed the C for AIX version 6 and higher -qmaxmem option value to -1.

Made LSOF\_AR environment variable more useful and documented it in 00XCONFIG.

Corrected the use of sum(1) to generate signatures for the lsof distribution and binaries to match the documentation that claims it is sum -r output. Jin Guojun <jin@george.lbl.gov> noticed and reported the problem.

Tested under OpenBSD

3.6.

Added checksum and GPG certificate files for the bz2, gz and Z lsof distribution archives. The new files reside with the distribution archives and supplement the signature information already inside the archives.

Validated on Solaris 10, i8xpc, build s10\_63.

4.74 January 17, 2005

Fixed a Solaris segment fault bug on systems that lack a /dev/allkmem device. Offered the fix as a patch to lsof 4.73. The bug was reported by Donald Zoch <donald.zoch@amd.com>.

Updated lsof for FreeBSD 6.0 and higher for a change in <sys/vnode.h>, based on a report from Sergey A. Osokin <osa@FreeBSD.ORG>. Made the update available in a 4.74 'A' edition pre-release.

Filed an HP bug report about missing pstat(2) CWD info for LOFS on HP-UX 11.11 and higher. The missing CWD info was noticed by Ermin Borovac <e.borovac@bom.gov.au>. Added info to 00FAQ about the problem, which can cause the lsof test suite's LTbasic test to fail.

Updated the q4-generated tcp\_s.h in the lsof distribution and added socket option support for HP-UX 11.00. Erwin Reyns <ereyns@europarl.eu.int> helped test.

Updated for Solaris 10, build s10\_69, with a patch

supplied by Mike Miscevic <miscevic@hotpop.com>.

Added v\_path support to Solaris 10 lsof. That relieves it of having to read and decode the kernel DNLC, and delivers full paths more reliably.

Added specialized NFS4 support to Solaris 10 lsof.

Applied Solaris 10 patches to lsof supplied by Casper Dik <casper@holland.sun.com>.

Updated lsof for NetBSD 2.99.10 and tested it on a system provided by Andrew Brown <atatat@atatdot.net>.

Added support for the FreeBSD 6.0-CURRENT f\_vnode pointer in the file structure.

Added BSDI, FreeBSD, NetBSD and OpenBSD support for the \*effnlink member of the inode structure. This makes the lsof LTnlink test run faster on all modified dialects and correctly on OpenBSD.

Added ptyfs support for NetBSD, using modifications provided by Andrew Brown.

Changed the netbsd Configure stanza to look by default for system header files in both /usr/include and /usr/src. (The NETBSD\_SYS environment variable can still be used to select an alternate for /usr/src.)

Corrects two FreeBSD 4.10 RPC/XDR type definitions.

Added an FAQ Q&A about setuid and setgid restrictions in HP-UX 11.11. The information in the answer was supplied by Frank Sanders <frank.sanders@siemens.com>.

Added abbreviations for AXI FCIO and FSNAPSHOT file flags. Holger VanKoll <Holger.VanKoll@swisscom.com> reported the missing FCIO.

Adjusted lsof's private AIX 64 bit rnode structure for 64 bit AIX 5.2 systems. (IBM doesn't distribute a correct <nfs/rnode.h> for it.)

Corrected a Linux socket inode printing bug reported by Igor Schein <igor@txc.com>.

Updated for FreeBSD 4.11. The support compiles but hasn't been tested.

Back-ported a FreeBSD 6.0-CURRENT fix to FreeBSD 5.3-RELEASE-p1. That was done to solve a compilation problem reported by Radko Keves <rado@daemon.sk>.

4.75 May 16, 2005

Dropped the \*claim\* that lsof works on DEC OSF/1 and Digital UNIX, since my last 4.0 test system has been removed. The last tested distribution of lsof on DEC OSF/1 and Digital UNIX was revision 4.74. It has been archived on lsof.itap.purdue.edu in pub/tools/unix/lsof/OLD/src.

Added negation forms to the values in the -g (PGID) and -p (PID) lists. Negated PGID and PID values, like negated UID or login name values, are applied without ORing or ANDing and take effect before any other selection criteria are applied.

At the request of Marcin Gozdzalik <gozdzal@gmail.com> added a -X option for Linux. The option inhibits the reading of the /proc/net/tcp\* and /proc/net/udp\* files.

Based on a report from David Gutierrez <davegu1@hotmail.com> changed DEC OSF/1 process table allocation to request memory in smaller increments.

Based on a report from jayjwa <jayjwa@atr2.ath.cx> updated the Customize script to use "tail -n 1" where possible.

Enabled support for FreeBSD 5.4.

Improved the BSDI, FreeBSD, NetBSD, OpenBSD and Solaris kvm\_open() and kvm\_openfiles() error messages.

Enabled support for NetBSD 2.99.12.

Improved HP-UX Configure stanza with help from Piet Starreveld <pstarrev@csc.com>. Picked some lint Piet found.

Enabled IPv6 support for HP-UX > 11. Piet Starreveld helped test it on 11.23, among others.

Updated for HP-UX 11.23 on the ia64 architecture.

Updated to latest FreeBSD 6.0-CURRENT, using a test system provided by Andrzej Tobola <ato@iem.pw.edu.pl>.

Added support for SCO OSR 6.0.0 and UnixWare 7.1.4 with help from Richard at SCO.

Corrected a Linux bug in NFS handling, reported by Karel Zak <kzak@redhat.com>. Karel supplied a patch.

Improved the code for accessing an AIX 3.2 and higher sockaddr\_un structure, thus eliminating a segmentation fault possibility.

Updated for AIX 5.3.

Added preliminary (DEBUG) support for the AIX SANFS file system.

Fixed a bug in the Solaris 10 processing of the vnode's v\_path pointer with code supplied by Edward Jajko <ejajko@portal.com>. The fix was offered as a patch to 4.74.

Dropped support for OpenUNIX 8, since a test system is no longer available. Archived an OpenUNIX-only distribution of the last revision (4.74) tested on OpenUNIX in pub/tools/unix/lsf/OLD/src.

Tested under Openbsd 3.7.

Tested under Darwin 7.7.0.

Enabled building on amd64 Solaris 10 with hints from Marc Aurele La France <tsi@ualberta.ca>. Marc provided a test system.

Supplied a missing quote in the FreeBSD Configure stanza. Carl Cook <Info@quantum-sci.com> reported the problem.

Removed "-O" option from tests/Makefile so that the HP-UX bundled compiler won't complain.

4.76 August 30, 2005

Corrected an example and spelling errors in man page.

Updated for Apple Darwin 8.x with changes supplied by Allan

Nathanson <ajn@apple.com>. Allan also provided a test system.

Completed documentation of CLRLFILEADD in all machine.h files.

At the request of Chris Markle <cmarkle@sendmail.com> added partial listen queue length to socket options displayed when -Tf is specified. Partial queue length is not reported for all dialects. (00FAQ lists the ones where it is reported.)

Updated for FreeBSD 7.0 with information supplied by Andrzej Tobola <ato@iem.pw.edu.pl>.

Updated Solaris VxFS support for VxFS versions 4 and above with technical advice from Craig Harmer <craig\_harmer@symantec.com>, Gary Millen <gary\_millen@symantec.com> and Chuck Silvers <charles\_silvers@symantec.com>. Testing help was provided by Michael Antlitz <mantlitz@prophasys.com>, Steve Ginsberg <steve@dhapdigital.com> and Kenneth Stailey <kstailey@yahoo.com>.

Fixed a Solaris address space map processing bug. Janardhan Molumuri <mjanardhan@gmail.com> reported the bug and help me identify it. Made the fix available as a patch to 4.75.

Added support for Solaris 10 port and CTFS files. The CTFS support is incomplete, because I don't know how to get inode number, size and link count. (There's a new 00FAQ entry about that.)

Investigated a report from Christopher J Warweg <warwegc@GAO.GOV> that the CHECKSUMS for the lsof 4.75 binary for 64 bit Solaris 8 was incorrect. It was my packaging error. I rebuilt and repackaged the binary.

Enabled support for Linux map file names with embedded spaces.

4.77 April 10, 2006



Added -X option support for Solaris 10 and above. When -X is specified lsof will report cached v\_node path names for unlinked files, followed by "(deleted)". Improved cached vnode path name handling by adding "(?)" to the end of path names of questionable accuracy. Updated 00FAQ to reflect these changes.

Updated for FreeBSD 7.0-CURRENT.

Fixed name addition spacing bug, reported by Stuart Anderson <anderson@ligo.caltech.edu>. Also updated Solaris 10 SAMFS support at Stuart's request.

Added missing "break;" and another HASSTATVFS test to the NetBSD and OpenBSD dnode.c. Bill Behr <bbeh@networkstoragecorp.com> reported those needs.

Fixed an HP-UX 11 file descriptor "chunk" size problem, reported by Per Allansson <per@appgate.com>. Per helped devise the fix and tested it. This fix was offered as a patch to lsof 4.76.

Updated for FreeBSD 6.0-STABLE and FreeBSD 6.1-PRERELEASE.

Updated scripts/sort\_res.perl5 with changes supplied by Frederick Fabian <fabian.frederick@skynet.be>, the author of the script.

Corrected +|-M man page documentation error, reported by Roger Cornelius <rac@tenzing.org>.

Improved FreeBSD user device random seed generation in response to a problem report from Danny Braniss <danny@cs.huji.ac.il>.

Eliminated three syntax error bugs and other compiler complaints from the PSTAT-based lsof. H. Merijn Brand <h.m.brand@xs4all.nl> reported the problems and tested the fixes.

Eliminated compiler complaints in the test suite.

Investigated problems with the building of lsof on PA-RISC HP-UX 11.23, based on a report from John Orndorff <John.Orndorff@sungard.com>. Found that

neither the HP bundled C compiler nor gcc would build lsof, but the the HP unbundled ANSI C compiler would. Concluded that HP bundled C compiler can't handle <gssapi/gssapi.h>. Devised a work-around to gcc's omission of the rpcent structure definition of <netdb.h> that allows it to compile lsof's print.c, but the resulting binary doesn't run reliably. Documented the situation in 00FAQ.

Changed reporting of unknown file types. The number of an unknown type is now reported as four octets. The change was made in response to a Linux lsof bug report from Karel Zak <kzak@redhat.com>.

Dropped the \*claim\* that lsof works on BSDI BSD/OS since my last test system has been removed. The last tested distribution of lsof for BSDI BSD/OS was revision 4.76. It has been archived on lsof.itap.purdue.edu in pub/tools/unix/lsof/OLD/src.

As a result of discussing the lsof source tar's MD5 checksum with Andrew Bell <andrew.bell.ia@gmail.com>, changed the description of a suitable MD5 tool in the lsof distribution's documentation to name the openssl "dgst" command.

Enabled compilation on Solaris 10 1/06 with a fix sent by Jason Fortezzo <fortezza@mechanicalism.net>. Made the fix available as a patch to 4.76.

Adjusted to FreeBSD 5.5-PRERELEASE.

Corrected a bug in the lsof library's process\_file() function to enable the locating of AIX XTI sockets by their TCP/IP address values. The bug was reported by Michel Dubois <Dubois@sears.ca>.

Based on a bug report from Karel Zak <kzak@redhat.com> added command name length checking to as many dialects as possible (Linux for Karel) for the "-c c" option.

Updated for OpenBSD 3.[89]. Tested the 3.9 update on a system provided by David Mazieres. I have not tested on OpenBSD 3.8, but David reports lsof 4.76 worked there.

Ended regression testing of lsof on 32 bit Solaris 8 with the ending of access to a test system. Lsof continues to be tested on 64 bit Solaris 8.

4.78 April 24, 2007

Added more information to the lsof FAQ about missing link counts and sizes on Linux files.

Simplified Linux stat() and lstat() usage.

Relocated #define's that prevent OpenBSD compilation on systems without a /proc file system. Pieter Bowman <bowman@math.utah.edu> reported the problem.

Added code to avoid processing Linux /proc/<PID>/maps file entries with zero device and node numbers. Some such entries now have names associated with them that are not path names -- e.g., "[heap]", "[stack]" or "[vdso]". Scott Worley <sworley@chkno.net> reported lsof's mishandling of such entries.

Added SELinux security context support, provided by James Antill <james.antill@redhat.com>.

I have not tested this, but James and Karel Zak <kzak@redhat.com> have.

Added the #include of <sys/types.h> to Solaris lsof to enabled compilation on Solaris 10 6/06. Peter Harvey Peter.Harvey@Sun.COM diagnosed the problem and supplied a patch.

Added better support for JFS2 on AIX 5.2 and 5.3, based on bug reports and help from Thomas Braunbeck <BRAUNBEC@de.ibm.com> and Tom Whitty <TWHITTY@cerner.com>.

Documented that lsof supports AIX 5.3 only up through maintenance level 1 (ML1).

Enabled Solaris lsof to locate the AFS vnode operation address for OpenAFS 1.4.1. The fix was supplied by Robert Jelinek <Robert.Jelinek@MorganStanley.com>.

Enabled support for Solaris 10 ZFS. If the necessary ZFS header files aren't found, lsof offers the option to drop ZFS support, to use internal, possibly inaccurate structure definitions, or to supply a path to the missing header files. Horst Scheuermann

<Horst.Scheuermann@uni-trier.de> provided a development system and helped test the support.

Corrected a typo in the man page, reported by Eric S. Raymond <esr@thyrsus.com>.

Changed the spelling of macroes to macros in lsof source and documentations files, based on a suggestion from Josh Soref <timeless@gmail.com> and verification with the OED.

The following dialects are no longer supported: 32 bit AIX 5.2, HP-UX 11, OpenStep 4.2, Solaris 2.6, Solaris 8, True Unix 64 and UnixWare 7.1.4. Lsof may work on them, but I no longer have test systems for them. Support for OpenBSD ends at its version 3.9 for lack of interest in the port.

4.79 April 15, 2008

\*\*\*\*\* IMPORTANT NOTE \*\*\*\*\*

\*  
\*  
\* Lsof support has been reduced to the following \*  
\* dialects: AIX, FreeBSD, Linux and Solaris, and \*  
\* only in selected versions of those dialects. \*  
\* The selected versions are listed in this file \*  
\* and in other lsof documentation.  
\*  
\*  
\* I have made this move because of retirement \*  
\* and because I no longer have many test systems \*  
\* available to me. \*  
\*  
\* Vic Abell \*  
\*  
\*

\*\*\*\*\*

Fixed a Solaris VXFS permission problem when accessing the VXFS inode offsets. The bug was reported by Gregory A. Ivanov <ivga@mts.ru>. Gregory tested the fix.

Moved an #include <string.h> later in FreeBSD dlsof.h to enable compilation on recent FreeBSD releases. The change was supplied by Roy Marples <uberlord@gentoo.org>.

Improved Linux /proc file stream reading speed by applying

an expanded version of a patch from Eric Dumazet <dada1@cosmosbay.com> that allocates a page size buffer to each stream. Improved TCP, TCP6, UDP and UDP6 hashing by determining the hash bucket count from the /proc/net sockstat and sockstat6 files. The improvement was suggested by Eric and he provided sample code. Eric also tested both improvements.

Modified Configure script to build lsof on FreeBSD

6.2. Tested it on a system provided by Larry Rosenman <ler@lerctr.org>.

Fixed a Linux maps file processing bug that prevented path names from having an embedded colon. James Lingard <jchl@arastra.com> reported the bug and helped with its fix.

Based on reports from Eric Dumazet and Samuel Thibault <samuel.thibault@ens-lyon.org> added support for the Linux 2.6.22 kernel's /proc/<PID>/fdinfo files -- i.e., file offset and flags. Samuel Thibault provided a test system.

Fixed a Linux UNIX socket memory leak, reported by Phillip Shin <pshin@xceedium.com>. Phillip supplied the fix.

With generous assistance from HP added support for an HP-UX 11.23 patch that makes TLI/XTI socket address information available.

Fixed

a header file problem for FreeBSD 6.2 on the Alpha architecture. The problem was reported by Pekka Honkanen <phonkane@cc.hut.fi>. Pekka tested the fix.

Based on a report and using suggested fixes from Karel Zak <kzak@redhat.com>, made these changes to Linux lsof: corrected a getpidcon() error message; insured that inode numbers are handled correctly for their unsigned long long type; and improved SELinux handling. At the request of Alon Bar-Lev <alonbl@gentoo.org> added the LINUX\_HASSELINUX environment variable to enable or inhibit SELinux support unconditionally.

Updated Configure for FreeBSD 8.0-CURRENT and tested lsof on AMD64 there.

Added a patch provided by Oles Hnatkevych  
<don\_oles@able.com.ua> for FreeBSD systems where the root  
file system is on a CD9660 device.

Added compensation for the disappearance of FMARK and FDEFER  
from the FreeBSD 8.0-CURRENT <sys/file.h>.

Updated FreeBSD lsof with ZFS support. Larry Rosenman  
<ler@lerctr.org>,  
Erwin Lansing <erwin@FreeBSD.org>, Wesley  
Shields <wxs@atarininja.org> and Dmitry Morozovsky  
<marck@rinet.ru> provided test systems.

Fixed a socket file identification problem reported by  
Pavol Rusnak <stick@gk2.sk>. Pavol also reported the  
cause of the problem.

Added the ability to format the repeat mode marker line  
with strftime(3), where the dialect supports the  
localtime(3) and strftime(3) C library functions. The  
addition was suggested by Mike Depot <mdepot@comcast.net>,  
who also tested it. The addition required creating a new  
main lsof source module, util.c, that contains functions  
whose compilation conflicts with the general header file  
tree defined by lsof.h and dlsof.h.

Based on reports from Andrei V. Lavreniyuk  
<andy.lavr@reactor-xg.kiev.ua> and Pav Lucistnik  
<pav@FreeBSD.org> updated the FreeBSD 7.0 and above  
file lock handling to use new locking structures. The  
update requires a terrible hack to get a definition  
for  
the lock owner structure from a kernel source module  
into a local lsof header file.

4.80 May 12, 2008

Updated for a FreeBSD 7.0 and above byte level locking  
change. The problem was reported by Conrad J. Sabatier  
<conrads@cox.net>, who helped test the update. Wesley  
Shields <wxs@FreeBSD.org> provided an 8.0-CURRENT test  
system.

Propagated the FreeBSD 7.0 and above locking changes to  
FreeBSD 6.x, based on a report from Edwin Groothuis  
<edwin@FreeBSD.org>.

Added warnings for unsupported dialects or versions.

Added Linux support for the UDPLITE protocol. Eric Dumazet <dada1@cosmosbay.com> supplied a patch.

Added a missing quote to the Configure script's FreeBSD stanza.

Added a usage.o rule to the HP-UX PSTAT-based Makefile. I mistakenly deleted the rule at revision 4.79. The missing rule was reported by Kawaljeet Kaur <kawaljeet.malviya@gmail.com> who tested the corrected Makefile.

4.81 October 21, 2008

Updated the Darwin libproc sources with changes from Allan Nathanson <ajn@apple.com>. Tested them on a iMac mini, provided by Apple Inc.

Changed dummy declarations in library source files to eliminate complaints about unused variables and empty object files. This change may not work on dialects I can no longer test; it has been tested on some versions of AIX, Darwin, FreeBSD, Linux and Solaris.

At the request of Hal Brooks <hal@uga.edu> added support for Linux /proc/net/packet files. Hal tested it.

Added socket file only performance enhancements to Linux and PSTAT-based HPUX lsof.

Added htonl call around improper usage of INADDR\_LOOPBACK; report from an Apple engineer forwarded by Allan Nathanson <ajn@apple.com>.

Adjusted for FreeBSD-8.0 change in device number handling. The adjustment should work for FreeBSD 5 and above, should the 8.0 change be propagated downward. The problem was reported by Pav Lucistnik <pav@FreeBSD.org>. An updated test system was provided by Erwin Lansing <erwin@FreeBSD.org>.

Reduced AIX support to version 5.3, since test systems with older versions are no longer available to me.

At the request of Marjo F. Mercado <mmercado@xceedium.com> and Phil Shin <pshin@xceedium.com> applied some speed improvements to lsof, particularly when the files of interest are /Internet files -- i.e., selected with lsof's

-i" option. Added a two new options to assist the improvements: 1) "-c^<command>" to tell lsof to exclude the named command(s); and 2) "-step|ud>:[^]state'" to tell lsof to include in its reporting or exclude (^) from its reporting Internet files in the named states (e.g., LISTEN, ^CLOSE\_WAIT, IDLE, etc.) For the most part these changes apply only to AIX, Darwin, FreeBSD, PSTAT-based HP-UX, Linux and Solaris, since those are the only places I could test them. They are controlled by the HASTCPUDPSTATE definition in each dialect's machine.h header file. Marjo and Phil provided HP-UX 11.23 and 11.31 test systems.

Fixed a stat(2) problem on HP-UX 11.31 while testing the speed improvements.

Adjusted for kernel header file changes in FreeBSD 8.0-CURRENT. Larry Rosenman <ler@lerctr.org> provided a test system.

Added a warning for Solaris systems where VxFS node info can't be obtained from the VxFS utility library. The warning was requested by Tom Matthews <Tom.MATTHEWS@rbs.com>.

Corrected mishandling of file system path name arguments that have trailing slashes, except, of course, the root file system, "/". Allan Nathanson <ajn@apple.com> reported the bug.

4.82 March 25, 2009

Corrected an over-zealous exclusion test that caused lsof to report nothing when it was given no arguments and built with HASSECURITY and HASNOSOCKSECURITY enabled. Joshua Kinard <kumba@gentoo.org> reported the bug and supplied information for reproducing it.

Based on a report from Dan Trinkle <trinkle@cs.purdue.edu> corrected use of <sys/utsname.h> for 32 bit Solaris 10 and above compilations. Simultaneously eliminated a casting complaint in arg.c and updated Configure to use the appropriate 64 bit compilation option (-xarch=v9 or -m64) with the Solaris Sun C compiler.

Updated for FreeBSD 7.1-PRERELEASE with information supplied by Larry Rosenman <ler@lerctr.org>.

Updated the Darwin libproc sources with changes from



Allan Nathanson <ajn@apple.com>. Tested them on a iMac mini, provided by Apple Inc. Allan also provided many page corrections.

Updated the FreeBSD Makefile to use the \${MAKE} variable for ZFS dnodet.c module compilation, based on a suggestion from Alexis Ballier <aballier@gentoo.org>.

Improved the Solaris VxFS library location test, based on a suggestion from Jason Fortezzo <fortezza@mechanicalism.net>. Jason tested the change.

Updated Solaris 10 ZFS support for ZFS version 4 and ZFS pool version 10, using a test system kindly provided by Vladislav Nespor <vladislav.nespor@id.ethz.ch>.

Renata

Maria Dart <renata@slac.stanford.edu> tested on ZFS version 4, verifying that the update works there, too. (ZFS pool version 10 is apparently the ZFS version shipped with the 10/08 update to Solaris. The original ZFS support targeted ZFS version 3.)

I still consider ZFS support in Solaris lsof a hack, because it depends on a znode structure definition that I developed using dbx. Sun is remiss in not distributing the ZFS header files used to build the distributed kernel.

Because of the znode structure definition hack, I can't guarantee that lsof ZFS support will work for any other versions of ZFS.

Solaris 10: adjusted to a change in the way devices are stored in the kernel; fixed a problem in zone handling; and added rudimentary sharedfs support. Carson Gaspar <carson@taltos.org> reported the device number problem, provided a test system, and tested the changes. Peter Vines <psv2b@eservices.virginia.edu> reported the zone handling problem and tested the fix.

Adapted to FreeBSD 8.0-CURRENT changes in device number computation. Problem was reported by Erwin Lansing <erwin@FreeBSD.org>. Larry Rosenman <ler@lerctr.org> provided a test system.

Corrected Solaris Configure test for appropriate VxFS library when using gcc to compile lsof.

Updated for loss of KAME IPv6 FreeBSD accommodations.

Adapted to FreeBSD 7.2. Made Configure script recognized FreeBSD 6.3.

4.83 January 18, 2010

Converted Solaris 10 and above ZFS support to use the CTF debugger library, libctf. Code was supplied by Robert Byrnes <Robert.Byrnes@deshaw.com>.

Corrected a typo in the testing of the LINUX\_HASSELINUX environment variable in the Configure script. The error was reported by Mike Frysinger <vapier@gentoo.org>. At Mike's request made Configure script accept LSOF\_RANLIB (ranlib command), LSOF\_CFGF (additional configuration flags) and LSOF\_CFGL (additional library specifications) from the environment.

Enabled

compilation of Solaris 10 lsof after a recent Sun patch which changed the PC file system's structure. Peter Vernam <pvernam@draper.com> reported the problem and helped with the fix.

Made the sort of configuration CFLAGS in the CkTestDB script impervious to locale settings.

Ported to Solaris 11, using a test system kindly provided by David Day <dday76@gmail.com>.

Adjusted to the disappearance of <nfs/rpcv2.h> in FreeBSD 8.0-BETA1.

Changed Solaris node type lookup to a hashed method and added some ability for it to handle duplicate vnodeop names in /dev/ksyms.

Updated for FreeBSD 9.0-CURRENT. Andrzej Tobola <ato@iem.pw.edu.pl> provided a test system. Extends the fix to FreeBSD 6.0 and above via a Configure test and a compile-time definition. The need for the extension was reported by Erik Trulsson <ertr1013@student.uu.se>>

Made corrections to FAQ typographical errors, suggested by Josh Soref <timeless@gmail.com>.

Added

\_\_UCLIBC\_\_ test to Linux dlsof.h so lsof would compile on an Intel ARM XScale processor. The addition was provided by Doug Kehn <rdkehn@yahoo.com>.

Added test for <utmpx.h> to FreeBSD configuration. Improved its use in lsof.h. The changes were supplied by Martin Wilke <miwi@FreeBSD.org>.

#### 4.84 July 29, 2010

Fixed a man page nroff command error with a correction supplied by Josh Soref <timeless@gmail.com>.

Made Configure script recognize FreeBSD 7.3. Larry Rosenman <ler@lerctr.org> provided a test system.

Improved task support, initially for Linux only, with help provided by Jerome Marchand <jmarchan@redhat.com> and Miklos Szeredi <mszeredi@suse.cz>. The support includes a new compile-time definition, HASTASKS, and a new run time option, "-K" to select task reporting.

While adding help output support for "-K", reorganized the printing of help columns to make it much easier to add a new option description.

Updated the Solaris PC file system structure patch in revision 4.83 so it will compile with gcc.

Disabled the Solaris lgrp\_root work-around in the Solaris machine.h so it won't cause compilation problems on Solaris 11. It no longer causes compilation problems on my Solaris 9 and 10 test systems, but some older Solaris 9 and 10 versions may still need it, so the work-around was left in the Sun machine.h and a FAQ entry was created about it.

Updated for Solaris 11 b134, using a test system kindly provided by Carson Gaspar <carson@taltos.org>. Made provisions for the next ZFS version. Added info about the failure of the LTnlink test on ZFS file systems.

Corrected typo in Configure script, reported by Dmitry Berezin <dmitryb@oit.rutgers.edu>.

#### 4.85 September 27, 2011

John Dzuberka <Zube@CS.ColoState.EDU> kindly provided a patched Solaris 9 test system with the lgrp\_root conflict and I was able to devise an automatic work-around for the conflict. The

special note in ../dialects/sun/machine.h  
was removed and  
the 17.28.1 FAQ entry was modified to reflect the update.

Added a Solaris 11 work-around for a typedef problem with  
<sys/mutex.h>. Carson Gaspar <carson@taltos.org> reported  
the problem and supplied the work-around.

Added support for FreeBSD 7.4 and 8.2; tested on systems  
provided by Larry Rosenman <ler@lerctr.org>.

Added support for 32 bit Solaris 11 lsof with mods supplied  
by Jan Wortelboer <J.H.P.Wortelboer@uva.nl>.

Added Solaris 11 support for using an alternate genunix  
location. Bill Goodridge <bill@its.brooklyn.cuny.edu>  
reported the alternate location.

Added further Linux cross configuration support to lsof's  
Configure script. The additional support was supplied by  
Grant Erickson <erick205@umn.edu>. See the descriptions of  
the LINUX\_\* environmen variables in 00XCONFIG for more  
information. Tested lsof on Linux kernel 2.6.32 and picked  
some lint that surfaced during the test.

Added fixes and changes  
for Apple Mac OS X 10.6, provided by  
Allan Nathanson <ajn@apple.com>. Allan also provided a test  
system.

Tested on FreeBSD 6.4 i386, using a test system provided by  
Terry Kennedy <TERRY@tmk.com>. Updated for recent FreeBSD ZFS  
changes on an 8.2 amd64 test system also provided by Terry.

Changed documentation to indicate FreeBSD 7.x is no longer  
supported, since I no longer have a test system.

Made some changes to the lsof man page, suggested by Navid  
<evil4chine@gmail.com>.

Added compensation for Solaris 10 systems that have patch  
144488-10. The patch requires that the new header file  
<sys/socket\_proto.h> be included while \_KERNEL is defined.  
Brett Bartick <Brett.bartick@nomura.com> reported the problem  
first, followed by Stuart Anderson <anderson@ligo.caltech.edu>.  
Michael Hocke <michael.hocke@nyu.edu> suggested a work-around  
which I refined to limit it to the specific Solaris 10 instance  
and then tested on a system provided by Charles

Stephens

<cfs@cowlabs.com>

Added the +|-e option for Linux. It exempts file systems named by path from function calls that might block in the kernel -- i.e., stat(2) and lstat(2), and when the +e form is used, readlink (2). The new packager of lsof for the Linux Fedora and RHEL distributions, Peter Schiffer <pschiffe@redhat.com>, asked for the feature so it could be used with Clearcase file systems, whose implementation can block stat(2) calls. I consider this feature very risky and easy to misuse -- e.g., specifying the file system as '/' would exempt all file systems. I don't intend to propagate this option to any other UNIX dialect that lsof currently supports.

Made FreeBSD 9 adjustment.

Fixed a Linux bug that prevented the display of paths for abstract UNIX sockets. Masatake Yamato <yamato@redhat.com> reported the bug and supplied a patch.

Added compensation for the removal of RPC header files from Glibc 2.14 for Linux. Marek Behun <kabel@blackhole.sk> reported the problem and supplied a patch.

Added support for Linux Netlink protocol. Masatake Yamato requested the support and supplied a patch. Peter Schiffer <pschiffe@redhat.com> provided a test system.

Corrected Linux UDP6-lite path. The error was reported by Masatake Yamato and he also supplied a patch.

Vic Abell <abe@purdue.edu>

September 27, 2011

Found in path(s):

\* /lsof-4-85-zip/00DIST

No license file was found, but licenses were detected in source scan.

/\*

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\*

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\*

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Found in path(s):

\* /Isof-4-85-zip/dialects/darwin/libproc/dfile.c  
 \* /Isof-4-85-zip/dialects/darwin/libproc/dlsof.h

No license file was found, but licenses were detected in source scan.

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/\* Extended regular expression matching and search library,  
 version 0.12.  
 (Implements POSIX draft P1003.2/D11.2, except for some of the  
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```

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| location. |

```

---

This file contains frequently asked questions about lsof and answers to them.

Vic Abell <abe@purdue.edu>  
September 27, 2011

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9.2.2 Why doesn't the /dev/kmem-based CCITT support work under 10.x?

9.2.3 Why can't /dev/kmem-based lsof be compiled with `cc -Aa` or `gcc -ansi` under HP-UX 10.x?

9.2.4 Why does /dev/kmem-based lsof complain about no C compiler?

9.2.5 Why does Configure complain about q4 for /dev/kmem-based lsof for HP-UX 11?

9.2.6 When compiling /dev/kmem-based lsof for HP-UX 11 what do the "aCC runtime: ERROR..." messages mean?

9.2.7 Why doesn't /dev/kmem-based lsof for HP-UX 11 report VxFS file link counts, node numbers, and sizes correctly?

9.2.8 Why can't /dev/kmem-based lsof be built with gcc for 64 bit HP-UX 11?

9.2.8.1 How can I acquire a gcc for building lsof for 64 bit HP-UX 11?

9.2.9 Why does /dev/kmem-based lsof for HP-UX 11 report "unknown file system type" for VxFS files?

9.2.10 Why does the ANSI-C compiler complain about comments in HP-UX 11 header files?

9.2.11 Why does dnode1.c cause the HP-UX 11 compiler to complain that <sys/fs/vx\_inode.h> is missing or incorrect?

9.3 PSTAT-based HP-UX lsof Questions

9.3.1 Why does PSTAT-based lsof complain about pst\_static and other PSTAT structures?

9.3.2 Why does PSTAT-based lsof complain it can't read pst\_\* structures?

9.3.3 Why does PSTAT-based lsof rebuild the device cache file after each reboot?

9.3.4 Why doesn't PSTAT-based lsof report TCP addresses for telnetd's open socket files?

9.3.5 Why does PSTAT-based lsof cause an HP-UX 11.11 kernel panic?

9.3.6 Why doesn't PSTAT-based lsof report a CWD that is on a loopback (LOFS) file system?

9.3.7 Why do some swinstall packages for PSTAT-based HP-UX 11.11 packages complain about setgid and setuid bits?

9.3.8 Why won't the bundled C compiler build PSTAT-based lsof for PA-RISC HP-UX 11.23?

9.3.9 Why won't gcc build PSTAT-based lsof for PA-RISC HP-UX 11.23?

9.3.10 Why does PSTAT-based lsof complain, "FATAL: pst\_stream\_size should be: 672; is 72" on HP-UX 11.11 and above?

9.4 Why won't the HP-UX depot install?

## 10.0 Linux Problems

### 10.1 What

do /dev/kmem-based and /proc-based lsof mean?

### 10.2 /proc-based Linux lsof Questions

10.2.1 Why doesn't /proc-based lsof report file offsets (positions)?

10.2.2 Why does /proc-based lsof report "can't identify protocol" for some socket files?

10.2.3 Why does /proc-based lsof warn about unsupported formats?

10.2.4 Why does /proc-based lsof report "(deleted)" after a path name?

10.2.5 Why doesn't /proc-based lsof report full open file information for all processes?

10.2.6 Why won't Customize offer to change HASDCACHE or WARNDDEVACCESS for /proc-based lsof?

### 10.2.7 /proc-based lsof Linux NFS questions

10.2.7.1 Why can't lsof find files on an accessible NFS file system?

10.2.7.2 Why can't lsof find files on an inaccessible NFS file system?

10.2.8 Why doesn't /proc-based Linux lsof report socket options and values, socket state flags, and TCP options and values?

10.2.9 Does /proc-based Linux lsof use a device cache?

10.2.10 Why doesn't /proc-based Linux lsof report any or all file structure values

for its +fcfgGn option?

### 10.3 Special Linux file types

10.3.1 Why is ``DEL" reported as a Linux file type?

10.3.2 Why is ``unknown" reported as a Linux file type?

### 10.4 Linux ``mem" Entry Problems

10.4.1 What do ``path dev=xxx" and ``path inode=yyy" mean in the NAME column of Linux ``mem" file types?

10.4.2 Why is neither link count nor size reported for some Linux ``DEL" and ``mem" file types?

### 10.5 Special Linux NAME column messages

10.5.1 What does ``(stat: xxx)" mean in the NAME column of Linux files?

10.5.2 What does ``(readlink: xxx)" mean in the NAME column of Linux files?

### 10.6 Why is ``NOFD" reported as a Linux file type?

10.7 Why does Linux lsof report a NAME column value that begins with ``/proc"?

### 10.8 Linux /proc/net/tcp\* and /proc/net/udp\* issues

10.8.1 Why use the Linux -X option?

10.8.2 Why does lsof say ``-i is useless when -X is specified"?

10.8.3 Why does lsof say ``can't identify protocol (-X specified)"?

## 11.0 NetBSD Problems

## 11.1 Why

doesn't lsof report on open kernfs files?

## 11.2 Why doesn't lsof report on open files on: file descriptor

file systems; /proc file systems; 9660 (CD-ROM) file systems;

MS-DOS (floppy disk) file systems; or kernel file systems?

## 11.3 Why does lsof produce confusing results for nullfs file systems?

## 11.4 NetBSD header file problems

### 11.4.1 Why can't the compiler find some NetBSD header files?

### 11.4.2 Why does NetBSD lsof produce incorrect output?

### 11.5 Why isn't lsof feature xxx enabled for NetBSD?

## 12.0 NEXTSTEP and OPENSTEP Problems

### 12.1 Why can't lsof report on 3.1 lockf() or fcntl(F\_SETLK) locks?

### 12.2 Why doesn't lsof compile for NEXTSTEP with AFS?

## 13.0 OpenBSD Problems

### 13.1 Why doesn't lsof support kernfs on my OpenBSD system?

### 13.2 Will lsof work on OpenBSD on non-x86-based architectures?

### 13.3 <sys/pipe.h> problems

#### 13.3.1 Why does the compiler claim nbpg isn't defined?

#### 13.3.2 What value should I assign to nbpg?

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### 13.5 Why isn't lsof feature xxx enabled for OpenBSD?

## 14.0 Output problems

### 14.1 Why do the lsof column sizes change?

### 14.2 Why does the offset have ``0t' and ``0x" prefixes?

### 14.3 What are the values printed in the FILE\_FLAG column and why is 0x<value> sometimes included?

#### 14.3.1 Why doesn't lsof display FILE\_FLAG values for my dialect?

## 14.4 Network Addresses

### 14.4.1 Why does lsof's -n option cause IPv4 addresses, mapped to IPv6, to be displayed in IPv6 notation?

### 14.5 Why does lsof output \x, ^x, or \xnn for characters sometimes?

#### 14.5.1 Why is space considered a non-printable character in command names?

### 14.6 Why doesn't lsof print all the characters of a command name?

### 14.7 Why does lsof reject some -c command names, saying their lengths are "> what system provides (nn)"?

### 14.8 Why does lsof sometimes print TYPE numbers instead of names?

## 14.9 Marker line format problems

#### 14.9.1 Why won't lsof accept a marker line format?

#### 14.9.2 Why does lsof reject the NL (%n) marker line format?

## 14.10 How

are protocol state name exclusion and inclusion used?

### 14.10.1 Why doesn't my dialect support state name exclusion and inclusion?

## 15.0 Pyramid Version Problems

### 15.0.5 Statement of deprecation

## 16.0 SCO Problems

### 16.1 SCO OpenServer Problems

#### 16.1.1 How can I avoid segmentation faults when compiling lsof?

#### 16.1.2 Where is libsocket.a?

#### 16.1.3 Why do I get "warning C4200" messages when I compile lsof?

### 16.2 SCO|Caldera UnixWare Problems

#### 16.2.1 Why doesn't lsof compile on my UnixWare 7.1.1 or above system?

#### 16.2.2 Why does lsof complain about node\_self() on my UnixWare 7.1.1 or above system?

#### 16.2.3 Why does UnixWare 7.1.1 or above complain about -lcluster, node\_self(), or libcluster.so?

#### 16.2.4 Why does UnixWare 7.1.1 or above lsof complain it can't read the kernel name list?

#### 16.2.5 Why doesn't lsof report link count, node number, and size for some UnixWare 7.1.1 or above CFS files?

#### 16.2.6 Why doesn't lsof report open files on all UnixWare 7.1.1 NonStop Cluster (NSC) nodes?

#### 16.2.7 Why doesn't lsof report the UnixWare 7.1.1 NonStop Cluster (NSC) node a process is using?

#### 16.2.8 Why does the compiler complain about missing UnixWare 2.1[.x] header files?

## 17.0 Sun Problems

### 17.0.5 Statement of deprecation

#### 17.1 My Sun gcc-compiled lsof doesn't work -- why?

#### 17.2 How can I make lsof compile with gcc under Solaris 2.[456], 2.5.1, 7, 8 or 9?

#### 17.3 Why does Solaris Sun C complain about system header files?

#### 17.4 Why doesn't lsof work under my Solaris 2.4 system?

#### 17.5 Where are the Solaris header files?

#### 17.6 Where is the Solaris /usr/src/uts/<architecture>/sys/machparam.h?

#### 17.7 Why does Solaris lsof say "can't read proc table"?

#### 17.8 Why does Solaris lsof complain about a bad cached clone device?

#### 17.9 Why doesn't Solaris make generate .o files?

#### 17.10 Why does lsof report some Solaris 2.3 and 2.4 lock types as `N'?

#### 17.11 Why does lsof Configure say "WARNING: no cc in ..."?

### 17.12 Solaris 7, 8 and 9 Problems

#### 17.12.1 Why does lsof say the compiler isn't adequate



for Solaris  
7, 8 or 9?  
17.12.2 Why does Solaris 7, 8 or 9 lsof say "FATAL: lsof was compiled for..."?  
17.12.3 How do I build lsof for a 64 bit Solaris kernel under a 32 bit Solaris kernel?  
17.12.4 How do I install lsof for Solaris 7, 8 or 9?  
17.12.5 Why does my Solaris 7, 8 or 9 system say it cannot execute lsof?  
17.12.6 What gcc will produce 64 bit Solaris 7, 8 and 9 executables?  
17.12.7 Why does lsof on my Solaris 7, 8 or 9 system say, "can't read namelist from /dev/ksyms?"  
17.13 Solaris and COMMON  
17.13.1 What does COMMON mean in the NAME column for a Solaris VCHR file?  
17.13.2 Why does a COMMON Solaris VCHR file sometimes seem to have an incorrect minor device number?  
17.14 Why don't lsof and Solaris pfiles reports always match?  
17.15 Why does lsof say, "kvm\_open(namelist=default, core=default): Permission denied?"  
17.16 Why is lsof slow on my busy Solaris UFS file system?  
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17.18 Solaris and VxFS  
17.18.1 Why doesn't lsof support VxFS 3.4 on Solaris 2.6, and above?  
17.18.2 Why does lsof report "vx\_inode: vxfsu\_get\_iooffsets error" for open Solaris 2.6 and above VxFS 3.4 and above files?  
17.18.3 Why does Solaris Configure claim there is no VxFS library?  
17.18.4 Why doesn't Solaris lsof report VxFS path name components?  
17.18.5 Why does Solaris 10 lsof report scrambled VxFS paths?  
17.19 Large file problems  
17.19.1 Why does lsof complain it can't stat(2) a Solaris 2.5.1 large file?  
17.20 Why does lsof get a segmentation fault on 64 bit Solaris 8 using NIS+?  
17.21 Will lsof crash the Solaris kernel?  
17.22 Why does lsof on Solaris 7, 8, or 9 report a kvm\_open() failure?  
17.23 Solaris and SAM-FS  
17.23.1 Why does Solaris lsof report "(limited SAM-FS info)"?  
17.23.2 Why can't lsof locate named SAM-FS files?  
17.24 Lsof and Solaris 10 zones  
17.24.1 How can I make lsof list the Solaris zone?  
17.24.2 Why doesn't lsof work in a Solaris 10 zone?  
17.24.3 Why does lsof complain it can't stat() Solaris 10 zone file systems?  
17.25 Solaris 10 problems

- 17.25.1 Why does Solaris 10 lsof sometimes report the wrong path name?
- 17.25.2 Why does Solaris 10 lsof sometimes report only the mounted-on directory and device?
- 17.25.3 What does "(deleted)" mean in the NAME column of a Solaris 10 open file?
- 17.25.4 What does "(?)" mean in the NAME column of a Solaris 10 open file?
- 17.26 Solaris contract file problems
  - 17.26.1 Why doesn't lsof report size, link count and node number for Solaris 10 contract files?
  - 17.26.2 Why can't lsof locate a Solaris 10 contract file by path name?
- 17.27 Solaris 10 ZFS problems
  - 17.27.1 Why does Configure ask for the location of ZFS header files?
  - 17.27.2 Why do -h and -v output warn about possibly inaccurate ZFS structure definitions?
  - 17.27.3 Why don't the Open Solaris ZFS header files provide correct ZFS kernel structure definitions?
- 17.28 Problems with Solaris 9 and above
  - 17.28.1 Why does the compiler complain about lgrp\_root on Solaris 9 and above?

## 18.0 Lsof Features

### 18.1 Why

doesn't lsof doesn't report on /proc entries on my system?

### 18.2 How do I disable the device cache file feature or alter it's behavior?

#### 18.2.1 What's the risk with a perverted device cache file?

#### 18.2.2 How do I put the full host name in a personal device cache file path?

#### 18.2.3 How do I put the personal device cache file in /tmp?

### 18.3 Why doesn't lsof know about AFS files on my favorite dialect?

#### 18.3.1 Why doesn't lsof report node numbers for all AFS volume files, or how do I reveal dynamic module addresses to lsof?

---

## 1.0 General Concepts

### 1.1 Lsof -- what is it?

Lsof is a UNIX-specific tool. Its name stands for LiSt Open Files, and it does just that. It lists information about files that are open by the processes running on a UNIX system.

See the lsof man page, the 00DIST file, the 00QUICKSTART file, and the 00README file of the lsof distribution for

more information.

## 1.2 Where do I get lsof?

lsof

is available via anonymous ftp from [lsof.itap.purdue.edu](ftp://lsof.itap.purdue.edu).

Look in the `pub/tools/unix/lsof` sub-directory.

<ftp://lsof.itap.purdue.edu/pub/tools/unix/lsof>

Bzip2'd, compressed and gzip'd tar files with GPG certificates are available.

### 1.2.1 Are there mirror sites?

On April 28, 2009 these sites appeared to have the latest lsof revision:

<ftp://ftp.fu-berlin.de/pub/unix/tools/lsof>

<ftp://sunsite.ualberta.ca/pub/Mirror/lsof>

### 1.2.2 Are lsof executables available?

Some lsof executables are available in the subdirectory tree `pub/tools/unix/lsof/binaries`. These are neither guaranteed to be current nor cover every dialect and machine architecture.

I don't recommend you use pre-compiled lsof binaries; I recommend you obtain the sources and build your own binary. Even if you're a Sun user without a Sun C compiler, you can use gcc to compile lsof.

If you must use a binary file, please be conscious of the security and configuration implications in using an executable of unknown or different origin. The lsof binaries are accompanied by GPG certificates. Please use them!

Three additional cautions apply to executables:

1. Don't try to use an lsof executable, compiled for one version of a UNIX dialect, on another. Patches can make the dialect version different.
2. If you want to use an lsof binary on multiple systems, they must be running the same dialect OS version and have the same patches and feature support.

### 1.2.3 How do I check the validity of an lsof distribution?

There are two ways to check the validity of an lsof distribution:

1. Follow the instructions in the CHECKSUMS\_<revision> file found with the lsof distribution.

Checking with GPG is the best method.

2. Follow the instructions in the "Security" section of the README.lsof\_<revision> file found inside the lsof distribution.

Again, checking with GPG is the best method.

### 1.2.4 Why can't I get the sum(1) result reported in README.lsof\_<revision>?

The "Security" section of the README.lsof\_<revision> file found inside the lsof distribution gives md5, sum, and GPG certificate information.

The simplest, the sum(1) signature, seems to be the trickiest. That's because there are different sum(1) methods, BSD systems usually have cksum(1) instead of sum(1), and different systems compute the block size value differently.

First, the lsof sum results are computed with the old, "alternate" algorithm. On newer systems, you can use sum's "-r" option to get that computation result.

Second, on BSD systems you usually must use cksum(1) instead of sum(1), because they have no sum(1). To tell cksum(1) to use the old, "alternate" algorithm, use its "-o1" option.

Third, the second value that sum reports, the block count, may be computed differently on different systems -- usually block size is considered to be 512 or 1,024. The lsof block counts were computed on a system with a sum(1) option that considers block size to be 512. The BSD system cksum(1) -o1 option considers block size to be 1,024. If your sum(1) or cksum(1) doesn't report a block count that matches the sum(1) signature given in README.lsof\_<revision>, check its man page to see what block size it uses, then adjust its reported block count appropriately.

### 1.2.5 Why won't gpg accept the lsof-signing PGP public key?

An older PGP key that once signed lsof distributions is included in lsof revisions prior to 4.70. The PGP key is indeed my key, but is incompatible with GPG. It was created about ten years ago and is still acceptable to PGP versions 2.6.2 through 6.5.2.

Lsof revisions 4.70 and above are signed with a copy of my PGP key that has been made acceptable for use with GPG by importing it under GPG's "--allow-non-selfsigned-uid" option.

You can find my GPG compatible key in lsof revisions 4.70 and above and at:

`ftp://lsof.itap.purdue.edu/pub/Victor_A_Abell.gpg`

If you have an older lsof revision with my PGP key, there are two possible ways to use it:

- \* Use it with a PGP version from 2.6.2 through 6.5.2.

- \* Use GPG's "--allow-non-selfsigned-uid" option when you import my PGP key into your GPG key ring.

```
$ gpg --allow-non-selfsigned-uid --import Victor_A_Abell.gpg
```

### 1.3 Where can I get more lsof documentation?

A significant set of documentation may be found in the lsof distribution (See "Where can I get lsof?"). There is a manual page, copious documentation in files whose names begin with 00, and a copy of this FAQ in the file 00FAQ (perhaps slightly less recent than this file if you're reading it via a web browser.)

Two URLs provide some documentation that appears in the lsof distribution:

FAQ: `ftp://lsof.itap.purdue.edu/pub/tools/unix/lsof/FAQ`

man page: `ftp://lsof.itap.purdue.edu/pub/tools/unix/lsof/lsof_man`

### 1.4 How do I report an lsof bug?

If you believe you have discovered a bug in lsof, you can

report it via e-mail to <abe@purdue.edu>.

Do NOT report lsof

bugs to the UNIX dialect vendor. Make sure "lsof" appears in the "Subject:" line so my e-mail filter won't classify your letter as Spam.

Before you send me a bug report, please read the "Bug Reports" section of the 00README file of the lsof distribution. It lists the steps you should take before and when reporting a suspected bug.

### 1.5 Where can I get the lsof FAQ?

This lsof FAQ is available in the file 00FAQ in the lsof distribution and at the URL:

<ftp://lsof.itap.purdue.edu/pub/tools/unix/lsof/FAQ>

#### 1.5.1 How timely is the on-line FAQ?

The on-line FAQ is sometimes too timely. :-)

I update it as soon as new information is available. That may include information about support that won't appear in the lsof source distribution until the next revision. If you encounter something like that, please send me e-mail at <abe@purdue.edu>. I may be able to point you at a pre-release distribution that contains the support of interest. Make sure "lsof" appears in the "Subject:" line so my e-mail filter won't classify your letter as Spam.

### 1.6 Is there a test suite?

Yes, as of lsof revision 4.63 there's an automated lsof test suite in the tests/ sub-directory of the lsof top-level directory.

More information on using the test suite, what it does, how to use it and how to configure it may be found in the 00TEST file of the lsof distribution. That file also explains where the test suite has been tested.

Frequently asked questions about the test suite will be asked and answered here in the FAQ. (See "Test Suite Problems.")

After lsof has been configured with the Configure script, lsof can be made and tested with:

```
$ make
$ cd tests
$ make
```

Under normal conditions -- i.e., unless the lsof tree has been cleaned or purged severely -- all tests or individual tests may be run by:

```
$ cd test
$ make
or
$ <run a single test> (See 00TEST.)
```

#### 1.7 Is lsof vulnerable to the standard I/O descriptor attack?

Lsof revisions 4.63 and above are not vulnerable.

Lsof revisions 4.62 and below are vulnerable, but no damage scenarios have so far been demonstrated.

The standard I/O descriptor attack is a local programmed assault on setuid and setgid programs that tricks them into opening a sensitive file with write access on a standard descriptor, usually stderr (2), and writing error messages to stderr. If the attacker can control the content of the error message, the attacker may gain elevated privileges.

The attack was first described in Pine Internet Advisory PINE-CERT-20020401, available at:

<http://www.pine.nl/advisories/pine-cert-20020401.txt>

If you are using an lsof revision below 4.63, you should remove any setuid or setgid permissions you might have given its executable. Then you should upgrade to lsof revision 4.63.

#### 1.8 Can I alter lsof's make(1) behavior?

Yes. There are at least two ways to do that.

You can put replacements for lsof Makefile strings in your environment. If you specify the -e make option, make will give environment variable values precedence over strings from the Makefile. For example, to change the compiler

string CC from the environment, you might do this with the Bourne shell:

```
$ CC=foobar; export CC
$ make -e
```

You can also replace Isof Makefile strings in the make command invocation. Here's the previous example done that way:

```
$ make CC=foobar
```

Changing the CFGF, CFGL, and DEBUG strings used in Isof Makefiles, either from the environment or from the make invocation, can significantly alter Isof make(1) behavior. I commonly use DEBUG to change the -O option to -g so I can build an Isof executable for debugging -- e.g.,

```
$ make DEBUG=-g
```

(Look for DEBUG in this FAQ for other examples of its use.)

Consult the Makefiles to see what CFGL, CFGL, and other Isof Makefile strings contain, and to see what influence their alteration might have on Isof make(1) behavior.

1.9 Is  
there an Isof license?

No.

The only restriction on the use or redistribution of Isof is contained in this copyright statement, found in every Isof source file. (The copyright year in or format of the notice may vary slightly.)

```
/*
 * Copyright 2002 Purdue Research Foundation, West Lafayette,
 * Indiana 47907. All rights reserved.
 *
 * Written by Victor A. Abell
 *
 * This software is not subject to any license of the American
 * Telephone and Telegraph Company or the Regents of the
 * University of California.
 *
 * Permission is granted to anyone to use this software for
 * any purpose on any computer system, and to alter it and
```



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- \*
- \* 4. This notice may not be removed or altered.
- \*/

## 1.10 Language locale support

### 1.10.1 Does lsof support language locales? How do I use the support?

Most UNIX dialect versions of lsof support 8 bit language locale characters -- e.g., the ability to print 8 bit characters that have accents and other marks over them.

See the answer to the "Does lsof support wide characters in language locales?" question for information on when lsof's language locale support covers characters wider than 8 bits.

To see if lsof supports language locales for your dialect, look in the dialect's machine.h header file for the HASSETLOCALE definition. If it is present and not disabled, then lsof has language locale support for the dialect.

To enable lsof's language locale support, you must specify in a locale environment variable (e.g., LANG) a language locale known to your system that supports the printing of marked characters -- e.g., en\_US. (On some dialects locale(1) may be used to list the known language locales.)

Note that LANG=C and LANG=POSIX are NOT language locales that support the printing of marked characters.

If the language locale doesn't support the printing of marked characters, lsof's OUTPUT of them follows the rules for non-printable characters described in the OUTPUT section of

lsof(8).

Consult your dialect's `setlocale(3)` man page for the names of environment variables other than `LANG` -- e.g., `LC_ALL`, `LC_TYPE`, etc. -- which may be used to define language locales.

#### 1.10.2 Does lsof support wide characters in language locales?

When lsof's language locale support is enabled with the `HASSETLOCALE` definition, for selected dialects lsof will also print wide characters (e.g., from UTF-8) when `iswprint(3)` reports them to be printable.

Wide character support is available when `HASWIDECHAR` is defined in a dialect's `machine.h` header file. As of this writing on July 22, 2004, the following dialect versions have wide character support:

- AIX >= 4.3.2
- Apple Darwin >= 7.3.0
- FreeBSD >= 5.2
- HP-UX >= 11.00
- /proc-based Linux
- NetBSD >= 1.6
- SCO OpenServer >= 5.0.6
- Solaris >= 2.6
- Tru64 UNIX 5.1

#### 1.11 Are any files in the lsof distribution copyrighted?

Yes. Most files carry the copyright of the Purdue Research Foundation and may be redistributed under the terms that accompany the copyright notice. Those terms may also be found in the answer to the question, "Is there an lsof license?")

A few files carry other copyright notices. Some are BSD notices and they explain the terms under which they are included in the lsof distribution.

Those that carry vendor copyright notices have been reproduced in their original or modified forms with permission from the copyright owners. That permission is indicated in the `README` files that accompany the files.

#### 1.12 Are there other lsof-related resources?

There are other resources available, connected to lsof. Among them are FreeBSD and Linux packages whose products use lsof and two particularly interesting resources.

The two interesting resources are a Gnome Tool Kit (GTK) GUI for lsof and a Perl wrapper module.

The GTK GUI is called Glsof and was developed by Gnele. It can be found at:

<http://www.sourceforge.net>

The Perl wrapper module by Marc Beyer can be found at:

<http://search.cpan.org/dist/Unix-Lsof/>

### 1.13 What does the "WARNING: unsupported dialect or version" mean?

The lsof configure script issues that message for UNIX dialects or their versions where I have been unable to test the current revision of lsof. The message doesn't mean that lsof won't work, just that I have no direct evidence that it will.

If the CONfigure script succeeds, except for the warning, try compiling lsof. If that succeeds, try the lsof test suite.

## 2.0 Lsof Ports

### 2.1 What ports exist?

The pub/lsof/README file carries the latest port information:

AIX 5.[23] and 5.3  
FreeBSD 4.9 and 6.4 for x86-based systems  
FreeBSD 8.[02] for AMD64-based systems  
Linux 2.1.72 and above for x86-based systems  
Solaris 9, 10 and 11

In the above list the only UNIX dialects present are ones for which I test the current lsof revision. Lsof may still support unlisted dialect versions -- e.g., HP-UX 10.20, Solaris 7, etc. -- but I don't have access to systems where I could test lsof on them, so I can't claim lsof works on them. If your dialect isn't in the list, you should try building lsof on it anyway.

Lsof version 4 predecessors, versions 2 and 3, may support older version of some dialects. Contact me via e-mail at <[abe@purdue.edu](mailto:abe@purdue.edu)>

if you're interested in their distributions. Make sure "Isof" appears in the "Subject:" line so my e-mail filter won't classify your letter as Spam.

## 2.2 What about a new port?

The 00PORTING file in the distribution gives hints on doing a port. I will consider doing a port in exchange for permanent access to a test host. I require permanent access so I can test new Isof revisions, because I will not offer distributions of dialect ports I cannot upgrade and test.

### 2.2.1 User-contributed Ports

Sometimes I receive contributions of ports of Isof to systems where I can't test future revisions of Isof. Hence, I don't incorporate these contributions into my Isof distribution.

However, I do make descriptions of these contributions available. You can find them in the 00INDEX and README files at:

<ftp://Isof.itap.purdue.edu/pub/tools/unix/Isof/contrib>

Consult the 00INDEX file in the contrib/ directory for a list of the available contributions and consult README there for information on how to obtain them.

## 2.3 Why isn't there an AT&T SVR4 port?

I haven't produced an AT&T SVR4 port because I haven't seen a UNIX dialect that is strictly limited to the AT&T System V, Release 4 source code. Every one I have seen is a derivative with vendor additions.

The vendor additions are significant to Isof because they affect the internal kernel structures with which Isof does business. While some vendor derivatives of SVR4 are similar, each one I have encountered so far has been different enough from its siblings to require special source code.

If you're interested in an SVR4 version of Isof, here are some existing ports you might consider:

DC/OSx (This obsolete port is only available upon

special request.)  
Reliant UNIX (This obsolete port is only available  
upon special request.)  
SCO|Caldera UnixWare (This is the most likely choice.)  
Solaris

## 2.4 Why isn't there an SGI IRIX port?

Lsof support for IRIX was terminated at lsof revision 4.36,  
because it had become increasingly difficult for me to  
obtain information on the IRIX  
kernel structures lsof needs  
to access.

At IRIX 6.5 I decided the obstacles were too large for me  
to overcome, and I stopped supporting lsof on IRIX. I have  
sources to the last revision of lsof (4.36) for IRIX, but  
that version of lsof does not work on IRIX 6.5 and is  
vulnerable to the standard I/O descriptor attack. (See  
the "Is lsof vulnerable to the standard I/O descriptor  
attack?" Q&A for more information.) Contact me to discuss  
obtaining those sources.

If you wish to pursue the issue, don't contact me, contact  
SGI. This case was opened with SGI on the subject:

Case ID: 0982584  
Category: Unix  
Priority: 30-Moderate Impact

Problem Summary:  
kernel structure header files needed for continued lsof  
support

Problem Description:  
Email In 07/17/98 19:09:23

## 2.5 Why does lsof's Configure script report "WARNING: unsupported dialect or version"?

Lsof's Configure script issues this message when it encounters  
a dialect or its version  
that lsof once supported, but no  
longer does. Usually I drop support for a dialect or version  
when I can no longer test lsof on it.

However, it's worth trying to compile and use lsof. Be sure to  
run the test suite. (See the answer to the "Is there a test

suite? question for information on the test suite.)

If you have problems with an unsupported dialect or version, contact me via e-mail at <abe@purdue.edu> and I may be able to help. Make sure "lsof" appears in the "Subject:" line so my e-mail filter won't classify your letter as Spam.

### 3.0 Lsof Problems

#### 3.1 Configuration Problems

##### 3.1.1 Why can't Configure determine the UNIX dialect version?

The lsof Configure script uses UNIX shell commands, often in a command pipeline, to determine the UNIX dialect version. (Consult the dialect stanza in Configure to determine which commands are used.) If Configure can't determine the dialect version, probably one of the commands is not behaving as Configure expects.

##### Symptoms

of the failure include Configure warning messages and incorrect version definitions in the Makefile CFLAGS.

If you suspect that the lsof Configure script is failing to determine the dialect version correctly, try running the commands from Configure stanza one at a time. That will usually reveal the source of the problem. Be particularly mindful that the PATH environment variable can cause commands to be executed from non-standard directories.

If you can't determine the source of the problem, there is a work-around. You can supply the UNIX dialect version in the LSOF\_VSTR environment variable. Use Configure as a guide to forming what it expects in LSOF\_VSTR. There is also some information on LSOF\_VSTR in the 00XCONFIG documentation file of the lsof distribution.

#### 3.2 Compilation Problems

##### 3.2.1 Why does the compiler complain about missing header files?

When you use make to build lsof, the compiler may complain that it can't find header files -- e.g.,

\$

make

```
(cd lib; make DEBUG="-O" CFGF="-DAIXA=0 -DAIXV=4330 \
-DLSOF_VSTR=\"4.3.3.0\"")
gcc -DAIXA=0 -DAIXV=4330 -DLSOF_VSTR="4.3.3.0" -O \
-c ckkv.c
In file included from ckkv.c:33: ../machine.h:70: \
sys/types.h: A file or directory in the path name \
does not exist. \

```

That type of complaint doesn't represent an lsof problem.  
It represents a problem with a missing system header file  
that probably should be found in /usr/include or in the  
system source tree.

As a first step try using find(1) to locate the problem  
header file. If it's a system header file and can't be  
found, here are some possible causes:

1. The file set, RPM or package containing the header files  
has not been installed. Instructions for doing that  
are specific to the UNIX dialect and beyond the scope  
of this document.

2. If the compiler is gcc, the private gcc header files:

- \* May not have been installed;

- \* May have been installed incorrectly;

- \* May not have been updated properly after the last  
compiler or system update;

- \* Ones from a previous installation may not have been  
removed.

A path leading to the gcc private header files can be  
found with `gcc -v`. Consult the gcc documentation for  
instructions on proper installation of the private gcc  
header files.

3. On some dialects -- e.g., FreeBSD, NetBSD, OpenBSD --  
lsof may need to use header files that are located in  
the system source tree -- /sys or /usr/src/sys, for  
example. Make sure the system source tree has been  
installed.

### 3.2.2 Why does gcc complain about the contents of header files

distributed by the system's vendor?

When you use make to build lsof and gcc to compile it, gcc may complain that it finds errors in system header files -- e.g.,

```
$ make
(cd lib; make DEBUG="-O" CFGF="-Dsolaris=80000 \
-DHASPR_GWINDOWS -m64 -DHASIPv6 -DHAS_VSOCK \
-DLSOF_VSTR=\"5.8\"")
gcc -Dsolaris=80000 -DHASPR_GWINDOWS -m64 -DHASIPv6 \
-DHAS_VSOCK -DLSOF_VSTR="5.8" -O -c dvch.c
In file included from /usr/include/sys/proc.h:31, \
from /homes/abe/gnu/gcc-3.2.1/lib/gcc-lib/sparcv9-sun-solaris2/\
3.2.1/include/sys/user.h:267, from /usr/include/kvm.h:13, \
from ../lsof.h:53, from ../lsof.h:172, from dvch.c:43: \
/homes/abe/gnu/gcc-3.2.1/lib/gcc-lib/sparcv9-sun-solaris2/\
3.2.1/include/sys/task.h:59: parse error before "uint_t"
```

Errors like the above are most likely not problems in the system's header files, but in the private copies of them that were created when gcc was made or installed. Note the presense of  
"../gcc-3.2.1/lib/gcc-lib/sparcv9-sun-solaris2/3.2.1/include/..."  
in the paths for user.h and task.h. It indicates both header files are gcc-specific.

To solve errors like this requires comparing the header files in the vendor's /usr/include tree to the gcc-specific ones in gcc's private gcc-lib/.../include tree. It may be necessary to regenerate gcc-specific header files, correct them or remove them. See the gcc distribution for the appropriate tools.

A possible temporary work-around is to direct gcc to use the vendor's header files instead of its temporary ones by declaring -I/usr/include in the compilation flags.

### 3.2.3 Other header file problems

Don't overlook any vendor tools that might validate the vendor header files installed on the system -- e.g., the Solaris pkgchk tool can be used to check the header files that were installed from the SUNWhea package.

For other header file problems contact me at <abe@purdue.edu>.



Please follow the reporting guidelines in the "How do I report an lsof bug?" section of this FAQ.

### 3.3 Why doesn't lsof report full path names?

lsof reports the full path name when it is specified as a search argument for open files that match the argument. However, if the argument is a file system mounted-on directory, and lsof finds additional path name components from the kernel name cache, it will report them.

lsof reports path name for file system types that have path name lookup features -- e.g., some versions of AdvFS for Digital and Tru64 UNIX. The Linux /proc-based lsof reports full path names, because the Linux /proc file system provides them. lsof on recent builds of Solaris 10 also report full path names, because those Solaris kernels record the full path name in the vnode structure.

Otherwise, lsof uses the kernel name cache, where it exists and can be accessed, and reports some or all path name components (e.g., the sys and proc.h components of /usr/include/sys/proc.h) for these dialects:

Apple Darwin  
DC/OSx  
FreeBSD  
HP-UX, /dev/kmem and PSTAT based  
Linux, /dev/kmem-based  
NetBSD  
NEXTSTEP  
OpenBSD  
OPENSTEP  
Reliant UNIX  
SCO OpenServer  
SCO|Caldera UnixWare  
Solaris 2.x, 7, 8 and 9 (except for some VxFS versions;

see the "Why doesn't Solaris  
lsof report VxFS path name  
components?" section for more  
information)  
Solaris 10 (early builds) Tru64 UNIX

As far as I can determine, AFS path lookups don't share in kernel name cache operations, so lsof can't identify open AFS path name components. Apparently Solaris VxFS versions 4 and

above don't share in kernel name cache operations, either, so lsof can't display path name components for those open files.

Since the size of the kernel name cache is limited and the cache is in constant flux, it does not always contain the names of all components in an open file's path; sometimes it contains none of them.

Lsof reports the file system directory name and whatever components of the file's path it finds in the cache, starting with the last component and working backwards through the directories that contain it. If lsof finds no path components, lsof reports the file system device name instead.

When lsof does report some path components in the NAME column, it prefixes them with the file system directory name, followed by " -- ", followed by the components -- e.g., /usr -- sys/path.h for /usr/include/sys/path.h. The " -- " is omitted when lsof finds all the path name components of a file's name.

The PSTAT-based HP-UX lsof relies on kernel name cache contents, too, even though its information comes to lsof via pstat() function calls. Consequently, PSTAT-based HP-UX lsof won't always report full paths, but may use the " -- " partial path name notation, or may occasionally report no path name at all but just the file system mounted-on directory and device names.

Lsof can't obtain path name components from the kernel name caches of the following dialects:

#### AIX

Only the Linux kernel records full path names in the structures it maintains about open files; instead, most kernels convert path names to device and node number doublets and use them for subsequent file references once files have been opened.

To convert the device and node number doublet into a complete path name, lsof would have to start at the root node (root directory) of the file system on which the node resides, and search every branch for the node, building possible path names along the way. That would be a time consuming operation and require access to the raw disk

device (usually implying setuid-root permission).

If the prospect of all that local disk activity doesn't concern you, think about the cost when the device is NFS-mounted.

Try using the file system mount point and node number lsof reports as parameters to find -- e.g.,

```
$ find <mount_point> -inum <node_number> -print
```

and you may get an appreciation of what a file system directory tree search would cost.

### 3.3.1 Why do lsof -r reports show different path names?

When you run lsof with its repeat ("`-r") option, you may notice that the extent to which it reports path names for the same files may vary from cycle to cycle. That happens because other processes are making kernel calls affecting the cache and causing entries to be removed from and added to it.

### 3.3.2 Why does lsof report the wrong path names?

Under some circumstances lsof may report an incorrect path name component, especially for files in a rapidly changing directory like /tmp.

In a rapidly changing directory, like /tmp, if the kernel doesn't clear the cache entry when it removes a file, a new file may be given the same keys and lead lsof to believe that the old cache entry with the same keys belongs to the new file.

Lsof tries to avoid this error by purging duplicate entries from its copy of the kernel name cache when they have the same device and inode number, but different names.

This error is less likely to occur in UNIX dialects where the keys to the name cache are node address and possibly a capability ID. The Apple Darwin, Digital UNIX, FreeBSD, HP-UX, NEXTSTEP, OPENSTEP, Solaris, Tru64 UNIX, and UnixWare dialects use node address. Apple Darwin, FreeBSD, NetBSD, OpenBSD, Tru64 UNIX, and also use a capability ID to further identify name cache entries.

### 3.3.3 Why doesn't lsof report path names for unlinked (rm'd) files?

When lsof gets path name components from the kernel's name cache, it does not report the path names of a file that has been unlinked from its parent directory -- e.g., deleted via `rm`, or the `unlink()` system call -- even when some process may still hold the file open; lsof reports only the file system's mounted-on directory and device. That's because path name components are removed from the kernel name cache when the file is unlinked.

Unlinked open files are sometimes used by applications for temporary, but invisible storage (i.e., `ls` won't show them, and no other process can open them.) However, they may occasionally consume disk space to excess and cause concern for a system administrator, who will be unable to locate them with `find`, `ls`, `du`, or other tools that rely on finding files by examining the directory tree.

By using lsof's `+L` option you can see the link count of open files -- in the `NLINK` column. An unlinked file will have an `NLINK` value of zero. By using the option `+L1` you can tell lsof to display only files whose link count is less than one (i.e., zero).

There are some UNIX dialect-specific exceptions to lsof's inability to report unlinked path names. They are described in the answer to the "When will lsof report path names for deleted files?" question.

### 3.3.4 Why doesn't lsof report the "correct" hard linked file path name?

When lsof reports a rightmost path name component for a file with hard links, the component may come from the kernel's name cache. Since the key which connects an open file to the kernel name cache may be the same for each differently named hard link, lsof may report only one name for all open hard-linked files. Sometimes that will be "correct" in the eye of the beholder; sometimes it will not. Remember, the file identification keys significant to the kernel are the device and node numbers, and they're the same for all the hard linked names.

### 3.3.5 When will lsof report path names for deleted files?

Lsof will report path names for deleted files for two dialects: Linux and later builds of Solaris 10.

Deleted Linux path names are reported by default and have "(deleted)" at their ends.

The display of Solaris 10 deleted path names may be selected with the -X option. When selected they are also reported with "(deleted)" at their ends.

### 3.4 Why is lsof so slow?

Lsof may appear to be slow if network address to host name resolution is slow. This can happen, for example, when the name server is unreachable, or when a Solaris PPP cache daemon is malfunctioning.

To see if name lookup is causing lsof to be slow, turn it off with the ``-n" option.

Port service name lookup or portmap registration lookup may also be causes of slow-down.

To suppress port service name lookup, specify the ``-P" option.

Lsof doesn't usually make direct portmap calls -- only when +M is specified, or when HASPMAPENABLED is defined during lsof construction. (The lsof help panel, produced with `lsof -h` will display the default portmap registration reporting state.) The quickest first step in checking if lsof is slow because of the portmapper is to use lsof's ``-M" option.

Lsof may be slow if UID to login name lookups are slow. Suppress them with ``-l".

On dialects where lsof uses the kernel name cache, try disabling its use with ``-C". (You can tell if lsof uses the kernel name cache by looking for ``-C" in lsof's ``-h" output.) Of course, disabling kernel name cache use will mean that lsof won't report full or partial path names, just file system and character device names.

If you're just interested in the open files of one process, try using the ``-p <Process-ID>" option to limit lsof to that process.

(The ``-p" option may also be followed with a list of Process-IDs.)

If you're interested in including or excluding certain commands, try lsof's "-c[^]cmd" option.

If you're interested in certain Internet TCP and UDP states (e.g., ESTABLISHED) or in excluding some (e.g., CLOSE\_WAIT), try lsof's "-s p:s" option. More information on it may be found in the answer to the "How are protocol state name exclusion and inclusion used?" question.

Your UNIX dialect may not support "-s p:s" and its associated performance improvements to Internet-only file processing. You can find more information on those topics in the answer to the "Why doesn't my dialect support state name exclusion and inclusion?" question.

Older AIX lsof may be slow to start because of its oslevel identity comparison. (Newer AIX lsof uses uname(2).) See the "Why does AIX lsof start so slowly?" and "Why does lsof warn 'compiled for x ... y; this is z.?' sections for more information.

### 3.5 Why doesn't

lsof's setgid or setuid permission work?

If you install lsof on an NFS file system that has been mounted with the nosuid option, lsof may not be able to use the setgid or setuid permission you give it, complaining it can't open the kernel memory device -- e.g., /dev/kmem.

The only solution is to install lsof on a file system that doesn't inhibit setgid or setuid permission.

### 3.6 Does lsof have security problems?

I don't think so. However, lsof does usually start with setgid permission, and sometimes with setuid-root permission. Any program that has setgid or setuid-root permission, should always be regarded with suspicion.

Lsof drops setgid power, holding it only while it opens access to kernel memory devices (e.g., /dev/kmem, /dev/mem, /dev/swap). That allows lsof to bypass the weaker security of access(2) in favor of the stronger checks the kernel makes when it examines the right of the lsof process to open files declared with -k and -m. Lsof also restricts some

device cache file naming options when it senses the process has setuid-root power.

On a few dialects lsof requires setuid-root permission during its full execution in order to access files in the /proc file system. These dialects include:

DC/OSx 1.1 for Pyramid systems

Reliant UNIX 5.4[34] for Pyramid systems

When lsof runs with setuid-root permission it severely restricts all file accesses it might be asked to make with its options.

The device cache file (typically .lsof\_hostname in the home directory of the real user ID that executes lsof) has 0600 modes. (The suffix, hostname, is the first component of the host's name returned by gethostname(2).) However, even when lsof runs setuid-root, it makes sure the file's ownerships are changed to that of the real user and group. In addition, lsof checks the file carefully before using it (See the question "How do I disable the device cache file feature or alter it's behavior?" for a description of the checks.); discards the file if it fails the scrutiny; complains about the condition of the file; then rebuilds the file.

See the 00DCACHE file of the lsof distribution for more information about device cache file handling and the risks associated with the file.

### 3.7 Will lsof show remote hosts using files via NFS?

No. Remember, lsof displays open files for the processes of the host on which it runs. If the host on which lsof is running is an NFS server, the remote NFS client processes that are accessing files on the server leave no process records on the server for lsof to examine.

### 3.8 Why doesn't lsof report locks held on NFS files?

Generally lock information held by local processes on remote NFS files is not recorded by the UNIX dialect kernel. Hence, lsof can't report it.

One exception is some patch levels of Solaris 2.3, and all versions of Solaris 2.4 and above. Lsof for those dialects

does report on locks held by local processes on remotely mounted NFS files.

### 3.8.1 Why does lsof report a one byte lock on byte zero as a full file lock?

When a process has a lock of length one, starting at byte zero, lsof can't distinguish it from a full file lock.

That's because most UNIX dialects represent both locks the same way in their file lock (flock or eflock) structures.

### 3.9 Why does lsof report different values for open files on the same file system (the automounter phenomenon)?

On UNIX dialects where file systems may be mounted by an automounter with the ``direct" type, lsof may sometimes report difference DEVICE, SIZE/OFF, INODE and NAME values when asked to report files open on the file system.

This happens because some files open on the file system -- e.g., the current directory of a shell that changed its directory to the file system as the file system's first reference -- may be characterized in the kernel with temporary automounter node information. The cd doesn't cause the file system to be mounted.

A subsequent reference to the file system -- e.g., an ls of any place in it -- will cause the file system to be mounted. Processes with files open to the mounted file system are characterized in the kernel with data that reflects the mounted file system's parameters.

Unfortunately some kernels (e.g., some versions of Solaris 2.x) don't revisit the process that did only a change-directory for the purpose of updating the data associated with the open directory file. The file continues to be characterized with temporary automounter information until it does another directory change, even a trivial ``cd .".

Lsof will report on both reference types, when supplied the file system name as an argument, but the data lsof reports will reflect what it finds in the kernel. For the different types lsof will display different data, including different major and minor device numbers in the DEVICE column, different lengths in the SIZE/OFF column, different node numbers in the INODE column,



and slightly different  
file system names in the NAME column.

In contrast, fuser, where available, can only report on one reference type when supplied the file system name as an argument. Usually it will report on the one that is associated with the mounted file system information. If the only reference type is the temporary automounter one, fuser will often be silent about it.

### 3.10 Why don't lsof and netstat output match?

Lsof and netstat output don't match because lsof reports the network information it finds in open file system objects -- e.g., socket files -- while netstat often gets its information from separate kernel tables.

The information available to netstat may describe network activities never or no longer associated with open files, but necessary for proper network state machine operation.

For example, a TCP connection in the FIN\_WAIT\_[12] state may no longer have an associated open file, because the connection has been closed at the application layer and is now being closed at the TCP/IP protocol layer.

#### 3.10.1 Why can't lsof find accesses to some TCP and UDP ports?

Lsof stands for LiSt Open Files. If there is no open file connected to a TCP or UDP port, lsof won't find it. That's the most common reason why lsof doesn't find a port netstat might report open.

One reason I've found on some UNIX dialects is that their kernels set aside TCP and UDP ports for communicating with support activities, running in application layer servers -- the automounter daemons, and the NFS biod and nfsd daemons are examples. Netstat may report the ports are in use, but lsof doesn't.

Another reason is that netstat may also be able to report a port is open on a particular dialect, because it uses a source of data different from what lsof uses -- e.g., netstat might examine kernel tables or use streams messages to MIB2, while lsof relies on the information it finds in open file structures and their descendants.

Sometimes it's possible to search the data netstat and lsof use. For example, on Linux /proc/tcp and /proc/udp can be examined. There might an entry there for a particular protocol and port, but if the line on which the port appears doesn't have an inode number that matches an inode number of an open file, lsof won't be able to identify the process using the port.

This is a tough question to which there is no easy answer.

### 3.11 Why does lsof update the device cache file?

At the end of the lsof output you may see the message:

```
lsof: WARNING: /Homes/abe/.lsof_vic was updated.
```

In this message /Homes/abe/.lsof\_vic is the path to the private device cache file for login abe. (See 00DCACHE.)

Lsof issues this message when it finds it necessary to recheck the system device directory (e.g., /dev or /devices) and rebuild the device cache file during the open file scan. Lsof may need to do these things it finds that a device directory node has changed, or if it cannot find a device in the cache.

### 3.12 Why doesn't lsof report state for UDP socket files?

Lsof reports UDP TPI connection state -- TS\_IDLE (Idle), TS\_BOUND (Bound), etc. -- for some, but not all dialects. TPI state is stream-based TCP/IP information that isn't available in many dialects.

A fairly weak general rule is if netstat(1) reports UDP TPI state, lsof may be able to report it, too. But don't be surprised if lsof fails to report UDP TPI state for your dialect. Other factors influence lsof's ability to report UDP TPI state, including the availability of state number data in kernel structures, and state number to state name conversion data.

### 3.13 I am editing a file with vi; why doesn't lsof find the file?

Classic implementations of vi usually don't keep open the file being edited. (Newer ones may do so in order to maintain an advisory lock.) Instead classic vi opens the file, makes a

temporary copy (usually in /tmp or /usr/tmp), and does its work in that file. When you save the file being edited from a classic vi implementation, it reopens and rewrites the file.

During a classic vi session, except for the brief periods when vi is reading or rewriting the file, lsof won't find an open reference to the file from the vi process, because there is none.

### 3.14 Why doesn't lsof report TCP/TPI window and queue sizes for my dialect?

lsof only reports TCP/TPI window sizes for Solaris, because only its netstat reports them. The intent of providing TCP/TPI information in lsof NAME column output is to make it easier to match netstat output to lsof output.

In general lsof only reports queue sizes for both TCP and UDP (TPI) connections on BSD-derived UNIX dialects, where both sets of values appear in kernel socket queue structures. SYSV-derived UNIX dialects whose TCP/IP implementations are based on streams generally provide only TCP queue sizes, not UDP (TPI) ones.

While you may find that netstat on some SYSV-derived UNIX dialects with streams TCP/IP may report UDP (TPI) queue sizes, you will probably also find that the sizes are always zero -- netstat supplies a constant zero for UDP (TPI) queue sizes to make its headers align the same for TCP and UDP (TPI) connections. Solaris seems to get it right -- i.e., its netstat does not report UDP (TPI) queue sizes.

When in doubt, I chose to avoid reporting UDP (TPI) queue sizes for UNIX dialects whose netstat-reported values I knew to be a constant zero or whose origin I couldn't determine. OSR is a dialect in this category.

#### 3.14.1 Why doesn't lsof report socket options, socket states, and TCP flags and values for my dialect?

The lsof -T argument, 'f', that selects the reporting of socket options, socket states and TCP flags was implemented at lsof revision 4.71 for the following UNIX dialects, providing the indicated information:

AIX 4.3.2 and 5.1 and above

All socket options and values, socket states, and TCP flags and values described in lsof(8) are reported.

Apple Darwin 7.2 and above

All socket options and values, socket states, and TCP flags and values described in lsof(8) are reported.

Digital UNIX and Tru64 UNIX 4.0

All socket options and values, socket states, and TCP flags and values described in lsof(8) are reported.

FreeBSD 4.9 and above

All socket options and values, socket states, and TCP flags and values described in lsof(8) are reported.

HP-UX 11.00 (/dev/kmem-based lsof)

All socket options and values are reported. No socket states are reported. Only the TF\_NODELAY TCP flag and the TF\_MSS value are reported.

HP-UX 11.11 and iiiiv2 (PSTAT-based lsof)

All socket options and values, and socket states are reported. No TCP flags or values are reported.

Linux

No socket options and values, socket states, or TCP flags and values are reported. The support for "-Tf" could not be added to Linux, because socket options, socket states, and TCP flags and values are not available

via the /proc file system.

NetBSD 1.6G and above

All socket options and values, socket states, and TCP flags and values described in lsof(8) are reported.

OpenBSD 3.4 and above

All socket options and values, socket states, and TCP flags and values described in lsof(8) are reported.

OPENSTEP 4.2

All socket options and values, socket states, and TCP flags and values described in lsof(8) are reported.

OpenUNIX 8

All socket options and values, socket states, and TCP flags and values described in lsof(8) are reported.

SCO OpenServer Release 5.0.6

All socket options and values, socket states, and TCP flags and values described in lsof(8) are reported.

Solaris 2.6, 8 and above

The socket option display is limited to BROADCAST, DEBUG, DGRAM\_ERRIND, DONTROUTE and OOBINLINE. Socket values are limited to KEEPALIVE and LINGER. No socket states are reported. The TCP DELACK, NODELAY and SENTFIN flags are reported. The TCP MSS value

is

reported.

UnixWare 7.1.[134]

All socket options and values, socket states, and TCP flags and values described in lsof(8) are reported.

### 3.14.2 Why doesn't lsof report the partial listen queue connection count for my dialect?

The reporting of partial listen queue connections was added to -Tf processing at lsof revision 4.76. Currently it is reported for these dialects:

#### AIX 4.3.2

This dialect is no longer supported, so no attempt was made to add partial listen queue length support for it.

#### AIX 5.1 and above

Partial listen queue information is available.

#### Apple Darwin 7.2 and above

Partial listen queue information is available.

#### Digital UNIX 4.0

This dialect is no longer supported, so no attempt was made to add partial listen queue length support for it.

#### FreeBSD 4.9 and above

Partial listen queue information is available.

#### HP-UX 11.00 (/dev/kmem-based lsof)

No partial listen queue information is available.

#### HP-UX

11.11 and iiiv2 (PSTAT-based lsof)

No partial listen queue information is available.

#### Linux

No partial listen queue information is available.

#### NetBSD 1.6G and above

Partial listen queue information is available.

#### OpenBSD 3.4 and above

Partial listen queue information is available.

#### OPENSTEP 4.2

Partial listen queue information is available.

#### OpenUNIX 8

This dialect is no longer supported, so no attempt was made to add partial listen queue length support for it.

#### SCO OpenServer Release 5.0.6

No partial listen queue information is available.

#### Solaris 2.6, 8 and above

Partial listen queue information is available.

#### Tru64 UNIX 5.0

This dialect is no longer supported, so no attempt was made to add partial listen queue length support for it.

#### Tru64 UNIX 5.1

Partial listen queue information is available.

#### UnixWare 7.1.[134]

Partial listen queue information is available.

### 3.15 What does "no more information" in the NAME column mean?

When lsof can find no successor structures -- a gnode, inode, socket, or vnode -- connected to the file structure of an open descriptor of a process, it reports "no more information" in the NAME column. The TYPE, DEVICE, SIZE/OFF, and INODE columns will be blank.

Because the file structure is supposed to contain a pointer to the next structure of a file's processing support, if the pointer is NUL, lsof can go no further.

Some UNIX dialects have file structures for system processes -- e.g., the sched process -- that have no successor structure pointers. The "no more information" NAME will commonly appear for these processes in lsof output.

It may also be the case that lsof has read the file structure while it is being assembled and before a successor structure pointer value has been set. The "no more information" NAME will again result.

Unless lsof output is filled with "no more information" NAME column messages, the appearance of a few should be no cause for alarm.

### 3.16 Why doesn't lsof find a process that ps finds?

If lsof fails to display open files for a process that ps indicates exists, there may be several reasons for the difference.

The process may be a "zombie" for which ps displays the "(defunct)" state. In that case, the process has exited and has no open file information lsof can display. It does still have a process structure, sufficient for the needs

of ps.

Another possible explanation is that kernel tables and structures may have been changing when lsof looked for the process, making lsof unable to find all relevant process structures. Try repeating the lsof request.

### 3.17 Why doesn't -V report a search failure?

The usual reason that -V won't report a search failure is that lsof located the search item, but was prevented from listing it by an option that doesn't participate in search failure reporting.

For example, this lsof invocation:

```
$ lsof -V -i TCP@foobar -a -d 999
```

won't report  
it can't find the Internet address TCP@foobar,  
even if there is an open file connected to that address,  
unless the open file also has a file descriptor number of  
999 (the ``-a -d 999" options).

Compile-time options can also affect -V results in much the same way. For example, if HASSECURITY and HASNOSOCKSECURITY are defined at compile time, this lsof invocation, run by a non-root user:

```
$ lsof -V -c inetd
```

won't report that it can't find the inetd command, even if there is a process running the inetd command, because the HASSECURITY and HASNOSOCKSECURITY options prevent the listing of all but the socket files of another user, and no socket file selector (e.g., "-i") was specified.

### 3.18 Portmap problems

#### 3.18.1 Why isn't a name displayed for the portmap registration?

When portmap registration reporting is enabled, any time there is a registration for a local TCP or UDP port, lsof displays it in square brackets, following the port number or service name -- e.g.,  
``:1234[name]" or ``:name[100083]".

The TCP or UDP port number or service number (what follows the `:') is displayed under the control of the `lsof -P` option. The registration identity is held by the portmapper and may be a name or a number, depending on how the registration's owner declared it. `lsof` reports what the port map holds and cannot derive a registration name from a registration number.

`lsof` can be compiled with registration reporting enabled or disabled by default, under the control of the `HASPMAPENABLED` `#define` (usually in `machine.h`). The `lsof` help panel (`lsof -h`) will show the default. `lsof` is distributed with reporting disabled by default.

### 3.18.2 How can I display only portmap registrations?

`lsof` doesn't have an option that will display only TCP or UDP ports with portmap registrations. The `+M` option only enables the reporting of registration information when Internet socket files are displayed; `+M` doesn't select the displaying of Internet socket files -- the `-i` option does that.

This simple `lsof` pipe to `grep` will do the job:

```
$ lsof -i +M | grep "\["
```

This works because `-i` selects Internet socket files, `+M` enables portmap registration reporting, and only output lines with opening square brackets will have registrations.

When portmap registration reporting is enabled by default, because the `lsof` builder constructed it that way, `+M` is not necessary. (The `lsof` help panel, produced with `lsof -h` will display the default portmapper registration reporting state.) However, specifying `+M` when reporting is already enabled is acceptable, as is specifying `-M` when reporting is already disabled.

Digression: `lsof` will accept `+'` or `-'` as a prefix to most options. (That isn't documented in the man page or help panel to reduce confusion and complexity.) The `-i` option is as acceptable as `+i`, so the above example could be written a little more tersely as:

```
$ lsof +Mi | grep "\["
```



But be careful to use the ``Mi" ordering, since ``iM" implies M is an address argument to `i'.

### 3.18.3 Why doesn't lsof report portmap registrations for some ports?

Lsof reports portmap registrations for local TCP and UDP ports only. It identifies local ports this way:

- \* The port appears in the local address section of the kernel structure that contains it.
- \* The port appears in the foreign address section of a kernel structure whose local and foreign Internet addresses are the same.
- \* The port appears in the foreign address section of a kernel address structure whose Internet address is INADDR\_LOOPBACK (127.0.0.1).

Following these rules, lsof ignores foreign portmapped ports. That's done for reasons of efficiency and possible security prohibitions. Contacting all remote portmappers could take a long time and be blocked by network difficulties (i.e., be inefficient). Many firewalls block portmapper access for security reasons.

Lsof may occasionally ignore portmap registration information for a legitimate local port by virtue of its local port rules. This can happen when a port appears in the foreign part of its kernel structure and the local and foreign Internet addresses don't match (perhaps because they're on different interfaces), and the foreign Internet address isn't INADDR\_LOOPBACK (127.0.0.1).

### 3.19 Why is `lsof | wc` bigger than my system's open file limit?

There is a strong temptation to count open files by piping lsof output to wc. If your purpose is to compare the number you get to some Unix system parameter that defines the number of open files your system can have, resist the temptation.

One reason is that lsof reports a number of "files" that don't occupy Unix file table space -- current working directories, root directories, jail directories, text files, library files, memory mapped files are some. Another reason

is that lsof can report a file shared by more than one process that itself occupies only one file table slot.

If you want to know the number of open files that occupy file table slots, use the +ff option and process the lsof output's FILE\_ADDR column information with standard Unix tools like cut, grep, sed, and sort.

You might also consider using lsof's field output with +ff, selecting the file struct address with -FF, and processing the output with an AWK or Perl script. See the list\_fields.awk, list\_fields.perl, and shared.perl5 scripts in the scripts/ subdirectory of the lsof distribution for hints on file struct post-processing filters.

### 3.20 Why doesn't lsof report file offset (position)?

Lsof won't report a file offset (position) value if the -s option has been specified, or if the dialect doesn't support the displaying of file offset (position).

That lsof is reporting only file size is indicated by the fact that the appropriate column header says SIZE instead of SIZE/OFF.

If lsof doesn't support the displaying of file offset (position) -- e.g., for Linux /proc-based lsof -- the -h or -? output panel won't list the -o option.

Sometimes the availability of file offset information depends on the dialect's kernel. This is particularly true for socket file offsets.

Maintenance of offsets for pseudo-terminal devices varies by UNIX dialect and is related to how the dialect kernel implements pseudo-terminal support. Kernels like AIX, for example, that short-circuit the transfer of data between socket and pseudo devices to reduce TCP/IP daemon interrupt rates won't advance offsets in the TCP/IP daemon socket files. Instead they will advance offsets in the open standard I/O files of the shell child process where the pseudo-terminal devices are used.

When in doubt about the behavior of lsof in reporting file offset information, do some carefully measured experiments, consult the lsof sources, or contact me at <abe@purdue.edu>

to discuss the matter. Please follow the reporting guidelines in the "How do I report an lsof bug?" section of this FAQ.

### 3.20.1 What does lsof report for size when the file doesn't really have one?

When a file has no true size -- e.g., it's a socket, a FIFO, or a pipe -- lsof tries to report the information it finds in the kernel that describes the contents of associated kernel buffers.

Thus, for example, size for most TCP/IP files is socket buffer size. The size of the socket read buffer is reported for read-only files; the size of the write buffer for write-only files; and the sum of the buffers sizes for read-write files.

### 3.21 Problems with path name arguments

#### 3.21.1 How do I ask lsof to search a file system?

You can ask lsof to search for all open files on a file system by specifying its mounted path name as an lsof argument -- e.g.,

```
$ lsof /
```

Output of the mount command will show file system mounted path names. It will also show the mounted-on device path for the file system.

If the mounted-on device is a block device (the permission field in output of `ls -l <device>` starts with a `b/`), you can specify its name, too -- e.g.,

```
$ lsof /dev/sd0a
```

If the mounted-on device isn't a block device -- for example, some UNIX dialects call a CD-ROM device a character device (ls output starts with a `c'`) -- you can force lsof to assume that the specified device names a file system with the `+f` option -- e.g.,

```
$ lsof +f -- /dev/sd0a
```

(Note: you must use `--` after `+f` or `-f` if a file name

follows immediately, because +f and -f can be followed by characters that specify flag output selections.)

When you use +f and lsof can't match the device to a file system, lsof will issue a complaint.

The +f option may be used in some dialects to ask lsof to search for an NFS file system by its server name and server mount point. If the mount application reports an NFS file system mounted-on value that way, then this sample lsof request should work.

```
$ lsof +f -- fleet:/home/fleet/u5
```

Finally, you can use -f if you don't want a mounted file system path name to be considered a request to report all open files on the file system. This is useful when you want to know if anyone is using the file system's mounted path name. This example directs lsof to report on open access to the '/' directory, including when it's being used as a current working or root directory.

```
$ lsof -f -- /
```

The lsof -f option performs the same function as -f does in some fuser implementations. However, since the lsof -c option was chosen for another purpose before the -f option was added to lsof, +f was selected as the analogue to the fuser -c option. (Sorry for the potential confusion.)

### 3.21.2 Why doesn't lsof find all the open files in a file system?

Lsof may not find all the open files in a file system for several reasons.

First, some processes with files open on the file system may have been changing status when lsof examined the process table, and lsof "missed" them. Remember, the kernel changes much faster than lsof can respond to the changes.

Second, be sure you have specified the file system correctly. Perhaps you specified a file instead. You can use lsof's -V option to have lsof report in detail on what it couldn't find. Make sure the report for the file system you specified says "file system." Here's some -V output:

```
$ lsof -V /tmp ./lsof.h ./lsof
COMMAND PID USER FD TYPE DEVICE SIZE/OFF INODE NAME
lsof 2688 abe txt VREG 18,1,7 1428583 226641 ./lsof
lsof 2689 abe txt VREG 18,1,7 1428583 226641 ./lsof
lsof: no file use located: ./lsof.h
```

You can also use lsof's +f option to force it to consider a path name as a file system. If lsof can't find a file system by the specified name, it will issue a complaint -- e.g.,

```
$ lsof +f -- /usr
lsof: not a file system: /usr
```

(/usr is a directory in the / file system.)

### 3.21.3 Why does the lsof exit code report it didn't find open files when some files were listed?

Sometimes lsof will list some open files, yet return a non-zero exit code, suggesting it hasn't found all the specified files.

The first thing you should when you suspect lsof is incorrect is to repeat the request, adding the -V option. In the resulting report you may find that your file system specification really wasn't a file system specification, just a file specification.

Finally, if you specify two files or two file systems twice, lsof will credit all matches to the first of the two and believe that there were no matches for the second. It's possible to specify a single file system twice with different path names by using both its mounted directory path name and mounted-one device name.

```
$ lsof +f -V spcuna:/sysprog /sysprog
COMMAND PID USER FD TYPE DEVICE SIZE/OFF INODE NAME
ksh 11092 abe cwd VDIR 39,0,1 1536 226562 /sysprog
(spcuna:/sysprog)
...
lsof: no file system use located: spcuna:/sysprog
```

All matches were credited to /sysprog; none to spcuna:/sysprog.

### 3.21.4 Why won't lsof find all the open files in a directory?

When you give lsof a simple directory path name argument (not a file system mounted-on name), you are asking it to search for processes that have the directory open as a file, or as a process-specific directory -- e.g., root or current working directory.

If you want to list instances of open files inside the directory, you need to specify the individual path names of those files, or use the lsof +D and +d options.

See the answer to the question "Why are the +D and +d options so slow?" before you use +D or +d casually.

See the answer to the question "Why do the +D and +d options produce warning messages?" for an explanation of some process authority limitations of +D and +d.

### 3.21.5 Why are the +D and +d options so slow?

The +D and +d options cause lsof to build a path name search list for a specified directory. +D causes lsof to descend the directory to its furthest subdirectory, while +d restricts it to the top level. In both cases, the specified directory itself is included in the search list. In both symbolic links are ignored.

Building such a search list can take considerable time, especially when the specified directory contains many files and subdirectories -- lsof must call the system readlink() and stat() functions for each file and directory. Storing the search list can cause lsof to use more than its normal amount of dynamic memory -- each file recorded in the search list consumes dynamic memory for its path name, characteristics, and search linkages. Using the list means lsof must search it for every open file in the system.

Building the search list for a directory specified on some file systems can be slow -- e.g., for an NFS directory with many files. Some file systems have special logging features that can introduce additional delays to the building of the search list -- e.g., NFS logging, or logging on a Solaris UFS file system. The bottom line is that slow search list construction may not be so much an lsof problem as a file system problem. (Hint: if you're using Solaris UFS logging, consider specifying the "logging,noatime"

option pair to reduce the number of atime writes to the UFS logging queue and disk.)

A somewhat risky way to speed up lsof's building of the search list is to use lsof's `--O` option. It forces lsof to do all system calls needed to build the search list directly, rather than in a child process. While direct system calls are much faster, they can block in the kernel -- e.g., when an NFS server stops responding -- stopping lsof until the kernel operation unblocks.

As an example of the load +D can impose, consider that an `lsof +D /` on a lightly loaded NeXT '040 cube with a 1GB root file system disk took 4+ minutes of real time. It also generated several hundred error messages about files and directories the lsof process didn't have permission to access with `stat(2)`.

The bottom line is that +D and +d should be used cautiously. +D is more costly than +d for deeply nested directory trees, because of the full directory descent it causes. So use +d where possible. And you might need to consider the performance of the file system that holds the directory you name with +d or +D.

In view of these warnings, when is it appropriate to use +D or +d? Probably the most appropriate time is when you would specify the directory's contents to lsof with a shell globbing construct -- e.g., `lsof *`. If that's what you need to do, `lsof +d .` is probably more efficient than having the shell produce a directory list, form it into an argument vector, and pass the vector to lsof for it to unravel.

See the answer to the question "Why do the +D and +d options produce warning messages?" for an explanation of some process authority limitations of +D and +d.

### 3.21.6 Why do the +D and +d options produce warning messages?

+D and +d option processing is limited by the authority of the lsof process -- i.e., lsof can only examine (with `lstat(2)` and `stat(2)`) files the owner of the process can access.

If the ownership, group membership, or permissions of the

specified directory, file within it, or directory within it prevents the owner of the lsof process from using lstat(2) or stat(2) on it, lsof will issue a warning message, naming the path and giving the system's (lstat(2)'s or stat(2)'s) reason (errno explanation text) for refusing access.

As an example, assume user abc has a subdirectory in /tmp, owned by abc and readable, writable and searchable by only its owner. If user def asks lsof to search for all /tmp references with +D or +d, lsof will be unable to lstat(2) or stat(2) anything in abc's private subdirectory, and will issue an appropriate warning.

Lsof warnings can usually be suppressed with the -w option. However, using -w with +D or +d means that there will be no indication why lsof couldn't find an open reference to a restricted directory or something contained in it.

Hint: if you need to use +D or +d and avoid authority warnings, and if you have super-user power, su and use lsof with +D or +d as root.

### 3.22 Why can't my C compiler find the rpcent structure definition?

When you try to compile lsof your compiler may complain that the rpcent structure is undefined. The complaints may look like this:

```
>print.c: In function `fill_portmap':
>print.c:213: dereferencing pointer to incomplete type
>...
```

The most likely cause is that someone has allowed a BIND installation to update /usr/include/netdb.h (or perhaps /usr/include/rpc/netdb.h), removing the rpcent structure definition that lsof expects to find there.

Only Solaris has an automatic work-around. (See dlsof.h in dialects/sun.). The Solaris work-around succeeds because there is another header file, <rpc/rpcent.h>, with the rpcent structure definition, and there is a Solaris C pre-processor test that can tell when the BIND <netdb.h> is in place and hence <rpc/rpcent.h> must be included.

Doubtlessly there are similar work-arounds possible in other UNIX dialects whose header files have been "touched"



by BIND, but in general I recommend restoration of the vendor's <netdb.h> and any other header files BIND might have replaced. (I think BIND replaces <resolv.h>, <sys/bitypes.h>, <sys/cdefs.h> -- and maybe others.)

### 3.23 Why doesn't lsof report fully on file "foo" on UNIX dialect "bar?"

lsof sometimes won't report much information on a given file, or may even report an error message in its NAME column. That's usually because the file is of a special type -- e.g., in a file system specific to the UNIX dialect -- and I haven't used a system where the file appeared during my testing.

If you encounter such a situation, send me e-mail at <abe@purdue.edu> and we may be able to devise an addition to lsof that will report on the file in question. Please follow the reporting guidelines in the "How do I report an lsof bug?" section of this FAQ. Make sure "lsof" appears in the "Subject:" line so my e-mail filter won't classify your letter as Spam.

### 3.24 Why do I get a complaint when I execute lsof that some library file can't be found?

On systems where the LIBPATH (or the equivalent) environment variable is used to record the library search path in executable files when they are built, an incorrect value may make it impossible for the system to find the shared libraries needed to load lsof for execution.

This may be particularly true on systems like AIX >= 4.1.4, where the lsof Makefile takes the precautionary step of using the -bnolibpath loader flag to insure that the path to the private static lsof library is not recorded in the lsof binary. Should LIBPATH be invalid when lsof is built, it will be recorded in the lsof binary as the default library path search order and lead to an inability to find libraries when lsof is executed.

So, if you get missing library complaints when you try to execute lsof, check LIBPATH, or whatever environment variable is used on your system to define library search order in executable files. Use the tools at your disposal to look at the library paths recorded in the lsof binary -- e.g.,

chatr on HP-UX, dump on AIX, ldd on Solaris.

Make sure, too, that when the correct library search path has been recorded in the executable file, the required library files exist at one or more of the search paths.

### 3.25 Why does lsof complain it can't open files?

When lsof begins execution, unless it has been asked to report only help or version information, typically it will attempt to access kernel memory and symbol files -- e.g., /unix, /dev/kmem. Even though lsof needs only permission to open these files for reading, read access to them might be restricted by ownerships and permission modes.

So the first step to diagnosing lsof problems with opening files is to use ls(1) to examine the ownerships and permission modes of the files that lsof wants to open. You may find that lsof needs to be installed with some type of special ownership or permission modes to enable it to open the necessary files for reading. See the "Installing Lsof" section of 00README for more information.

### 3.26 Why does lsof warn "compiled for x ... y; this is z."?

Unless warnings are suppressed (with -w) or the kernel identity check symbol (HASKERNIDCK) definition has been deleted, all but one lsof dialect version (exception: /proc-based Linux lsof) compare the identity of the running kernel to that of the one for which lsof was constructed. If the identities don't match, lsof issues a warning like this:

lsof: WARNING: compiled for Solaris release 5.7; this is 5.6.

Two kernel identity differences can generate this warning -- the version number and the release number.

Build and running identity differences are usually significant, because they usually indicate kernels whose structures are different -- kernel structures commonly change at dialect version releases. Since lsof reads data from the kernel in the form of structures, it is sensitive to changes in them. The general rule is that an lsof compiled for one UNIX dialect version will not work correctly when run on

a different version.

There are three work-arounds: 1) use -w to suppress the warning -- and risk missing other warnings; 2) permanently disable the identity check by deleting the definition of HASKERNIDCK in the dialect's machine.h header file -- with the same risk; or 3) rebuild lsof on the system where it is to be run. (Deleting HASKERNIDCK can be done with the Customize script or by editing machine.h.)

Generally checking kernel identity is a quick operation for lsof. However, it is potentially slow under AIX, where lsof must run /usr/bin/oslevel. To speed up lsof, use -w to suppress the /usr/bin/oslevel test. See "Why does AIX lsof start so slowly?" for more information.

### 3.27 How can I disable the kernel identity check?

The kernel identity check is controlled by the HASKERNIDCK definition. When it is defined, most dialects (exclusion: /proc-based Linux lsof) will compare the build-time kernel identity with the run-time one.

To disable the kernel identity check, disable the HASKERNIDCK definition in the dialect's machine.h header file. The Customize script can be used to do that in its section about the kernel identity check.

Caution: while disabling the kernel identity check may result in smaller lsof startup overhead, it comes with the risk of executing an lsof that may produce warning messages, error messages, incorrect output, or no output at all.

### 3.28 Why don't ps(1) and lsof agree on the owner of a process?

Generally the user ID lsof reports in its USER column is the process effective user ID, as found in the process structure. Sometimes that may not agree with what ps(1) reports for the same process.

There are sundry reasons for the difference. Sometimes ps(1) uses a different source for process information, e.g., the /proc file system or the psinfo structure. Sometimes the kernel is lax or confused (e.g., Solaris 2.5.1) about what ID to report as the effective user ID. Sometimes the system carries only one user ID in its process

structure (some BSD derivatives), leaving lsof no choice.

The differences between lsof and ps(1) user identifications should be small and normally it will be apparent that the confusion is over a process whose application has changed to an effective user ID different from the real one.

### 3.29 Why doesn't lsof find an open socket file whose connection state is past CLOSE\_WAIT?

TCP/IP connections in states past CLOSE\_WAIT -- e.g., FIN\_WAIT\_1, CLOSING, LAST\_ACK, FIN\_WAIT\_2, and TIME\_WAIT -- don't always have open files associated with them. When they don't, lsof can't identify them. When the connection state advances from CLOSE\_WAIT, sometimes the open file associated with the connection is deleted.

### 3.30 Why don't machine.h definitions work when the surrounding comments are removed?

The machine.h header files in dialect subdirectories have some commented-out definitions like:

```
/* #define HASSYSDC "/your/choice/of/path */
```

You can't simply remove the comments and expect the definition to work. That's intended to make you think about what value you are assigning to the symbol. The assigned value might have a system-specific convention. HASSYSDC, for example, might be /var/db/lsof.dc for FreeBSD, but it might be /var/adm/lsof.dc for Solaris.

Symbols defined in the lsof documentation are described in 00PORTING, other machine.h comments, and other lsof documentation files. HASSYSDC, for example, is discussed in 00DCACHE. When comments and documentation don't suffice, consult the source code for hints on how the symbol is used.

### 3.31 What

do "can't read inpcb at 0x...", "no protocol control block", "no PCB, CANTSENDMORE, CANTRCVMORE", etc. mean?

Sometimes lsof will report "can't read inpcb at 0x00000000", "no protocol control block", "no PCB, CANTSENDMORE, CANTRCVMORE" or a similar message in the NAME column for open TCP socket files. These messages mean the file's socket

structure lacks a pointer to the INternet Protocol Control Block (inpcb) where lsof expects to find connection addresses -- local and foreign ports, local and foreign IP addresses. The socket file has probably been submitted to the shutdown(2) function for processing.

In some implementations lsof issues the "no PCB, CANTSENDMORE, CANTRCVMORE" message, which tries to explain the absence of a protocol control block by showing the socket state settings that have been made by the shutdown(2) function.

If a non-zero address follows the "0x" in the "can't read inpcb" message, it means lsof couldn't read inpcb contents from the indicated address in kernel memory.

### 3.32 What do the "unknown file system type" warnings mean?

Lsof may report a message similar to"

```
unknown file system type, v_op: 0x10472f10
```

in the NAME column for some files.

This means that lsof has encountered a vnode for the file whose operation switch address (from v\_op) references a file system type for which there is no support in lsof. After lsof identifies the file system type, it uses pre-compiled code to locate the file system specific node for the file where lsof finds information like file size, device number, node number, etc.

To get some idea of what the file system type might be, use nm on your kernel symbol file to locate the symbol name that corresponds to the v\_op address -- e.g., on Solaris do:

```
$ nm -x /dev/ksyms | grep 0x10472f10
0x10472f10 ... |file_system_name_vnodeops
```

Where "file\_system\_name" is the clue to the unsupported file system.

Lsof doesn't use the v\_op address to identify file system types on all dialects. Sometimes it uses an index number it finds in the vnode. It will translate that symbol to a short name in the warning message -- e.g., "nfs3" -- if

possible.

### 3.33 Installation

#### 3.33.1 How do I install lsof?

There is no "standard" way to install lsof. Too much depends on local conditions for me to be able to provide working install rules in the lsof make files. (The skeleton install rules you will find just give "hints.") See the "Installing lsof" section of 00README for a fuller explanation.

To install lsof you will need to consider these questions:

- \* Who should be able to use lsof? (See HASSECURITY and HASNOSOCKSECURITY in the "Security" section of 00README.)
- \* Where should lsof be installed? This is a decision mostly dictated by local conditions. Somewhere in /usr/local -- etc/ or/sbin/ -- is a common choice.
- \* What permissions should I give the lsof executable?  
The answer to this varies by dialect. The make files have install rules that give hints. The "Installing lsof" section of 00README gives information, too.
- \* What if I want to install lsof in a shared file system for machines that require different lsof configurations?  
See the next question and answer, "How do I install a common lsof when I have machines that need differently constructed lsof binaries?"

#### 3.33.2 How do I install a common lsof when I have machines that need differently constructed lsof binaries?

A dilemma that faces some system administrators when they install lsof in a shared file system -- e.g., NFS -- is that they must have different lsof executables for different systems.

The answer is to build an lsof wrapper script that is executed in place of lsof. The script can use system commands to determine which lsof binary should be executed.

Consider this example. You have HP-UX machines with 32 and 64 bit kernels that share the /usr/local/sbin directory where you want to install

lsof. Consequently, on each system you must use a different lsof executable, built for the system's bit size. (That's because lsof reads kernel structures, sized by the kernel's bit size.)

One answer is to install three things in /usr/local/sbin:

1) a 32 bit lsof as lsof32; 2) a 64 bit lsof as lsof64; and 3) an lsof script. The script might look like this one, based on work by Amir J. Katz:

```
#!/bin/sh
x=`/usr/bin/getconf KERNEL_BITS` # returns 32 or 64
if /usr/bin/test "X$x" = "X32"
then
 lsof32 $*
else
 if /usr/bin/test "X$x" = "X64"
 then
 lsof64 $*
 else
 echo "Can't determine which lsof executable to use;"
 echo "getconf KERNEL_BITS says: $x"
 exit 1
 fi
fi
```

Solaris users should consult "How do I install lsof for Solaris 7, 8 or 9?" for information on a similar trick using the Solaris isaexec command.

Users of other dialects might be able to use a command like uname(1) that can identify a distinguishing feature of the system to be incorporated in pre-installed lsof executable names. For example, use `uname -r` and install binaries with suffixes that match `uname -r` output.

### 3.34 Why do lsof 4.53 and above reject device cache files built by earlier lsof revisions?

When lsof revisions 4.53 run and encounter a device cache file built by an earlier revision, it will reject the file and build a new one. The rejection will be advertised with these messages:

```
lsof: WARNING: no /dev device in <name>: 2 sections
...
lsof: WARNING: created device cache file: <name>
```

This happens because the header line of the device cache file was changed at revision 4.53 to contain the number of the device on which the device directory resides. The old device cache file header line -- the "2 sections" line in the above warning message, now reads "2 sections, dev=600".

This is not a serious problem, since lsof automatically rebuilds the device cache file with the correct header line.

### 3.35 What do "like block special" and "like character special" mean in the NAME column?

When lsof comes across an open block or character file whose device, raw device and inode place it somewhere other than /dev (or /devices), lsof doesn't report the /dev (or /devices) name in the NAME column. Instead lsof reports the file system name and device or path name in the NAME column and parenthetically adds "like block special <path>" or "like character special <path>".

The value for <path> will point to a block or character device in /dev (or /devices) whose raw device number matches that of the open file being reported, but whose device number or node number (or both) don't match.

Such an open file is connected to a device node that has been created in a directory other than /dev (or /devices.) See `mknod(8)` for information on how such nodes are created. (Generally one needs root power to create device nodes with `mknod`.)

### 3.36 Why does an lsof make fail because of undefined symbols?

When lsof is compiled via the ``make`` step and the final load step fails because of missing symbols, the problem may not be lsof. The problem may be that `ld`, called by the compiler as part of the ``make`` step, can't find some library that lsof needs.

First check the last compiler line of the make operation -- e.g., the last line with `cc` or `gcc` in it before the undefined symbol report -- for loader arguments, i.e., ones beginning with `"-l"`. Except for `"-llsof"` the rest name system libraries. (`"-L./lib"` precedes `"-llsof"` to



tell the loader its location.)

Check that all the named system libraries exist. Look in /lib and /usr/lib as a start, but that may not be the only place system libraries live. Consult your dialect's documentation, e.g., the compiler and loader man pages, for other possible locations.

If some system library doesn't exist, that may mean it was never installed or was removed. You'll have to re-install the missing library.

You may find that all the system libraries lsof uses exist. Your next step might be to use nm and grep to see if any of them contain the undefined symbols.

```
$ nm library | grep symbol
```

If the undefined symbol exists in some library named by the lsof make step, then you might have a problem with some environment variable that controls the load step. The most common is LD\_LIBRARY\_PATH. It may have a setting that causes ld to ignore a directory containing a library lsof names. If this is the case, try unsetting LD\_LIBRARY\_PATH in the environment of the ld process -- e.g., do:

```
$ unset LD_LIBRARY_PATH
or
% unsetenv LD_LIBRARY_PATH
```

Consult your ld man page for other environment variables that might affect library searching -- e.g., LIBPATH, LPATH, SHLIB\_PATH, etc.

If the undefined function doesn't exist in any libraries lsof names, check other libraries. See if the function has a man page that names its library. If the latter is true, please let me know, because that is an lsof problem I need to fix.

If none of these solutions work for you, send me some documentation via e-mail at <abe@purdue.edu>. Include `uname -a` output, the output of the lsof `Configure ...` and `make` steps, and the contents of the environment in force when the `make` step was executed -- e.g., `env` or `printenv` output. If you've located the libraries lsof names, send me that

information, too. Make sure "Isof" appears in the "Subject:" line so my e-mail filter won't classify your letter as Spam.

### 3.37 Command Regular Expressions (REs)

#### 3.37.1 What are basic and extended regular expressions?

Lsof's `--c` option allows the specification of regular expressions (REs), enclosed in two slash (/) characters and followed by these modifiers:

- `b` the RE is a basic RE.
- `i` ignore case.
- `x` the RE is an extended RE (the default).

Note: the characters of the regular expression may need to be quoted to prevent their expansion by the shell.

Example: this RE is an extended RE that matches exactly four characters, whose third may be an upper ('O') or lower case ('o') oh:

```
-c /^..o.$/i
```

For simplicity's sake, an RE that is acceptable to `egrep(1)` is usually called an extended RE.

REs suitable for the old line editor, `ed(1)`, are often called basic REs (and sometimes also called obsolete).

These are some ways basic REs usually differ from extended REs. (There are other differences.)

\* `\|`, ``+``, ``?``, `{`, and `}` are ordinary characters.

\* ``^`` is an ordinary character except at the beginning of the RE.

\* ``$`` is an ordinary character except at the end of the RE.

\* ``*`` is an ordinary character if it appears at the beginning of the RE.

For more information on REs and the distinction between basic and extended REs, consult your dialect's man pages for `ed(1)`, `egrep(1)`, `sed(1)`, and possibly `regex(5)` or

regex(7).

### 3.37.2 Why can't I put a slash in a command regular expression?

Since

a UNIX command name is the last part of a path to the command's executable, the lsof command regular expression (RE) syntax uses slash (/) to mark the beginning and end of an RE. Slash may not appear in the RE and the backslash escape is ineffective for "hiding" it.

More likely than not, if you try to put a slash in an lsof command RE, you'll get this response:

```
$ lsof -s/.\/ ...
lsof: invalid regexp modifier: /
```

Lsof is complaining the first character it found after the second slash isn't an lsof command RE modifier -- 'b', 'i', or 'x'.

### 3.37.3 Why does lsof say my command regular expression wasn't found?

When you use both forms of lsof's -c option -- ``-c <command>" and ``-c /RE/[m]" -- and ask that lsof do a verbose search (``-V"), you may be surprised that lsof will say that the regular expression wasn't found.

This can happen if the ``-c <command>" form matches first, because then the ``-c/RE/[m]" test will never have been applied.

For example:

```
$./lsof -clsof -c/^..o.$/ -V -adcwd
COMMAND PID USER FD TYPE DEVICE SIZE/OFF NODE NAME
lsof 7850 abe cwd VDIR 6,0 2048 96442 / (/dev/sd0a)
lsof: no command found for regex: ^..o.$
```

The ``-clsof" option matched first, so the ``-c/^..o.\$/ option wasn't tested.

### 3.38 Why doesn't lsof report on shared memory segments?

Lsof reports on shared memory segments only if they're associated with an open file. That's consistent with lsof's mission -- to LiSt Open Files. Shared memory segments with no file associations aren't open files.

That's not to say that a report on shared memory segments and their associated processes wouldn't be useful. But it calls for a new tool, not more baggage for lsof.

### 3.39 Why does lsof report two instances of itself?

When you ask lsof to report all open files and it has permission to do so, you may see two lsof processes in the output. The processes are connected via pipes -- e.g., here's an HP-UX 11 example.

```
COMMAND PID USER FD TYPE DEVICE ...
...
lsof 29450 abe 7w PIPE 0x48732408 ...
lsof 29450 abe 8r PIPE 0x48970808 ...
...
lsof 29451 abe 6r PIPE 0x48732408 ...
lsof 29451 abe 9w PIPE 0x48970808 ...
```

The first process will usually be the lsof you initiated; the second, an lsof child process that is used to isolate its parent process from kernel functions that can block -- e.g., readlink() or stat().

Information to and from the kernel functions is exchanged via the two pipes. When the parent process detects that the child process has become blocked, it attempts to kill the child. Depending on the UNIX dialect that may succeed or fail, but the parent won't be blocked in any event.

See the "BLOCKS AND TIMEOUTS" and "AVOIDING KERNEL BLOCKS" sections of the lsof man page for more information on why the child process is used and how you can specify lsof options to avoid it. (Caution: that may be risky.)

### 3.40 Why does lsof report '\n' in device cache file error messages?

Lsof revisions prior to 4.58 may report '\n' in error messages it delivers about problems in the device cache file -- e.g.,

```
lsof: WARNING: no ...: 4 sections\n
```

That's deliberately done to show the exact contents of the device cache file line about which lsof is complaining, including its terminating NL (New Line) '\n' character.

In the above example the line in the device cache file causing the lsof complaint contains "4 sections" and ends with a '\n'.

At revision 4.58 and above, device cache error messages like the one in the above example have been changed to read:

lsof: WARNING: no ...: line "4 sections"

The terminal '\n' is no longer reported, the line contents are enclosed in double quote marks (""), and the word "line" has been added as a prefix to denote that what follows is a line from the device cache file.

### 3.41 Kernel Symbol and Address Problems

#### 3.41.1 What does "lsof: WARNING: name cache hash size length error: 0" mean?

When run on some systems, lsof may issue this warning:

lsof: WARNING: name cache hash size length error: 0

That is an example from a FreeBSD system where lsof reads the kernel's \_nchash variable and finds its value is zero.

Similar warnings include:

WARNING: kernel name cache size:

WARNING: can't read kernel's name cache:

WARNING: no name cache address

WARNING: name cache hash size length error:

WARNING: unusable name cache size:

These warnings are issued when lsof is attempting to read the kernel's name cache information. They are usually the result of a mis-match between the addresses for kernel symbols lsof gets via nlist(2) and the addresses in use by the kernel.

Lsof usually gets kernel symbol addresses from what it believes to be the kernel boot file. In FreeBSD, for example, that's the path returned by getbootfile(3), usually /kernel.

The boot file can have other names in other UNIX dialects -- /unix, /vmunix, /bsd, /netbsd, /mach, /stand/vmunix,

etc.

Lsof will get incorrect (mismatched) addresses from the boot file if it has been replaced by a newer one which hasn't yet been booted -- e.g., if this is done in FreeBSD:

```
mv /kernel /kernel.OLD
mv /kernel.NEW /kernel
```

Until the FreeBSD system is rebooted, the booted kernel is /kernel.OLD, but getbootfile() says it is /kernel. If symbol addresses important to lsof in /kernel.OLD and /kernel don't match, the lsof WARNING messages result.

#### 3.41.2 Why does lsof produce "garbage" output?

Kernel name cache warnings may not be the only sign that lsof is using incorrect symbol addresses to read kernel values. If there's no reasonable test lsof can make on what it reads from the kernel, it may issue other warnings or even report nonsensical results.

The warnings may appear on STDERR, such as:

```
lsof: can't read proc table info
```

Or the warnings may appear in the NAME column as messages saying lsof can't read or interpret some kernel structure -- e.g.,

```
... NAME
... can't read file struct from 0x12345
```

One possible work-around is to point lsof's kernel symbol address gathering at the proper boot file. That can be done with lsof's -k option -- e.g.,

```
$ lsof -k /kernel.OLD
```

The best work-around is to make sure the standard boot file is properly sited -- e.g., if you've moved a new /kernel in place, boot it.

#### 3.42 Why does lsof report open files when run as super user that it doesn't report when run with lesser privileges?

The most likely cause is that the HASSECURITY option was

selected when the lsof executable was built.

If HASSECURITY is defined when lsof is built, and lsof is run with the privileges of a non-ROOT user, it will only list open files belonging to the user. The same lsof executable, when run with root user privileges, will list all open files.

However, if HASSECURITY and HASNOSOCKSECURITY are both defined when lsof is built, lsof will list open files belonging to the user and will also list anyone else's open socket files, provided their listing is selected with the "-i" option.

So first ask yourself if the process whose open files lsof won't list belong to a user other than the one under which you're running lsof, and are not open socket files. If either is true, use lsof's help (-h or -?) option and look for a line near the bottom of the help panel that says:

```
"... can list all files..."
```

If the leading "..." says "Only root" then HASSECURITY was defined when lsof was built. If the trailing "..." says "...", but anyone can list socket files" then HASNOSOCKSECURITY was also defined.

Should you want an lsof not built with HASSECURITY defined, rerun the lsof Configure script. If you let Configure do customization, make sure you answer 'n' when it asks if you want to enable HASSECURITY and HASNOSOCKSECURITY. If you don't need to do customization, you can rebuild lsof with the "-n" option to Configure. Here's an example of such a rebuild sequence:

```
$ Configure -clean
$ Configure -n <dialect-abbreviation>
$ make
```

More information on the HASSECURITY and HASNOSOCKSECURITY options may be found in the "Security" section of the README file of the lsof distribution.

### 3.43 Test Suite Problems

#### 3.43.1 Errors all tests can report:

#### 3.43.1.1 Why do tests complain "ERROR!!! can't execute ../lsof"?

All tests in the test suite expect an executable lsof file to exist in the tests parent directory, ../lsof.

If there's none there, the tests/Makefile has a rule to make it, but there are probably circumstances where that rule may fail.

The work-around is to re-Configure and re-make lsof, then run the test suite.

#### 3.43.1.2 Why do tests complain "ERROR!!! can't find ..." a file?

Many tests create (or use from a supplied environment variable path) a test file and use lsof to find it. When lsof can't find the file, the tests report the error with messages of the form:

```
ERROR!!! can't find ... : <some file path>
```

or

```
ERROR!!! lsof couldn't find ...
```

These type of error messages mean that the lsof field output delivered to the test didn't contain a file that the test could identify as the one it intended lsof to find. It might also mean that the process information -- command name, PID or parent PID -- didn't match what the test expected.

This could imply a bug in the test or a bug in lsof. Try using lsof to find a known file that is open. For example, while in the tests sub-directory, do this:

```
$ sleep 30 < Makefile
$../lsof Makefile
```

If lsof doesn't report that Makefile is open, then the fault may be with lsof. If lsof reports the file is open, search further in the test code for the failure cause.

#### 3.43.1.3 Why do some tests fail to compile?

If a test suite program fails to compile, it may be because I've never had an opportunity



to compile the test on the particular UNIX version you are using.

See Appendix B in 00TEST for a list of the UNIX dialects where the test suite has been validate.

#### 3.43.1.4 Why do some tests always fail?

There are several tests in the optional group that have conflicting or special requirements:

LTbigf needs a dialect and file system that support large files.

LTlock won't work if the tests/ sub-directory is on an NFS file system.

LTnfs won't work if the tests/ sub-directory is not on an NFS file system.

So for two tests in particular, LTlock and LTnfs, one will generally fail.

Some failing tests can be run successfully by supplying to them a path to the appropriate type of file system with the -p option.

#### 3.43.1.5 Why does the test suite say it hasn't been validated on my dialect?

When you use the default rule of the test suite's Makefile, it may issue this complaint:

```
$ cd tests
$ make
!!!WARNING!!!
```

This dialect or its particular version may not have been validated with the lsof test suite. Consequently some tests may fail or may not even compile.

```
!!!WARNING!!!
```

You are then given the opportunity to answer 'y' to have the test suite operation continue.

This message means that the tests/TestDB file in the tests

sub-directory doesn't show that the test suite has been run with the combination of compiler flags found in tests/config.cflags. The tests might not run; they may encounter compiler failures.

See 00TEST for more information on the UNIX dialects where the test suite has been validated and on the workings of TestDB and its supporting scripts.

When the tests/Makefile "auto" rule is used, the message is more terse and the condition is fatal.

This suite has not been validated on:

<dialect\_description>

No opportunity to continue is offered.

The tests/Makefile "silent" rule will skip checking for the validation footprint.

#### 3.43.1.6

Why do the tests complain they can't stat() or open() /dev/mem or /dev/kmem?

When the tests detect that lsof for the dialect reads its information from kernel memory (i.e., the LT\_KMEM definition is present in tests/config.cflags), and when the lsof executable path is ../lsof, the tests make sure they can stat() and open() for read access the relevant kernel memory devices, /dev/kmem and possibly /dev/mem.

If those stat() or open() operations fail, the tests issue an error message and quit. The message explains why the system rejected the operation in terms of system "errno" symbols and messages. More often than not the explanation will be that the process lacks permission to access the indicated device node.

One work-around is to give the lsof executable being tested the necessary permission -- e.g., via chgrp, chmod, etc. -- and set its path in the LT\_LSOF\_PATH environment variable. (See 00TEST.)

Another work-around is to make sure the process that runs the tests has the necessary permissions -- e.g., run it as root, or enable the process login to access the resources.

For example, I can run the tests on my personal work-station because /dev/kmem and /dev/mem are readable by the "kmem" group and my login is in that group.

### 3.43.2 LTbigf test issues

#### 3.43.2.1 Why does the LTbigf test say that the dialect doesn't support large files?

Large file support is defined dialect by dialect in the lsof source files and Configure script. If large file support isn't defined there, it isn't defined in the LTbigf test.

If you think that's wrong for a particular dialect, contact me via e-mail at <abe@purdue.edu>. Make sure "lsof" appears in the "Subject:" line so my e-mail filter won't classify your letter as Spam.

#### 3.43.2.2 Why does LTbigf complain about operations on its config.LTbigf\* file?

The LTbigf must be able to write a large file test (size > 32 bits) and seek within it and the process file ulimit size must permit the operation. If the default location for the test file, tests/, isn't on a file system enabled for large file operations or if the process ulimit file block size is too small, lsof will get file operation errors, particularly when seeking

There may be a work-around. Specify the path to a file LTbigf can write in a file system enabled for large file operations a the -poption. Make sure that the ulimit file block size permits writing a large file. For example, presuming /scratch23 is large-file-enabled, and presuming you have permission to raise the ulimit file block size, this shell commands will allow the LTbigf test to run on AIX:

```
$./LTbigf -p /scratch23/abe/bigfile
```

(Note: syntax for the ulimit command varies by dialect and by shell. Discovering the proper variant is left to the reader.)

More information on this subject can be found in the LTbigf

description in the 00TEST file. Of course, the LTbigf.c source file in tests/ is the ultimate source of information,

#### 3.43.2.3

Why does LTbigf warn that lsof doesn't return file offsets?

On some dialects (e.g., Linux) lsof can't report file offsets, because the data access method underlying lsof doesn't provide them. If LTbigf knows that lsof can't report file offsets for the dialect, it issues this warning:

```
LTbigf ... WARNING!!! lsof can't return file offsets
for this dialect, so offset tests have
been disabled.
```

LTbigf then performs the size test and skips the offset tests.

For more information see 00TEST and the "Why doesn't /proc-based lsof report file offsets (positions)?" Q&A of this file.

#### 3.43.3 Why does the LTbasic test complain "ERROR!!! lsof this ..." and "ERROR!!! lsof that ..."?

The LTbasic test program uses lsof to examine a running lsof process. It looks for the lsof current working directory, executable (if possible), and kernel memory file (if applicable).

Failures to find those things result in the LTbasic error messages. More information on how LTbasic produces the error messages may be found in the LTbasic.c source file.

On HP-UX 11.11 and higher, for example, if the test's current working directory is on a loopback (LOFS) file system, LTbasic won't be able to find the current working directory of the lsof process because of a bug in the HP-UX kernel.

The solution for that HP-UX problem is to install an HP-UX patch. See the answer to the "Why doesn't PSTAT-based lsof report a CWD that is on a loopback (LOFS) file system?" question for more information on the patch.

#### 3.43.4 NFS test issues

##### 3.43.4.1 Why does the LTnfs test complain "couldn't find NFS file ..."?

The LTnfs test must work with an NFS test file. After it opens the file it asks lsof to find it on an NFS file system. If the file isn't on an NFS file system, lsof won't find it, and the NFS test script complains and fails.

The work-around is to use -p option to supply a path to a regular NFS file (not a directory) that is on an NFS file system that LTnfs can read. Presuming /share/bin/file is such a file and can be opened for reading by the LTnfs test, this sample shell command could be used to run the LTnfs test successfully:

```
$./LTnfs -p /share/bin/file
```

(If the NFS file system is enabled for large files, the NFS test will produce the error message described in the following Q&A.)

### 3.43.5 LTnlink test issues

#### 3.43.5.1 Why does the LTnlink test complain that its test file is on an NFS file system?

The LTnlink test may complain:

```
LTnlink ... WARNING!!! test file <path> is NFS mounted.
```

and then issue an explanation and a hint about using the -p option.

The LTnlist test does this because of the way NFS file links are managed when an NFS file is unlinked and the unlinking process still has the file open. Unlike with files on a local file system, when an NFS file that is still open is unlinked, its link count is not reduced.

The file name is changed to a name of the form .nfsxxxx and the link count is left unchanged until the process holding the file open closes it. That's done by NFS so it can keep proper track of the file on NFS clients and servers.

Since the link count isn't reduced when the LTnlink test program closes the NFS test file it still has open, lsof won't find it for LTnlink with a link count of zero. Consequently, LTnlink disables that test section and issues

its warning.

The warning suggests that the unlink test section can be run by giving LTnlink a path to a test file with the -p option. That path must name a file LTnlink can write and unlink. Presuming /scratch23/abe/nlinkfile is on a local file system and the LTnlink test can write to it and unlink it, this sample shell command can be used to run the complete LTnlink test successfully:

```
$ LTnlink -p /scratch23/abe/nlinkfile
```

#### 3.43.5.2 Why does LTnlink delay and report "waiting for link count update: ..."?

On some UNIX dialects and file system combinations the updating of link count after a file has been unlinked can be delayed. Consequently, lsof won't be able to report the updated link count to LTnlink for a while.

When lsof doesn't report the proper link count to LTnlink, it sleeps and repeats the lsof call, using the "waiting for link count update: ..." message as a signal that it is waiting for the expected lsof response. The wait cycle duration is limited to approximately one minute.

#### 3.43.5.3 Why does LTnlink fail because of an unlink error?

LTnlink may fail with an error similar to:

```
LTnlink ... ERROR!! unlink(<name>) failed: (Permission denied).
```

That message will be followed by a short explanation.

The error means that the kernel support for the file system on which the file <name> resides does not allow a process to unlink a file while it has the file open. (When LTnlink is run without the "-p path" option, it creates a <name> that begins with "./config.LTnlink" and ends with the LTnlink process ID number.)

An unlink failure of this type runs counter to original UNIX file system behavior, but it has been observed on some file system types, especially on the ZFS file system.

The work-around is to run LTnlink on a file system that allows

a process to unlink a file it has open. Usually /tmp has that support. So, try running LTnlink this way:

```
$./LTnlink -p /tmp/<name>
```

where <name> is a unique name in /tmp of your choosing. To be safe, create a subdirectory in /tmp, named by your login:

```
$ rm -f /tmp/<login>
$ mkdir /tmp/<login>
$./LTnlink -p /tmp/<login>/<name>
```

### 3.43.6 LTdnlc test issues

#### 3.43.6.1 Why won't the LTdnlc test run?

Lsof is unable to access the DNLC cache on AIX, because the kernel symbols for the DNLC aren't exported. Contact IBM to learn why that decision was made.

The LTdnlc test won't work on Apple Darwin because lsof can't obtain reliable DNLC information.

The LTdnlc test may fail on other dialects. Failure causes include: a busy system with a DNLC that is changing rapidly; path name components too large for the DNLC; a file system -- e.g., NFS, /tmp, loopback -- which doesn't fully participate in the DNLC; or DNLC limitations (Many DNLC implementations will only store path name components if they are 31 characters or less.)

If you suspect the file system doesn't fully participate in kernel DNLC processing, as a work-around rebuild and test lsof on one that does.

#### 3.43.6.2 What does the LTdnlc test mean by "... <path> found: 100.00%"?

Even when it succeeds the LTdnlc test will report:

```
LTdnlc ... /export/home/abe/src/lsof4/tests found: 100.00%
```

This message means that the LTdnlc test asked lsof to find the file at the indicated path five times and lsof found the full path name in the indicated percentage of calls. The LTdnlc test considers it a failure if the percentage falls below 50.0%

### 3.43.6.3 Why does the DNLC test fail?

The DNLC test may fail when some component of the lsof tests/ sub-directory can't be cached by the kernel DNLC. Some kernels have a limit on the length of individual components (typically) 32.

### 3.43.7 Why hasn't the test suite been qualified for 64 bit HP-UX 11 when lsof is compiled with gcc?

When I attempted to qualify lsof for HP-UX 11, compiled with gcc 3.0, the LTsock test failed. I traced the failure to a gcc compilation error. Because LTsock is an important test, I didn't feel that the test suite was qualified if it failed.

LTsock compiles and runs correctly on 64 bit HP-UX 11 when compiled with HP's ANSI-C.

### 3.43.8 LTzsoff test issues

#### 3.43.8.1 Why does LTzsoff warn that lsof doesn't return file offsets?

On some dialects (e.g., Linux) lsof can't report file offsets, because the data access method underlying lsof doesn't provide them. If LTzsoff knows that lsof can't report file offsets for the dialect, it issues this warning:

```
LTzsoff ... WARNING!!! lsof can't return file offsets
for this dialect, so offset tests
have
been disabled.
```

LTzsoff then performs the size test and skips the offset tests.

For more information see 00TEST and the "Why doesn't /proc-based lsof report file offsets (positions)?" Q&A of this file.

### 3.43.9 LTlock test issues

## 3.44 File descriptor list (the ``-d'' option) problems

### 3.44.1 Why does lsof reject a ``-d'' FD list?

Lsof rejects ``-d'' FD lists that contain both exclusions



and inclusions with messages like:

lsof: exclude in an include list: ^1

lsof: include in an exclude list: 2

That's because ``-d" FD lists are processed as ORed lists, so it makes no sense for them to contain both exclusions and inclusions.

I.e., if a ``-d" FD list were to contain ``^cwd,1", the ``^cwd" member is useless, because the ``1" member dominates by saying "include only FD 1". That effectively excludes ``cwd" FD.

Note that lists may have multiple members of the same type, exclude or include. They are processed as an ORed set.

If an FD isn't excluded by any member of an exclude list, it is selected. If an FD is included by any member of an include list, it is selected.

#### 3.44.2 Why are file descriptors other than those in my FD list reported?

The FD list that follows ``-d" excludes or includes file descriptors, but unless the ``-a" (AND) option is specified, the FD list selections are ORed to the other selections.

For example, the following lsof command will cause all file descriptors to be listed for the lsof command, and all but the cwd descriptor for all other commands, probably not what was intended.

```
$ lsof -clsof -d^cwd
```

Hint: use ``-a" -- e.g.,

```
$ lsof -clsof -a -d^cwd
```

#### 3.45 How can I supply device numbers for inaccessible NFS file systems?

When lsof can't get device numbers for inaccessible NFS file systems via stat(2) or lstat(2), it attempts to get them from the mount table's dev=xxx options. Successes are reported with a warning message that indicates the source of the device number

and that output might be incomplete as a consequence of the warnings.

Some system mount tables -- e.g., Linux /proc/mounts -- don't have a dev=xxx option. In that case, and provided lsof for the dialect supports them, you can use the +m option to create a mount table supplement file and the "+m m" option to use it.

First check the lsof -h (help) output to see if the +m and "+m m" options are supported. If they are, use +m to create a mount table supplement file when all mounted file systems are accessible. Use "+m m" later to make the supplement available when some mounted file systems might not be available.

Here's an example that creates a mount supplement file in \$HOME/mnt-sup and later makes it available to lsof.

```
$ rm -f $HOME/mnt-sup
$ lsof +m > $HOME/mnt-sup
...
$ lsof +m $HOME/mnt-sup <other lsof options>
```

If lsof has to get the device number from the supplement, it will issue an informative warning message. The warning can be suppressed with lsof's -w option.

Caution! Since the mount table supplement file is static, it is its supplier's responsibility to update it as file system mounts change.

For more information, consult the lsof man page. The "ALTERNATE DEVICE NUMBERS" section has useful information on how lsof acquires device numbers when stat(2) or lstat(2) fail.

### 3.46 Why won't lsof find open files on over-mounted file systems?

When a file system, /xyz for example, is mounted on the same mount point as another file system, /abc for example, running lsof with an argument of the path of the first file system's mount point -- the over-mounted one, /abc -- probably will not reveal any files open on /abc.

That's because lsof looks for open files on a file system by looking for files with the file system's device number. The two file systems usually have different device numbers and lsof determines the device number search key from the supplied name

of the second file system.

A general

work-around exists only for Linux. On that UNIX dialect, when you know the over-mounted file system's mount point path, you can ask lsof to report on all open files and grep that output for the path of the over-mounted file system mount point.

### 3.47 What can be done when lsof reports no more space?

Many lsof methods cache information in memory, using the dialects malloc() library function. When malloc() can't allocate the requested amount of memory, lsof exits with warning messages similar to this AIX message:

```
lsof: no more dev-ch space at pid 2257750: 0x82a8e600
```

Lsof then exits immediately and produces no more output.

A possible work-around is to increase the memory foot print of the shell that runs lsof. That is often done with the ulimit(1) shell command.

### 3.48 What if the lsof build encounters ar and ld problems?

The lsof main and library Makefiles use the library archiver, ar, and the system loader, ld, applications. Improperly located, installed or configured versions of them may cause the lsof build to encounter errors with them.

The application producing the error should identify itself in its error messages.

The first thing to check the path of the application that is being used. Try ``which ar`` or ``which ld`` to see if perhaps the PATH used during the build might be causing the wrong archiver or loader to be used.

If the problem is with the use of the wrong archiver, and it's not possible to correct the PATH to it, try using the LSOF\_AR environment variable to specify the path to and arguments for the correct archiver. See 00XCONFIG for more information and note that LSOF\_AR must specify the path to the archive application and the arguments for it, less the terminating library and module name arguments.

If the problem is with the loader, there is no lsof work-around. That's because lsof calls the loader via the C compiler, so the problem must be fixed at the compiler (system) level.

## 4.0 AIX Problems

### 4.1 What

is the Stale Segment ID bug and why is -X needed?

Kevin Ruderman reports that he has been informed by IBM that processes using the AIX 3.2.x, 4.1[.12345], 4.2[.1], and 4.3.x kernel's readx() function can cause other AIX processes to hang because of what appears to be file system corruption.

This failure, known as the Stale Segment ID bug, is caused by an error in the AIX kernel's journaled segment memory handler that causes the kernel's dir\_search() function erroneously to believe directory entries contain zeroes. The process using the readx() call need not be doing anything wrong. Usually the system must be under such heavy load that the segment ID being used in the readx() call has been freed and then reallocated to another process since it was obtained from kernel memory.

Lsof uses the readx() function to access library entry structures, based on the segment ID it finds in the proc structure of a process. Since IBM probably will never fix the kernel bug, I've added an AIX-specific option to lsof that controls its use of the readx() function.

By default lsof readx() use is disabled; specifying the ``-X" option enables readx() use.

If you want to change the default readx() behavior of AIX lsof, change the HASXOPT, HASXOPT\_ROOT, and HASXOPT\_VALUE definitions in dialects/aix/machine.h. You can also use these definitions to enable or disable readx() -- consult the comments in machine.h. You may want to disable readx() use permanently if you plan to make lsof publicly executable.

When HASXOPT\_ROOT is defined, lsof will restrict use of the -X option to processes whose real UID is root; if HASXOPT\_ROOT isn't defined, any user may specify the -X option. The Customize script offers the option to change

HASXOPT\_ROOT when HASXOPT is defined and HASXOPT\_ROOT is named in any dialect's machine.h header file.

I have never seen lsof cause a problem with its use of readx(), but I believe there is some chance it could, given the right circumstances.

#### 4.1.1 Stale Segment ID APAR

Here are the details of the Stale Segment ID bug and IBM's response, provided by Kevin Ruderman.

##### AIX V3

APAR=ix49183

user process hangs forever in kernel due to file system corruption

STAT=closed prs TID=tx2527 ISEV=2 SEV=2

(A "closed prs" is one closed with a Permanent Restriction.)

RCOMP=575603001 aix v3 for rs/6 RREL=r320

##### AIX V4 (internal defect, no apar #)

prefix p

name 175671

abstract KERMP: loop for ever in dir\_search()

##### Problem description:

1. Some user application -- e.g., lsof -- gets the segment ID (SID) for the process private segment of a target process from the process table.
2. The target process exits, deleting the process private segment.
3. The SID is reallocated for use as a persistent segment.
4. The user application runs again and tries to read the user area structure from /dev/mem, using the SID it read from the process table.
5. The loads done by the driver for /dev/mem cause faults in the directory; new blocks are allocated; the size changed; and zero pages created.
6. The next application that looks for a file in the affected

directory hangs in the kernel's `dir_search()` function because of the zero pages. This occurs because the kernel's `dir_search()` function loops through the variable length entries one at a time, moving from one to the next by adding the length of the current entry to its address to get the address of the next entry. This process should end when the current pointer passes the end of the known directory length.

However, while the directory length has increased, the entry length data has not, so when `dir_search()` reaches the zero pages, it loops forever, adding a length of zero to the current pointer, never passing the end of the directory length. The application process is hung; it can't be killed or stopped.

IBM closed the problem with a PRS code (Permanent Restriction) under AIX Version 3 and had targeted a fix for AIX 4.2. They have recently (I became aware of it September 10, 1996) cancelled the defect report altogether and have indicated they are not going to fix the defect.

#### 4.2 Gcc Work-around for AIX 4.1x

When gcc is used to compile `lsof` for AIX 4.1x, it doesn't align one element of the user structure correctly. `Xlc` sees the `U_irss` element as a type "long long" and aligns it on an 8 byte boundary. That's because the default mode of `xlc` is `-qlonglong`; when `-qlonglong` is enabled, the `_LONG_LONG` symbol is also defined.

Gcc sees `U_irss` as a two element array of type long, because `_LONG_LONG` isn't defined. Hence gcc aligns the `U_irss` element array on a 4 byte boundary, rather than an 8 byte one, making the gcc incantation of the user structure 4 bytes shorter than `xlc`'s.

When the length of gcc's user structure is supplied as argument 4 to the undocumented `getuser()` function of the AIX kernel, `getuser()` rejects it as an incorrect size and returns `EINVAL`.

`Lsof` has a work-around for this problem. It involves a special test in the `Configure` script when the "aixgcc" `Configure` abbreviation is used -- e.g.,

\$ Configure -n aixgcc

The test is to compile a small program with gcc and check the alignment of U\_irss. If it's not aligned on an 8 byte boundary, the Configure script makes a special copy of <sys/user.h> in ./dialects/aix/aix<AIX\_version> whose U\_irss will align properly, and generates compile time options to use it.

While I have tested this work-around only with 4.1.4, it should work with earlier versions of AIX 4.1. It does not work for AIX 4.2; a different work-around is employed there. (See the next section.)

If you want to use this technique to compile other AIX 4.1x programs with gcc for using getuser(), check the Configure script.

Stuart D. Gathman identified this gcc AIX alignment problem.

#### 4.3 Gcc and AIX 4.2[.1]

Alignment problems with gcc and AIX 4.2[.1] inside the user structure are more severe, because there are some new 64 bit types in AIX that gcc doesn't yet (as of 2.7.x) support. The <sys/user.h> U\_irss element problem, discussed in 4.3 above, doesn't exist in 4.2[.1].

The AIX lsof machine.h header file has a work-around, provided by Henry Grebler, that bypasses gcc alignment problems. Later versions of gcc (e.g., 2.8.x) will probably bypass the problems as well.

#### 4.4 Why won't lsof's Configure allow the use of gcc for AIX below 4.1?

Gcc can't reliably be used to compile lsof for AIX versions below AIX 4.1 because of possible kernel structure element alignment differences between it and xlc.

#### 4.5 What is an AIX SMT file type?

When you run AIX X clients with the DISPLAY environment variable set to ``:0.0" they communicate with the AIX X server via files whose kernel file structure has an undefined type (f\_type == 0xf) -- at least there's no

definition for  
it in <sys/file.h>.

These are Shared Memory Transport (SMT) sockets, an artifact of AIXWindows, designed for more efficient data transfers between the X server and its clients.

Henry Grebler and David J. Wilson alerted me to the existence of these files. Mike Feldman and others helped me identify them as SMT sockets.

The curious reader can find more about SMT sockets in  
/usr/lpp/X11/README.SMT.

#### 4.6 Why does AIX lsof start so slowly?

When AIX lsof starts it compares the running kernel's identity to the one for which it was built, using /usr/bin/oslevel. That comparison can sometimes take a long time to complete, depending on the system's maintenance level and how recently it was examined with oslevel.

AIX revisions 4.67 and above for AIX 5 and above don't use oslevel to determine the kernel identity. They use uname(2) instead, and it is much faster.

You can skip the oslevel test by suppressing warning messages with lsof's -w option. Doing that carries with it the risk of missing other warning messages, however.

You can also disable the kernel identity check by disabling the definition of the HASKERNIDCK symbol by editing AIX machine.h header file or by using the Customize script to disable it.

See the "Why does lsof warn "compiled for x ... y; this is z.?" section for more information.

#### 4.7 Why does exec complain it can't find libc.a[shr.o]?

When you try to execute lsof you may get this complaint:

```
exec(): 0509-036 Cannot load program ./lsof because of
the following errors:
0509-022 Cannot load library libc.a[shr.o].
0509-026 System error: A file or directory in
the path name does not exist.
```



This is probably the result of making lsof when the LIBPATH environment variable contained a directory path that doesn't contain libc.a. You can see what LIBPATH contained when lsof was made by using the dump application on lsof. For example, if LIBPATH contained /foo/bar when lsof was made, you will see this (partial) dump output:

```
$ dump -H lsof
...
Import File Strings
INDEX PATH BASE ...
0 /foo/bar
```

To correct the problem, revisit the lsof source directory and remake lsof this way:

```
$ unset LIBPATH; make (sh or ksh)
or
% unsetenv LIBPATH; make (csh or tcsh)
```

4.8 What does lsof mean when it says, "no PCB, CANTSENDMORE, CANTRCVMORE" in a socket file's NAME column?

When an AIX application calls shutdown(2) on an open socket file, but hasn't called close(2) on the file, the file will remain visible to lsof as an open socket file without any extended protocol information.

Lsof reports that state in the NAME column by saying that there is "no PCB" (Protocol Control Block) for the protocol (e.g., TCP in the NODE column). If the open socket file has the state variables SO\_CANTSENDMORE and SO\_CANTRCVMORE set -- i.e., from the shutdown(2) call -- lsof reports them with the CANTSENDMORE and CANTRCVMORE notes in the NAME column.

4.9 When the -X option is used on AIX 4.3.3, why does lsof disable it, saying "WARNING: user struct mismatch; -X option disabled?"

The -X option causes lsof to read the loader information of the user structure from virtual memory via the readx() system call. It does that with the user structure definition from <sys/user.h> that was compiled into the lsof executable.

On AIX 4.3.3 there are two different user structure

definitions in two separate <sys/user.h> header files, distributed at different times by IBM. If lsof was compiled with one and the kernel on which lsof is being run was compiled with the other, lsof normally won't get correct loader information when it calls readx().

In an attempt to compensate for that difference, lsof makes an independent check of the loader information by getting the user structure's open file count via readx() and comparing it to the open file count obtained independently via getprocs().

When the two counts don't match, lsof tries to read the count (and re-read the loader information) with two offsets, based on observed differences between the two user structures.

When one of the three attempts produces a correct open file count, lsof uses its corresponding offset on subsequent readings of the loader information.

When none of the three attempts produces a correct open file count, lsof issues the WARNING message and disables -X processing.

To eliminate this problem, obtain an lsof binary that matches the kernel of the AIX 4.3.3 system where you want to run lsof. Compiling lsof on the target system is the preferred way to get a matching binary.

#### 4.10 Why doesn't the -X option work on my AIX 5L or 5.[123] system?

If your AIX 5L or 5.[123] system uses the ia64 architecture, lsof needs setuid-root permission to be able to do the processing that -X requires.

Check the output of `uname -a` to determine the architecture type.

The work-around is to give lsof setuid-root permission.

#### 4.11 Why doesn't /usr/bin/oslevel report the correct AIX version?

The oslevel man page says, "The oslevel command reports the level of the operating system using a subset of all filesets installed on your system."

You can see which fileset is below the expected level with

oslevel's -l option. For example, if you believe your system is at AIX level 4.3.3, but oslevel reports 4.3.2, use this oslevel command to find the filesets below 4.3.3:

```
$ /usr/bin/oslevel -l 4.3.3.0
```

If you don't know what level argument to supply to oslevel's -l option, use oslevel's -q option first.

#### 4.11.1 Why doesn't /usr/bin/oslevel report the correct AIX version on AIX 5.1?

The subset list for oslevel on AIX 5.1 seems to include at least two filesets, xlsmp.msg.en\_US.rte and xlsmp.rte, that do not install from AIX 5.1 media with a 5.1.0.0 level. Hence, oslevel reports 5.0.0.0 instead of the expected 5.1.0.0.

If either xlsmp.msg.en\_US.rte or xlsmp.rte is installed, lsof's Configure script and run-time tests will identify the AIX version incorrectly. The run-time test will issue a complaint message of this form:

```
lsof: WARNING: compiled for AIX version xxx; this is yyy.
```

You can correct the Configure test by pre-defining the oslevel value, setting the correct value in the LSOF\_VSTR environment variable before running the Configure script -- e.g., to pre-define AIX 5.1 when using ksh, do this:

```
$ LSOF_VSTR=5.1.0.0 Configure -n aix
```

You can't affect oslevel output without uninstalling xlsmp.msg.en\_US.rte and xlsmp.rte. If you can't do that, you'll have to put up with the run-time complaint.

#### 4.12 Why does lsof for AIX 5.1 or above Power architecture complain about kernel bit size?

When you run an lsof binary on an AIX 5.1 or above Power system, it might complain:

```
lsof: FATAL: compiled for a 32 bit kernel.
The bit size of this kernel is 64.
```

or

```
exec: 0509-036 Cannot load program ./lsof
```

because of  
the following errors:  
0509-032 Cannot run a 64-bit program on a 32-bit  
machine.

Starting at lsof revision 4.61, lsof binaries for Power  
architecture systems running AIX 5.1 or above are closely  
tied to the kernel bit size. Lsof must do that so it can  
read and understand kernel structures.

Lsof's Configure script tunes the lsof configuration so  
that the binary built in the make(1) step is adjusted to  
the kernel bit size.

An lsof binary knows the bit size for which it was constructed,  
tests the bit size of the kernel under which it is running,  
and objects if the two sizes don't match. To see the bit  
size for which lsof was constructed, run it with its -v  
option and look for these lines in the output:

```
configuration info: 32 bit kernel
or
configuration info: 64 bit kernel
```

(Note: these lines will appear only in -v output for AIX  
5.1 and above lsof binaries, built for Power architecture.)

You can see the kernel bit size  
test method in the aix  
stanza of the lsof Configure script and in the get\_kernel\_access()  
function of the lsof ../dialects/aix/dproc.c source file.

There is more information on pre-defining the kernel bit  
size when building lsof in Configure, 00PORTING, and  
00XCONFIG.

The only work-around is to use an lsof binary built to  
match the running kernel bit size.

#### 4.13 What can't gcc be used to compile lsof on the ia64 architecture for AIX 5 and above?

Gcc can't be used to compile lsof on the ia64 architecture  
for AIX 5 and above because I haven't had access to a system  
that has a working gcc compiler. The gcc compiler on my  
one and only ia64 AIX 5.1 test system, provided by IBM,  
didn't work at all.

4.14 Why does lsof get a segmentation fault when compiled with gcc for a 64 bit Power architecture AIX 5.1 kernel?

When lsof is configured with the lsof "aixgcc" Configure abbreviation, the resulting lsof executable may cause a segmentation violation when it is run. I've observed this with gcc version 2.9-aix43-010414-7.

As far as I have been able to tell, the segmentation fault is the result of a gcc compilation, loading, or library error. Watching lsof run with gcc's companion debugger, gdb, shows no error in the lsof source code that might explain the fault.

The only work-around I know is to use the IBM C compiler in place of gcc -- i.e., use the "aix" lsof Configure abbreviation.

4.15 Why does lsof ignore AFS on my AIX system?

The lsof Configure script quits on AIX when AFS is present, the AIX version is greater than 4.3.3.0 or the AFS version is greater than 3.5. That's because I have no test systems available for those AIX and AFS version combinations.

When the lsof Configure script detects an AIX and AFS version combination that is unsupported, it will report:

```
!!!FATAL: Lsof does not support AFS on this combination of
AIX and AFS versions. To disable AFS, set the
value of the AIX_HAS_AFS environment variable
to
"no".
```

The only work-around is to set the AIX\_HAS\_AFS environment variable as explained in the error message:

```
$ AIX_HAS_AFS=no; export AIX_HAS_AFS
$./Configure -n aix
```

4.16 Why does lsof report "system paging space is low" and exit?

When AIX paging space runs low, the AIX kernel sends a SIGDANGER signal to processes, warning them that they should reduce their memory usage.

When lsof receives that signal, it issues the following fatal

error message and exits:

lsof: FATAL: system paging space is low.

A possible work-around is to limit the amount of information lsof must cache in its process memory with the "-c", "-g", "-l" and "-p" options.

Also see the answer to the "What can be done when lsof reports no more space?" question.

#### 4.17 Why does lsof have a compilation problem on AIX 5.3 above maintenance level 1?

On some AIX 5.3 systems with maintenance levels 2 and higher installed, lsof 4.77 and below may not compile properly. The compiler complains the snapshotObject structure definition, needed by <j2/j2\_inode.h>, is missing.

That problem is fixed in the 4.78 revision.

### 5.0 Apple Darwin Problems

#### 5.1 What do /dev/kmem-based and libproc-based mean?

Lsof for Apple Darwin currently uses /dev/kmem to read kernel data structures from which it gathers and reports open file information. That version of lsof is called /dev/kmem-based lsof.

At an upcoming release lsof will use a library called libproc to obtain information about open files. That version of lsof will be called libproc-based lsof.

The /dev/kmem-based lsof sources may be found in the kmem subdirectory of the dialects/darwin branch of the lsof source tree. When the supporting version of Apple Darwin is released, the libproc-based lsof sources will be found in .../dialects/darwin/libproc.

#### 5.2 /dev/kmem-based Apple Darwin Questions

##### 5.2.1 Why does Configure ask for a path to the Darwin XNU kernel header files?

When lsof was ported to Apple

Darwin by Allan Nathanson at revision 4.53, some kernel header files needed by lsof weren't being exported by the developers. (That's still true at lsof revision 4.76.)

At first a shell script that Allan provided would get the missing header files by checking them out from the CVS root. Although the script was updated from time to time, eventually the re-organization of Darwin sources has made it impossible to update the script to do an automatic download of the missing header files.

At lsof revision 4.69 and above it is necessary for the Darwin lsof builder to download the Darwin XNU kernel headers before attempting to build lsof. The download may be done via a web browser, starting at this URL:

<http://www.opensource.apple.com/darwinsource/index.html>

Once there, select the link to the Mac OS X version that matches the one on the system where lsof is to be built.

Follow that link's "[ Source ]" link. Once there, select the tar.gz link of the xnu\* entry near the bottom of the page.

That entry should have a name that matches the xnu\* name shown by ``uname -a`` -- e.g., if `uname` reports:

```
$ uname -a
... root:xnu/xnu-517.7.21 ...
```

Then the appropriate xnu\* entry is xnu-517.7.21. Clicking its link should lead to an "Apple Open Source" page requesting an Apple ID and password.

Enter them if they're available. If an Apple ID and password are not available, get them by following the instructions on the page -- i.e., follow the [signin.apple.com](http://signin.apple.com) link.

Once a valid Apple ID and its password have been entered, the download will begin. Select the saving of the downloaded xnu\*.tar.gz file in an appropriate place on the Mac OS X system.

Once the download completes, install it. Use `gunzip` to decompress the download and `tar` to extract the archive -- e.g.,

```
$ gunzip -c xnu-517.7.21.tar.gz | tar xf -
```

Remember the absolute path to the extracted archive. That is its installed place. E.g., if the xnu-517.7.21.tar archive was extracted to the lsof builder's home directory, its full installation path will be something like:

```
~/xnu-517.7.21
```

Now run the lsof Configure script. When it asks for the path to the installed Darwin XNU kernel header files, supply the path to the gunzip'd and extracted xnu\* archive -- e.g.,  
~/xnu-517.7.21.

The path to the Darwin XNU kernel headers may also be supplied to the Configure script in the DARWIN\_XNUDIR environment variable, eliminating the need to enter it interactively -- e.g.,

```
$ DARWIN_XNUDIR=~/xnu-344.49 ./Configure -n darwin
```

#### 5.2.1.1 Why does Configure complain that Darwin XNU kernel header files are missing?

These are some reasons why the lsof Configure script might claim that Darwin XNU header files are missing:

- \* The wrong path to them was specified.
- \* The files and directories in the path are not readable and searchable -- i.e., check the modes and ownerships.
- \* The downloaded archive doesn't match the Mac OS X version of the system.

If in doubt, revisit the Darwin XNU kernel header file download instructions in the answer to the question "Why does Configure ask for a path to the Darwin XNU kernel header files?"

If Configure still can't find Darwin XNU kernel header files, contact me via e-mail at <abe@purdue.edu> for help. Make sure "lsof" appears in the "Subject:" line so my e-mail filter won't classify your letter as Spam.

#### 5.2.2 Why doesn't Apple Darwin lsof report text file information?



At the first port of lsof to Apple Darwin, revision 4.53, insufficient information was available -- logic and header files -- to permit the installation of VM space scanning for text files. As of lsof 4.70 it is still not available.

Text file support will be added to Apple Darwin lsof after the necessary information becomes available.

### 5.2.3 Why doesn't Apple Darwin lsof support IPv6?

At the first port of lsof to Apple Darwin, revision 4.53, Apple Darwin lacked IPv6 support.

IPv6 became available in Apple Darwin version 1.5 and support for it was added to lsof then.

### 5.2.4 Why does lsof complain about a mismatch between the release for which lsof was compiled and the booted Mac OS X release?

When lsof is started on the "Gold Master" Darwin release (aka Mac OS X), it complains:

lsof: compiled for 1.0 release; this is 1.3.2.

This happens because the lsof binary released with Mac OS X was built on a system whose release number (1.0) doesn't match that of the released system -- usually 1.3.x. Lsof makes this check because UNIX dialect OS changes are often accompanied by header file changes that affect lsof.

In this specific case, this error can be ignored. If you don't want to do that, get the lsof distribution and build lsof so its built-on and running-on Mac OS X release numbers match.

### 5.2.5 Why does lsof for Apple Darwin 8 and higher report "stat(...): ..." in the NAME column?

Lsof for Apple Darwin 8 may report messages like these in the NAME column:

stat(/private/var/run/asl\_prune): No such file or directory  
or  
stat(/private/var/db/netinfo/local.nidb/Config): Permission denied

Those messages indicate that lsof was unable to collect open file information for the paths enclosed in "stat(...)" with the

stat(2) function, because the function encountered the reported error.

A work-around for the "Permission denied" error is to run lsof with elevated privileges -- e.g., when logged on as the super user.

If the stat(2) error message is "No such file or directory", the file probably has been unlinked (removed) and there is no lsof work-around.

#### 5.2.6 What are the limitations of Apple Darwin lsof link count reporting?

Lsof for Apple Darwin cannot report link count information reliably.

For Apple Darwin below 8 link count information is not always available in the kernel node structures available to lsof.

When link count information is available, however, it includes link counts

of zero. Thus, using lsof's +L1 option may result in the finding of some files whose link counts are zero.

Lsof can report only some link count information for Apple Darwin 8 and above. Link count information is only available for files where lsof can assemble the full file path and has permission to apply stat(2) to it. (See the answer to the "Why does lsof for Apple Darwin 8 and higher report "stat(...): ..." in the NAME column?" question for more information on stat(2) failures.)

Apple Darwin 8 and above files that have been unlinked and thus have a link count of zero cannot be found by stat(2) -- i.e., stat(2) returns a "No such file or directory" error. As a result lsof never displays link counts of zero and the use of lsof's +L1 option to find them always fails.

#### 5.3 Libproc-based Apple Darwin Questions

#### 6.0 BSD/OS BSDI Problems

##### 6.0.5 Statement of deprecation

As of lsof revision 4.76 support for BSDI BSD/OS has been dropped. The 4.76 distribution of lsof

for BSDI BSD/OS may be  
found on [lsof.itap.purdue.edu](http://lsof.itap.purdue.edu) in `pub/tools/unix/lsof/OLD/src`.

## 7.0 DEC OSF/1, Digital UNIX, and Tru64 UNIX Problems

### 7.1 Why does lsof complain about non-existent /dev/fd entries?

When you run lsof for Digital UNIX 3.2, lsof may complain:

```
lsof: can't lstat /dev/fd/xxx: No such file or directory
lsof: can't lstat /dev/fd/yyy: No such file or directory
```

(Or it may warn about other missing /dev/fd paths.) When you do an `ls /dev/fd` none of the missing paths are listed.

This is caused by a bug in the DEC library function `getdirentries()`. For some reason, when /dev/fd is a file system mount point, `getdirentries()` returns an incorrect size for it to `readdir()`. (Lsof calls `readdir()` in its `ddev.c readdev()` function.) Because of the incorrect size, `readdir()` goes past the end of the /dev/fd directory buffer, encounters random paths and returns them to lsof. Lsof then attempts to `lstat(2)` the random paths, gets error replies from `lstat(2)`, and complains about the paths.

Duncan McEwan discovered this error and has reported it to DEC. Duncan also supplied an alternate `readdir()` function as a work-around. I've incorporated his `readdir()` in `dialects/osf/ddev.c` (as the static `ReadDir()` function) with some slight modifications, and enabled its use when the `USELOCALREADDIR` symbol is defined.

The Configure script defines `USELOCALREADDIR` for Digital UNIX version 3.2. If you don't want to use Duncan's local `readdir()` function, edit the Makefile and remove `-DUSELOCALREADDIR` from the `CFGF` string. When DEC releases a corrected `getdirentries()` function, I'll modify the Configure script to stop defining `USELOCALREADDIR`.

### 7.2 Why does the Digital UNIX V3.2 ld complain about Ots\* symbols?

When you compile lsof on your Digital UNIX V3.2 system, ld may complain:

```
ld:
Unresolved:
```

```
knlist
_OtsRemainder32Unsigned
_OtsDivide64Unsigned
_OtsRemainder64Unsigned
_OtsDivide32Unsigned

_OtsMove
_OtsDivide32
_OtsRemainder32
*** Exit 1
```

Chris Eleveld reports this happens on Digital UNIX V3.2 systems after the Fortran compiler has been installed.

The best work-around seems to be to remove -lmld from the CFGL string in the Makefile produced by Configure -- i.e., change:

```
CFGL= -lmld
to
CFGL=
```

According to the V3.2 man page for nlist(3), this shouldn't work, but my testing shows that it does. Although I haven't been able to test this second work-around, you might try adding -lots to CFGL, rather than removing -lmld -- i.e., change:

```
CFGL= -lmld
to
CFGL= -lmld -lots
```

WARNING: my testing also shows that the V2.0 nlist(3) man page means what it says when it calls for -lmld -- lsof loaded without -mld under V2.0 can't locate the proc (process) table address.

**DON'T REMOVE -lmld FROM THE DIGITAL UNIX V2.0 MAKEFILE.**

If you run into this problem, please let me know what problem you encountered and how you solved it.

### 7.3 Why can't lsof locate named pipes (FIFOs) under V3.2?

While lsof for V3.2 can report on named pipes (FIFOs), it can't find them by name. That appears to happen because of the way the V3.2 kernel lstat(2) function reports named

pipe device numbers.

The V3.2 kernel reports the device number as 0xffffffff, while the kernel structures for named pipes that lsof examines contain the device number of the file system on which the named pipe resides.

Consequently, lsof can't match the device and inode number pair it receives from applying lstat(2) to the named pipe with any device and inode number pair it finds when scanning kernel structures.

I don't have a work-around. You can, of course, ask for full lsof output and use a post-processing filter (e.g., grep) to locate the named pipe of interest.

This problem doesn't exist under V2.0.

#### 7.4 Why does lsof use the wrong configuration header files?

For example, why can't the lsof compilation find cpus.h?

DEC

OSF/1, Digital UNIX, and Tru64 UNIX configuration header files describe the hardware and software environment for which your kernel boot file was constructed. For example, /sys/<name>/cpus.h defines the number of CPUs in its NCPUS #define.

Lsof searches for the configuration header file subdirectory in /sys (/usr/sys for Digital UNIX version 4.0 and Tru64 UNIX) by converting the first host name component to capital letters -- e.g., TOMIS is derived from tomis.bio.purdue.edu. If that subdirectory exists, lsof uses header files from it. (Configure reports what subdirectory is being used.)

If Configure doesn't find a host-name derived subdirectory, it prompts you for the entry of a subdirectory name. If you can't find one, quit Configure and run the kernel generation process to create a proper configuration subdirectory. If you don't identify a proper configuration subdirectory and you try to compile lsof, the compiler will complain about missing header files -- e.g., a missing cpus.h.

Once you have located or generated a proper configuration subdirectory, rerun Configure. If you have generated a configuration subdirectory whose name is derived from the

host name, Configure will find and use it. If not, you will have to specify its name to Configure.

#### 7.5 Why does lsof indicate incomplete paths with " -- " for Tru64 UNIX 5.1 files?

When lsof can't find a component of a path in the kernel's name cache (aka DNLC), or can't determine that the left-most component has as its parent the file system root, it uses an "incomplete path" notation. That notation begins with the file system root name, followed by " -- ", followed by the consecutive path name components lsof was able to find in the DNLC -- e.g., `"/ -- init"`.

Because the DNLC was significantly redesigned in Tru64 UNIX 5.1, lsof's handling of the cache had to be completely redone. As part of the DNLC redesign a name cache entry parameter lsof formerly used to locate the file system root of a path was removed. With help from Chang Song I've been able to implement an alternate method for detecting the root of these file system types: AdvFS (MSFS), CDFS, DVDFS, FDFS, NFS, NFS3, and UFS.

When lsof doesn't know how to identify the root for a file system type, it will resort to the " -- " incomplete path notation.

#### 7.6 Why doesn't lsof report link count, node number, and size for some Tru64 5.x CFS files?

Lsof reports link count, node number, and size for open CFS files as recorded in their kernel node structure's cached attributes. Sometimes not all attributes are cached on the system where lsof runs, so lsof cannot report them.

#### 7.7 Why does lsof say it can't read the kernel name list or proc table on Digital UNIX 4.x or Tru64 UNIX?

By default on Digital UNIX 4 and Tru64 UNIX lsof reads the addresses for kernel symbols with the `knlist(3)` function. That function can fail, for example, when the `kloadsrv` daemon isn't running or is malfunctioning. When that happens, lsof may abort with one of these error messages:

lsof: can't read kernel name list from `knlist(3)`: ...  
or

lsof: can't read proc table info

The first message suggests a complete knlist(3) or kloadsv failure; the second, a partial one.

If you know the name of the file from which the running system was booted, e.g., /vmunix, you can use lsof's -k option to direct it to read kernel symbol addresses from the name list of that file --

```
$ lsof -k /vmunix ...
```

If that works, then knlist(3) is malfunctioning and you need to fix it.

## 8.0 FreeBSD Problems

### 8.1 Why doesn't lsof report on open kernfs files?

Lsof doesn't report on open FreeBSD kernfs files because the structures lsof needs aren't defined in the kernfs.h header file in /sys/misc/kernfs.

### 8.2 Why doesn't lsof work on my FreeBSD system?

If lsof doesn't work on your FreeBSD system, first make sure you have the latest lsof revision. See the answer to the "Where do I get lsof?" question for information on how to get the latest lsof revision.

Once you have gotten the latest lsof revision, Configure and make it. If Configure fails -- e.g., it complains about an unknown FreeBSD version -- then lsof probably hasn't been ported to your FreeBSD version yet, and there's no need to go any further. Follow the answer to the "How do I report an lsof bug" to report the Configure complaint to me.

If you are able to Configure and make lsof, run its test suite. (See the answer to the "Is there a test suite?" question for more information on how to use lsof's test suite.)

If lsof still fails, make sure your kernel sources, kernel header files, kernel boot file, standard header files and libraries are synchronized. They should all be built from the

same CVS refresh. (Don't forget to do a "make buildworld" followed by a "make installworld".) If they aren't, then the KVM library or lsof may be using kernel structure definitions that don't match the booted kernel; or lsof may fail to compile properly because of header files in /usr/src/sys/sys and /usr/include/sys that don't match.

If you have synchronized your kernel, header files and libraries, and still can't get lsof to work, follow the steps in the answer to the "How do I report an lsof bug" question to report the problem to me.

### 8.3 Why doesn't lsof work on the RELEASE version of CURRENT?

Lsof tracks the CURRENT release of the current leading edge FreeBSD version, because my access to leading edge FreeBSD is limited to FreeBSD.org reference systems, all running the CURRENT release.

Sometimes that tracking leads to changes in lsof that won't work on an earlier RELEASE version of the current leading edge version.

When that happens, please send e-mail to me <abe@purdue.edu>. Make sure "lsof" appears in the "Subject:" line so my e-mail filter won't classify your letter as Spam.

### 8.4 Why does kvm\_open() complain it can't find some file?

If lsof issues this complaint:

```
lsof: kvm_open(execfile=/boot/kernel/kernel,
corefile=/dev/mem: No such file or directory
```

Your FreeBSD system might not have a /dev/mem device. If not, create one -- e.g., as root do:

```
mknod /dev/mem c <major> 0
chmod 440 /dev/mem
chgrp kmem /dev/mem
```

For <major> use /dev/kmem's major device number.

You may have to run kldload, too -- again as root do:

```
kldload mem
```



## 8.5 FreeBSD ZFS Problems

### 8.5.1 Why does FreeBSD lsof report "WARNING: no ZFS support has been defined."?

Lsof issues that message when it detects a file on a ZFS file system, but has not been built with support for ZFS. Lsof's Configure script detects support can be added for ZFS when it finds this file:

```
/usr/src/sys/contrib/opensolaris/uts/common/fs/zfs/sys/zfs_znode.h
```

That header file and others in the OpenSolaris files in /usr/src enable lsof to extract information about ZFS files from the kernel structures associated with them.

## 8.6 Why

can't Configure create lsof\_owner.h for FreeBSD 6 and above?

Lsof may report:

```
Creating ./lockf_owner.h from /usr/src/sys/kern/kern_lockf.c
FATAL ERROR: can't read /usr/src/sys/kern/kern_lockf.c
FATAL ERROR: ./lockf_owner.h creation failed (see 00FAQ)
or
Creating ./lockf_owner.h from /usr/src/sys/kern/kern_lockf.c
FATAL ERROR: ./lockf_owner.h creation failed (see 00FAQ)
```

Those messages mean that lsof's Configure script failed to create a local header file, ./lockf\_owner.h, needed to use the new kernel file locking code of some versions of FreeBSD 6 and above.

The changes that implement that new locking code alter the lockf structure in <sys/lockf.h> and introduce a new structure, lockf\_entry, to that header file. When Configure detects the presence of the lockf\_entry definition in <sys/lockf.h>, it tries to construct the local header file, ./lockf\_owner.h.

Configure has to do that because an unfortunate side effect of the new kernel file locking code is that <sys/lockf.h> doesn't contain the lockf\_owner structure definition referenced in its own lockf structure. Lsof needs to access elements of that lockf\_owner structure to determine if a lock belongs to the process that has a file open.

The missing `lockf_owner` structure definition is in the kernel source file, typically `/usr/src/sys/kern/kern_lockf.c`.  
Configure tries to extract the `lockf_owner` structure definition from `kern_lockf.c` into lsof's local header file, `./lockf_owner.h`.  
If Configure can't do that, it reports:

```
FATAL ERROR: ./lockf_owner.h creation failed
```

If Configure can't even read `kern_lockf.c`, it first reports:

```
FATAL ERROR: can't read /usr/src/sys/kern/kern_lockf.c
```

The work-around for this problem is to update the FreeBSD kernel `/usr/src` tree (e.g., do a CVSup or csup) on the system where lsof is to be built and then do a "make buildworld" followed by a "make installworld".

#### 8.6.1 Why are there lockf structure compiler errors for FreeBSD 6.0 and higher lsof?

If, when compiling lsof, the compiler complains with error messages like:

```
dnode.c: In function 'get_lock_state':
dnode.c:113: error: 'struct lockf' has no member named 'lf_flags'
dnode.c:115: error: 'struct lockf' has no member named 'lf_id'
...
```

Then lsof is being built on a system that has new kernel file locking code and lsof's Configure script failed to build a local `lockf_owner.h` header file with a structure definition lsof needs.

See the "Why can't Configure create `lsof_owner.h` for FreeBSD 6 and above?" section for more information and a work-around.

#### 8.6.2 Why don't `/usr/src/sys/sys/lockf.h` and `/usr/include/sys/lockf.h` match?

This mismatch can cause the errors explained in the answer to the "Why are there lockf structure compiler errors for FreeBSD 6.0 and higher lsof?" question.

If `/usr/src/sys/sys/lockf.h` has been updated with a CVSup or csup, the new `lockf.h` won't be propagated to `/usr/include/sys` until

the "make buildworld" and "make installworld" steps have been completed.

## 9.0 HP-UX Problems

### 9.1 What do /dev/kmem-based and PSTAT-based mean?

Lsof for HP-UX 11.0 and below uses /dev/kmem to read kernel data structures from which it gathers and reports open file information. That version of lsof is called /dev/kmem-based lsof.

Starting with HP-UX 10.10, finding definitions for the necessary kernel structures became more difficult as HP no longer distributed header files in /usr/include that defined all kernel structures. So I started "inventing" structure definitions by using Q4 to display them.

By HP-UX 11, the process of invention became extremely intensive to support. Following a patch to the ipc\_s structure in early 1999, my invented definition of that structure became incorrect. Although I was able to devise a work-around test for the patch with Q4, it was clear that my inventions were bound to cause more problems.

Discussion with HP about the patch led to my proposing that an lsof API in the HP-UX kernel was the proper solution. Much to my surprise, HP agreed. I believe Carl Davidson was the prime mover behind that decision, but I know others participated, among them Louis Huemiller, Rich Rauenzahn, and Sailu Yallapragada. I am indebted to these folks and HP for their willingness to do this work.

The API was added to the PSTAT interface in a project named PEGLE, Pstat Enhancements for Glance and Lsof. Louis and Sailu did the bulk of the design and implementation work and testing began in March, 2000

HP-UX 11.11 is the first version that provides PSTAT support for lsof. HP-UX versions in between 11.0 and 11.11 -- all Beta versions as far as I can determine -- have no lsof support.

See the "PSTAT-based HP-UX lsof Questions" section for questions and answers specific to PSTAT-based HP-UX lsof. The next section, "Why doesn't a /dev/kmem-based HP-UX lsof

compilation use -O?" covers /dev/kmem-based HP-UX lsof.

The

/dev/kmem-based lsof sources may be found in the kmem subdirectory of the dialects/hpux branch of the lsof source tree. The PSTAT-based lsof sources may be found in .../dialects/hpux/pstat.

## 9.2 /dev/kmem-based HP-UX lsof Questions

The sources for /dev/kmem-based lsof for HP-UX may be found in lsof\_<revision>/dialects/hpux/kmem.

Lsof's Configure shell script decides to use these sources when it finds that the /usr/include/sys/pstat subdirectory doesn't exist.

Lsof can be forced to use the /dev/kmem sources by setting "/dev/kmem" in the HPUX\_BASE environment variable. Consult the Configure shell script and 00XPORTING for more information.

### 9.2.1 Why doesn't a /dev/kmem-based HP-UX lsof compilation use -O?

If you only have the standard (bundled) HP-UX C compiler and haven't purchased and installed the optional one, then you can't use cc's -O option. The HP-UX cc(1) man page says this:

"Options

Note that in the following list, the cc and c89 options

-A , -G , -g , -O , -p , -v , -y , +z , and +Z are not supported by the C compiler provided as part of the standard HP-UX operating system. They are supported by the C compiler sold as an optional separate product."

Lsof's Configure script tries to detect what C compiler product you have installed by examining your compiler. If that examination reveals a standard (bundled) compiler, lsof avoids using -O.

If the Configure compiler test fails, the C compiler will complain that it doesn't support -O. You can suppress that complaint with this make invocation:

```
$ make DEBUG=""
```

### 9.2.2 Why doesn't the /dev/kmem-based CCITT support work under 10.x?

Pasi Kaara, who originally provided the HP-UX CCITT support, reports that it no longer works under HP-UX 10.x. Consequently, at lsof revision 4.02 it has been disabled.

### 9.2.3 Why can't /dev/kmem-based lsof be compiled with `cc -Aa` or `gcc -ansi` under HP-UX 10.x?

Some HP-UX 10.x header files, needed by lsof, can't be compiled properly in ANSI\_C mode; structure element definition and alignment problems result. The `f_offset` member of the file structure, for example, is incorrect.

This ANSI-C obstacle extends to using the `-Aa` option of the HP C compiler and the `-ansi` option of `gcc`.

### 9.2.4 Why does /dev/kmem-based lsof complain about no C compiler?

Lsof's Configure script looks in `/bin` and `/usr/ccs/bin` for an HP C compiler, because it needs to know if the compiler is the standard (bundled) one or the optional separate product. If it finds no compiler in either place, Configure quits after complaining:

```
No executable cc in /bin or /usr/ccs/bin
```

If you don't have a C compiler in either of these standard places, you should consider installing it. If you have `gcc` installed, you can use it by declaring the ```hpuxgcc``` abbreviation to lsof's Configure script.

If you have a C compiler in a non-standard location, you can use the `HPUX_CC_DIR[12]` environment variables to name the path to it. Consult the `00XCONFIG` file of the lsof distribution for more information.

### 9.2.5 Why does Configure complain about q4 for /dev/kmem-based lsof for HP-UX 11?

When you run Configure on an HP-UX 11 system, it may complain:

```
!!!ERROR!!! !!!ERROR!!! !!!ERROR!!! !!!ERROR!!!
Configure can't use /usr/contrib/bin/q4 to examine the ipis_s
structure. You must do that yourself, report the result in
the HPUX_IPC_S_PATCH environment variable, then repeat the
Configure step. Consult the Configure script's use of
```

/usr/contrib/bin/q4 and the 00XCONFIG file for information on ipis\_s testing and the setting of HPUX\_IPC\_S\_PATCH.  
!!!ERROR!!! !!!ERROR!!! !!!ERROR!!! !!!ERROR!!!

This message states that Configure cannot use q4 from /usr/contrib/bin to examine the kernel's boot image for the ipis\_s structure. Maybe q4 hasn't been installed, or perhaps Configure can't execute it.

Lsof needs to gather information about ipis\_s to determine if the ipis\_s structure is defined in the kernel boot image, if the ipis\_s structure of the kernel boot image has an ipis\_msgsqueued member, and if the ipc\_s structure of the kernel boot image uses has an ipc\_ipis member.

The ipis\_s structure isn't described in any header file HP-UX releases with HP-UX 11. It appears in the private lsof header file ../dialects/hpux/kmem/hpux11/ipc\_s.h. Lsof gets local and remote connection addresses (IP and port numbers) from ipc\_s, so an incorrect ipc\_s definition may cause incorrect reporting of TCP/IP connection addresses. It definitely will cause incorrect reporting on 32 bit kernels. In any case lsof should be compiled with a correct ipc\_s definition no matter the kernel bit size, so the Configure script always tests for it when the HP-UX version is 11.

For lsof's Configure script to gather the necessary ipis\_s information q4 needs to be installed in /usr/contrib/bin and the kernel boot image, /stand/vmunix, needs to have been processed with pxdB. If either is untrue, lsof issues the above error message, perhaps preceded by q4 messages. (Note: lsof's use of q4 may also fail if q4 can't execute nm -- e.g., it can't find /usr/bin/nm, or there is a conflicting, private version of nm earlier in the path.)

If /stand/vmunix hasn't been processed by pxdB, the q4 messages will include:

q4: (error) vmunix not pxdB'd  
or  
q4: (warning) /stand/vmunix has not been processed by pxdB.

It's possible to make a suitable private copy of /stand/vmunix for configuring lsof. That requires /opt/langtools/bin/pxdB or the q4 version of pxdB from /usr/contrib/bin/q4pxdB.

The path to the result is supplied to the lsof Configure script in the HPUX\_BOOTFILE environment variable. Configure still requires /usr/contrib/bin/q4.

The following sample Bourne shell commands make a private copy of /stand/vmunix in /tmp, process it with pxdB or q4pxdB, and supply its path to lsof's Configure script in HPUX\_BOOTFILE.

```
$ cp /stand/vmunix /tmp/vmunix.lsof

$ /opt/langtools/bin/pxdB /tmp/vmunix.lsof
or
$ /usr/contrib/bin/q4pxdB /tmp/vmunix.lsof

... pxdB messages ...
$ HPUX_BOOTFILE=/tmp/vmunix.lsof Configure -n hpux
```

It may also be necessary to use q4 outside the lsof Configure script. In that case q4 can be used to determine the state of ipis\_s and ipc\_s with these q4 commands:

```
$ /usr/contrib/bin/q4 /stand/vmunix
...
q4> fields -c struct ipc_s
...
q4> fields -c struct ipis_s
```

Look in the q4 output for the ipc\_ipis member of the ipc\_s structure, and look in the q4 output for the ipis\_s structure for the ipis\_msgsqueued member. If ipc\_s has ipc\_ipis but ipis\_s lacks ipis\_msgsqueued, set HPUX\_IPC\_S\_PATCH environment variable to "1". If ipc\_s has ipc\_ipis and ipis\_s has ipis\_msgsqueued, set HPUX\_IPC\_S\_PATCH to "2" -- e.g.,

```
$ HPUX_IPC_S_PATCH=1 Configure -n hpux
or
$ HPUX_IPC_S_PATCH=2 Configure -n hpux
```

If ipis\_s has no ipc\_ipis member, set HPUX\_IPC\_S\_PATCH to "N" -- e.g., use this Configure step:

```
$ HPUX_IPC_S_PATCH=N Configure -n hpux
```

9.2.6 When compiling /dev/kmem-based lsof for HP-UX 11 what do the "aCC runtime: ERROR..." messages mean?

When the lsof Makefile asks the HP-UX unbundled compiler to load lsof, it may complain:

```
/bin/cc -o lsof -DHPUXV=1100 -DHASVXFS -DHPUXKERNBITS=64 \
-I/home/abe/src/lsof4/dialects/hpux/kmem/hpux11 +DD64 \
-DHAS_IPC_S_PATCH=2 -I/home/abe/src/lsof4/dialects/hpux/kmem \
-DLSOF_VSTR="B.11.00\" -g dfile.o dmnt.o dnode.o dnode1.o \
dnode2.o dproc.o dsock.o dstore.o arg.o main.o misc.o \
node.o print.o proc.o store.o usage.o -L./lib -llsof -lelf \
-lnsl
aCC runtime: ERROR: Unexpected use of shared libraries
aCC runtime: ERROR: Read aCC manpage, +A option
/usr/lib/nls/loc/locales.1//is_IS.iso88591
```

This is a bug in the HP-UX national language support.  
(Notice the last message with "locales" in it?) Complain  
to  
HP -- then use this work-around before executing make:

```
$ unset LANG
$ make
```

#### 9.2.7 Why doesn't /dev/kmem-based lsof for HP-UX 11 report VxFS file link counts, node numbers, and sizes correctly?

This is usually the result of running an lsof binary whose revision number is less than 4.57 on a system that has OnlineJFS support installed. It can also happen with lsof 4.57 binaries when the OnlineJFS support with which they were built doesn't match the OnlineJFS status of the system on which they are run.

The OnlineJFS status of lsof 4.57 and higher binaries can be determined by running:

```
$ lsof -v 2>&1 | grep HASONLINEJFS
```

If that shell pipe produces output, lsof was compiled with OnlineJFS support enabled; no output, disabled.

If OnlineJFS is installed on an HP-UX 11 system the /sbin/fs/vxfs/subtype executable exists and outputs "vxfs3.3" when run.

The problem occurs because the optional OnlineJFS support installation doesn't update <sys/fs/vx\_inode.h>.



Consequently  
lsof can be compiled with an incorrect definition of the  
vx\_inode structure and look for link counts, node  
numbers, and sizes in the wrong places in the structure.

The current response I have gotten from HP is that no  
<sys/fs/vx\_inode.h> update will be provided for OnlineJFS.

I've addressed this problem temporarily with a work-around  
(hack) in lsof revision 4.57.

9.2.8 Why can't /dev/kmem-based lsof be built with gcc for 64 bit  
HP-UX 11?

When Configure is given the "hpuxgcc" abbreviation, the  
HP-UX version is 11, and the kernel bit size is 64, the  
lsof Configure script may abort with the messages:

```
!!!!!!!!!!!!!! FATAL ERROR !!!!!!!!!!!!!!!
```

```
APPARENTLY GCC CANNOT BUILD 64 BIT EXECUTABLES.
A COMPILER MUST BE USED THAT CAN. SEE 00FAQ
FOR MORE INFORMATION.
```

(This is the "more information" in 00FAQ.)

This means the Configure script compiled a test program  
with gcc the result wasn't an ELF-64 binary. lsof tries  
two gcc modes,  
one with no options and another with the  
-mlp64 option, before it concludes gcc can't be used.

See the "How can I acquire a gcc for building lsof for 64  
bit HP-UX 11?" answer for information on where you might  
be able to get a gcc for HP-UX 11 that can produce ELF-64  
executables.

9.2.8.1 How can I acquire a gcc for building lsof for 64 bit HP-UX 11?

Check this HP URL:

[http://h21007.www2.hp.com/dspp/tech/tech\\_TechSoftwareDetailPage\\_IDX/1,1703,547,00.html](http://h21007.www2.hp.com/dspp/tech/tech_TechSoftwareDetailPage_IDX/1,1703,547,00.html)

(That's one very long link; be careful you cut 'n paste it  
all.)

In November 2001 that URL led to a web page whose title  
was "gcc for hp-ux 11." The page offered a link for

downloading a 64 bit gcc 3.0 compiler for HP-UX 11.0 and 11i. Rich Rauenzahn of HP installed that compiler on an HP test system he allows me to use and I successfully built a 64 bit lsof with it.

The HP package may install the 64 bit capable gcc in /usr/local/pa20\_64/bin/gcc, so you may have to adjust your path or set the LSOF\_CC environment variable to compensate.

9.2.9 Why does /dev/kmem-based lsof for HP-UX 11 report "unknown file system type" for some open files?

The lsof binary being used probably doesn't have support for the VxFS file system.

To confirm that, check `lsof -v` output for "-DHASVXFS". If it's not present, lsof doesn't have VxFS support.

You also need to establish that lsof really is complaining about VxFS files by checking the kernel boot file for the symbol associated with the hexadecimal address reported in the "unknown file system type" message -- e.g., "v\_op: 0x8711c8." Use nm(1) to do that:

```
$ nm -x /stand/vmunix | grep 8711c8
```

If nm reports the symbol associated with the address is vx\_vnodeops, then lsof is complaining about an open VxFS file.

The solution in that case is to build lsof yourself (The bundled C compiler will do it.), making sure that lsof's Configure script detects the presence of VxFS. Configure does that by finding these two header files:

```
/usr/include/sys/fs/vx_hpux.h
/usr/include/sys/fs/vx_inode.h
```

If the system where you are building lsof doesn't have those header files, but does have VxFS, you might be able to install the header files by installing the HP JournalFS package from the CoreOS CD -- in particular the file set JournalFS.VXFS-PRG and its associated patch, PHKL\_18543. (My thanks to Steve Bonds for that information.)

Finally, if you find that lsof isn't complaining about VxFS when it complains about an unknown file system type, send

e-mail to me <abe@purdue.edu> for further assistance. Make sure "Isof" appears in the "Subject:" line so my e-mail filter won't classify your letter as Spam.

#### 9.2.10 Why does the ANSI-C compiler complain about comments in HP-UX 11 header files?

When compiling Isof on HP-UX 11, the HP ANSI-C compiler's pre-processor, cpp, may complain about comments in HP-UX header files -- e.g.,

```
cpp: "/usr/include/sys/cdfs.h", line 232: warning 2028:
Found comment
inside comment started on line 232.
cpp: "/usr/include/sys/cdnode.h", line 196: warning 2028:
Found comment inside comment started on line 196.
cpp: "/usr/include/nfs/snode.h", line 30: warning 2028:
Found comment inside comment started on line 30
```

This is not a problem with Isof. It is a problem with the HP-UX header files; they have non-compliant ANSI-C comment sequences in them -- e.g.,

```
<sys/cdfs.h>: 232
/* struct cdfs *cdfs_link; /* linked list of file systems */
```

The initial "/\*" is not terminated by an ending "\*/" before the appearance of a second "/\*".

#### 9.2.11 Why does dnode1.c cause the HP-UX 11 compiler to complain that <sys/fs/vx\_inode.h> is missing or incorrect?

If CFLAGS in the Isof Makefile for an HP-UX 11 compilation includes HASONLINEJFS, indicating the system has OnlineJFS support, Isof needs the <sys/fs/vx\_inode.h> header file. Sometimes it is missing from /usr/include/sys/fs.

<sys/fs/vx\_inode.h> is a header file that must be obtained from Veritas. If that proves impossible, please contact me via e-mail at <abe@purdue.edu>. Make sure "Isof" appears in the "Subject:" line so my e-mail filter won't classify your letter as Spam.

### 9.3 PSTAT-based HP-UX Isof Questions

The sources for PSTAT-based Isof for HP-UX may be found in

lsof\_<revision>/dialects/hpux/pstat.

Lsof's Configure shell script decides to use these sources when it finds that the /usr/include/sys/pstat subdirectory exists.

Lsof can be forced to use the PSTAT-based sources by setting "pstat" in the HPUX\_BASE environment variable. Consult the Configure shell script and O0XPORTING for more information.

### 9.3.1 Why does PSTAT-based lsof complain about pst\_static and other PSTAT structures?

When lsof starts it may issue one of these fatal error messages:

```
lsof: FATAL: can't determine PSTAT static size
lsof: FATAL: can't read <n> bytes of pst_static
lsof: FATAL: pst_static doesn't contain <name>_size
lsof: FATAL: <name>_size
should be <n>
```

These messages indicate that lsof's tests for the proper level of PSTAT support have failed. The structure names, given in <name>, and sizes, given in <n>, identify the support deficiency more precisely.

You may need to upgrade the PSTAT support in your kernel to be able to use PSTAT-based lsof.

### 9.3.2 Why does PSTAT-based lsof complain it can't read pst\_\* structures?

Lsof may put messages like the following in the NAME column of its output.

```
can't read cwd pst_filedetails: Permission denied
can't read mem pst_filedetails: Permission denied
can't read rtd pst_filedetails: Permission denied
can't read txt pst_filedetails: Permission denied
can't read pst_filedetails: Permission denied
can't read 3 stream structures: Permission denied
can't read pst_socket: Permission denied
```

These messages indicate that the lsof binary lacks the authority to read the name structures for processes other than ones belonging to the

UID under which lsof is running.

Authority to read the structures of other processes is limited to root processes -- i.e., lsof must have setuid-root permission if it is to list open files for arbitrary processes.

If you want to eliminate these errors, you must run lsof as root or install it with setuid-root permission.

### 9.3.3 Why does PSTAT-based lsof rebuild the device cache file after each reboot?

After each HP-UX rebuild, the first time a user runs lsof it will report:

```
lsof: WARNING: device cache mismatch: /dev/tun...
lsof: WARNING: created device cache file: /<user_path>
```

This happens because the device numbers on /dev/tun\* device nodes are recalculated at each reboot. When lsof detects a change in the device number of a /dev/tun\* file, it rebuilds its local device cache file.

### 9.3.4 Why doesn't PSTAT-based lsof report TCP addresses for telnetd's open socket files?

When lsof can't report TCP addresses for telnetd's open socket files it is because an unpatched PSTAT kernel interface doesn't report the addresses to lsof.

This has been addressed in PSTAT kernel patch PHKL\_24047. It is available from the HP IT Resource Center at:

<http://itrc.hp.com>

In the page's "maintenance / support" box select the "individual patches" link. Once at its page, select the "hp-ux" link. On that page select the "Series 800" or "Series 700" radio button and select "11.11" from the pull-down list to the right of the button. Under "search or browse the path list" select "Search by Patch IDs" from the pull down list, enter PHKL\_24047 in the following text box, and select search. That should lead to information about PHKL\_24047 and a link for downloading it. (You may have to log in first and you may have to create a login identity by registering before you can log in.)

Some time in March 2006 the PHKL\_24047 patch was "lost" by the HP-UX networking lab. It has been "found" again in August 2006 and will be re-released as a GRO patch "some time." I don't yet know when that will be. You must contact HP to learn about the availability of the GRO patch.

### 9.3.5 Why does PSTAT-based lsof cause an HP-UX 11.11 kernel panic?

When PSTAT-based lsof runs on some HP-UX 11.11 kernels, the kernel may panic. Symptoms include:

Console message:

```
0xFBE000301100EF00 00000000 0000EF00 -
type 31 = legacy PA HEX chassis-code
```

/var/adm/syslog:

```
... vmunix: Trap Type 15 (Data page fault)
... vmunix: Instruction Address (pcsq.pcoq) = 0x...
```

The panic is caused by a bug in the way PSTAT's pstat\_getstream() function obtains module names from streams managed by the otsam stream driver (part of OSI Transport Services). lsof calls pstat\_getstream() when it encounters an open otsam stream file. An HP-UX 11.11 system uses otsam if otsam appears in /stand/system.

HP-UX 11.11 patch PHKL\_24507 (available some time after July 15, 2001) fixes the pstat\_getstream() bug. See the information in the answer to the "Why doesn't PSTAT-based lsof report TCP addresses for telnetd's open socket files?" question for information on how to obtain the patch.

### 9.3.6 Why doesn't PSTAT-based lsof report a CWD that is on a loopback (LOFS) file system?

When PSTAT-based lsof reports on processes whose current working directory (CWD) is on a loopback file system, lsof can't report the open CWD file. The reason is that the HP-UX 11.11 and above kernel's loopback file system code is not passing the CWD file ID to the kernel's pstat(2) code. Hence lsof is given no information on the lofs CWD.

The problem was first reported to me by Ermin Borovac and an internal bug report was filed with the HP-UX file system group on October 26, 2004. That report has now been answered by the

patch PHKL\_33200 -- s700\_800 11.11 lofs cumulative patch. The HP IT Resource Center (<http://itrc.hp.com>) is a source for the patch.

9.3.7 Why do some swinstall packages for PSTAT-based HP-UX 11.11 packages complain about setgid and setuid bits?

First, let me explain that I do not provide lsof swinstall packages for lsof. Others provide them and they should be contacted about problems with their packages.

However, I have become aware of a problem with one package about which I have some information I can share. The problem shows up in these swinstall messages:

```
ERROR: Unknown owner and/or group for file
"/usr/local/bin/lsof". SUID and/or SGID bit was
not set.
ERROR: Failed installing fileset "lsof.lsof-RUN,r=4.73".
Check the above output for details.
```

The swpackage SUID/SGID functionality was restricted by changes for POSIX compliance, breaking backward compatibility. The patch PHCO\_27671 allows SUID/SGID for uid/gid of 0 only, as a compromise between backward compatibility and POSIX conformance.

If the setuid bit is to be set on the executable, the UID and GID of the executable must be 0 (zero).

9.3.8 Why won't the bundled C compiler build PSTAT-based lsof for PA-RISC HP-UX 11.23?

A PA-RISC HP-UX 11.23 bundled C compiler dated May 2005 or later will not build PSTAT-based lsof. It will deliver error messages related to the system's <gssapi/gssapi.h> header file.

There is nothing wrong with that header file or lsof. The problem is that the bundled C compiler can't cope with the gssapi.h header file.

The work-around is to use the HP ANSI C compiler. Using gcc is not a satisfactory work-around. See the answer to the "Why won't gcc build PSTAT-based lsof for PA-RISC HP-UX 11.23?" question for more information.

### 9.3.9 Why won't gcc build PSTAT-based lsof for PA-RISC HP-UX 11.23?

Gcc will not even compile PSTAT-based lsof revisions below 4.77 for PA-RISC HP-UX 11.23 dated May 2005 or later. It reports errors in lsof's print.c fill\_portmap() function about missing members of the rpercent structure. That happens because gcc defines \_XOPEN\_SOURCE\_EXTENDED which disables the definition of the rpercent structure in <netdb.h>.

Using the HP bundled C compiler is not a viable work-around. That is explained in the answer to the "Why won't the bundled C compiler build PSTAT-based lsof for PA-RISC HP-UX 11.23?"

While an lsof revision 4.77 or higher can be compiled with gcc, the results are unreliable. lsof will compile, but it occasionally produces segment faults when it runs. I have not been able to reproduce the failure reliably or locate a debugger that will work with the gcc-compiled lsof.

The only reliable work-around is to use the HP ANSI C compiler.

### 9.3.10 Why does PSTAT-based lsof complain, "FATAL: pst\_stream\_size should be: 672; is 72" on HP-UX 11.11 and above?

This message indicates a mismatch between the PSTAT header files used to build lsof (<sys/pstat.h> and those in the /usr/include/sys/pstat subdirectory), and those that built the running kernel.

Unfortunately the June 2008 patch set for HP-UX 11.23 creates this inconsistency, because it does not contain all the patches needed to match the kernel with the PSTAT header files. Even more serious is that the missing patches update the kernel's PSTAT support to provide TCP/UDP endpoint information to lsof from TCP/TLI streams.

The patch inconsistency comes about because, while the following patch is installed,

PHKL\_36577 1.0 PM-PSTAT section 2 manpage changes

other kernel patches are not.

The PHKL\_36577 patch updates the PSTAT header files and manual pages to match kernel changes that other patches with the



following numbers (or patches that contain or supersede them)  
contain:

PHNE\_36575 1.0 Cumulative STREAMS Patch  
PHNE\_37670 1.0 cumulative ARPA Transport patch  
PHNE\_37851 1.0 NFS cumulative patch

Those patches implement the kernel changes that support the  
delivery of information promised in patch PHKL\_36577.

The work-around is to install the missing patches.

#### 9.4 Why won't the HP-UX depot install?

I don't distribute lsof depots, so  
I can't support them.

From time to time depots prepared by various sites -- e.g.,  
usually HP-UX software collection sites -- will contain errors  
that cause installation of the depot to fail.

Do not contact me when this happens. Instead, contact the  
administrator of the site that prepared the depot.

As should be clear from the bulk of the lsof documentation, I  
do not recommend you use pre-built lsof binaries in any form.  
Instead, I recommend you obtain the lsof source distribution  
and build lsof yourself.

### 10.0 Linux

#### 10.1 What do /dev/kmem-based and /proc-based lsof mean?

At approximately Linux 2.1.72 and exactly at lsof revision  
4.23 support for Linux forks. The first fork, containing  
the oldest lsof form is based on access to kernel memory  
structures, and is called /dev/kmem-based lsof. A  
/dev/kmem-based lsof is heavily intertwined with the Linux  
kernel version, its header files, and its system map file.  
Typically a /dev/kmem-based lsof needs only setgid permission  
to  
local all open file information.

After approximately Linux 2.1.72 and at revision 4.23 lsof  
obtains all its information from the /proc file system.  
That lsof is called the /proc-based lsof. A /proc-based  
lsof does not read kernel memory, needs neither kernel

header files nor the system map file, and is less likely to be affected by Linux kernel changes. However, it does require setuid-root permission to list all open files, and it can't report file offsets (positions).

After revision 4.52 the /dev/kmem-based Linux sources for lsof are no longer distributed. Information about them may be found in the 00INDEX and README files at:

<ftp://lsof.itap.purdue.edu/pub/tools/unix/lsof/OLD/src>

## 10.2 /proc-based Linux lsof Questions

### 10.2.1 Why doesn't /proc-based lsof report file offsets (positions)?

/proc-based lsof revisions 4.79 and above can only report file offsets (positions) for the files of Linux kernels 2.6.22 and above.

During its initialization /proc-based lsof tests to see if offset information can be obtained. If it cannot, lsof disables offset reporting. If the -o option was selected, lsof also issues this warning:

lsof: WARNING: can't report offset; disregarding -o.

### 10.2.2 Why does /proc-based lsof report "can't identify protocol" for some socket files?

/proc-based lsof may report:

```
COMMAND PID ... TYPE ... NODE NAME
pump 226 ... sock ... 309 can't identify protocol
```

This means that it can't identify the protocol (i.e., the AF\_\* designation) being used by the open socket file. lsof identifies protocols by matching the node number associated with the /proc/<PID>/fd entry to the node numbers found in selected files of the /proc/net sub-directory. Currently /proc-based lsof examines these protocol files:

```
/proc/net/ax25 (untested)
/proc/net/ipx (needs kernel patch)
/proc/net/raw
/proc/net/raw6
/proc/net/tcp
```

```
/proc/net/tcp6
/proc/net/udp
/proc/net/udp6
```

```
/proc/net/unix
```

If /proc-based lsof says it can't identify the protocol for an open socket file, you may be able to identify the protocol yourself by using `grep` to look for the specific node number in the files of `/proc/net` -- e.g.,

```
$ grep <node_number> /proc/net/*
```

You may not be able to find the desired node number, because not all kernel protocol modules fully support `/proc/net` information.

If you find a matching node number in a `/proc/net` file that is not currently being processed by lsof, contact me via e-mail at [<abe@purdue.edu>](mailto:abe@purdue.edu). I'll discuss adding support to /proc-based lsof for the protocol of the `/proc/net` file with you. Make sure "lsof" appears in the "Subject:" line so my e-mail filter won't classify your letter as Spam.

The code that matches node numbers of open IPX protocol socket files to those in `/proc/net/ipx` requires Jonathan Sergeant's Linux 2.1.79 patch to `/usr/src/linux/net/ipx/af_ipx.c`. The patch, suitable for input to Larry Wall's patch program, may be found in the lsof distribution file:

```
.../dialects/linux/proc/patches/net_ipx_af_ipx.c.patch
```

### 10.2.3 Why does /proc-based lsof warn about unsupported formats?

Lsof may issue the following warning:

```
lsof: WARNING: unsupported format: /proc/net/<file>
```

if the header line of the indicated `<file>` in `/proc/net` -- `ax25`, `ipx`, `raw`, `tcp`, `udp`, or `unix` -- doesn't match what lsof expects to find.

When the header line of a `/proc/net` file isn't what lsof expects, lsof probably can't parse the rest of the file correctly and doesn't try. As a result, lsof can't report any NAME column information (e.g., local and remote addresses) for socket files bound to the indicated network protocol.

If you get this warning, please send me e-mail at <abe@purdue.edu>. Include the contents of the file lsof claims has an unsupported format. Make sure "lsof" appears in the "Subject:" line so my e-mail filter won't classify your letter as Spam.

#### 10.2.4 Why does /proc-based lsof report "(deleted)" after a path name?

The "(deleted)" notation following a path name in /proc-based lsof's NAME column comes from the /proc/<PID>/fd/<FD> entry for the open file. It's the Linux kernel's way of indicating the file is open but has been unlinked (rm'd).

#### 10.2.5 Why doesn't /proc-based lsof report full open file information for all processes?

/proc-based lsof can only report on processes whose /proc files it has permission to read. /proc normally grants permission to read all its files only to root or to the owning user ID.

Without permission to read most /proc files, lsof can only report full information for processes belonging to the user who is running lsof. /proc-based lsof may be able to report some information for all processes, depending on the permissions of their associated /proc files, but usually /proc-based lsof won't be able to access the files in /proc/<PID>/fd/ that describe regular open files.

If you want /proc-based lsof to report on all processes, you must install it with setuid-root permission.

#### 10.2.6 Why won't Customize offer to change HASDCACHE or WARNDEVACCESS for /proc-based lsof?

/proc-based lsof doesn't read device information from /dev or the device cache file, so it makes no sense to change the state of device cache processing or /dev node accessibility warnings.

#### 10.2.7 /proc-based lsof Linux NFS questions

##### 10.2.7.1 Why can't lsof find files on an accessible NFS file system?

On occasion lsof may be unable to identify that an open file is on an NFS file system. This is most likely the

result of a bug in the way the Linux kernel supplies information to the reader of /proc/mounts (lsof) -- sometimes that pseudo-file is truncated by the kernel.

One way to see if this is the case is to search for the NFS file system in /proc/mounts -- e.g.,

```
$ grep <NFS_file_system_mount_point> /proc/mounts
```

If you get no output or the third word of the output isn't "nfs", then lsof won't consider the file system an NFS file system.

A second test is to look at the end of /proc/mounts -- e.g.,

```
$ tail /proc/mounts
```

If tail reports "# truncated" then /proc/mounts is incomplete because of a Linux kernel bug. The bug is documented at:

<http://www.xss.co.at/sysinfo/mounts.html>

The bug is fixed in Linux kernel 2.4.18, and possibly in some earlier Linux kernel versions.

#### 10.2.7.2 Why can't lsof find files on an inaccessible NFS file system?

If lsof issues this message about a Linux file system, mounted from an NFS server:

```
lsof: WARNING: can't stat() nfs file system /xxx/yyy
```

Then lsof won't be able to find any open files on the file system.

That's because of an inadequacy in the Linux /proc file system. Its /proc/mounts file doesn't give the device doublet (major and minor numbers) of the file system as do many UNIX systems (e.g., Solaris). The only way lsof can get the device doublet for a Linux file system is to call stat(2) on the file system path, which fails if the NFS server isn't accessible.

When lsof doesn't know the device doublet of a file system, it can't find open files on the inaccessible file system,

because it can't match the doublets of open files to the doublet of the inaccessible file system.

This topic is covered extensively in lsof(8) in its ALTERNATE DEVICE NUMBERS and BLOCKS AND TIMEOUTS sections.

#### 10.2.8 Why doesn't /proc-based Linux lsof report socket options and values, socket state flags, and TCP options and values?

The Linux /proc file system doesn't report socket options and values, socket states, and TCP options and values to lsof.

#### 10.2.9 Does /proc-based Linux lsof use a device cache?

No. The Linux /proc/<PID>/fd/\* entries provide device names to lsof via readlink(2). It is not necessary to enable device cache processing for /proc-based Linux lsof via the Customize script or modifications to the Linux machine.h header file.

#### 10.2.10 Why doesn't /proc-based Linux lsof report any or all file structure values for its +fcfgn option?

/proc-based lsof revisions 4.79 and above can only report some file structure values for Linux kernels below 2.6.22.

When running on Linux kernels at 2.6.22 and above lsof 4.79 can report some file flag values -- i.e., in response to the +fg or +fG options. The flag values are obtained from the /proc/<PID>/fdinfo/ files introduced at Linux kernel 2.6.22.

/proc-based Linux lsof tests its availability to obtain file flag values at initialization. If values are not available, lsof disables file flag reporting. If the flags were requested with +fg or +fG, lsof displays this warning:

lsof: WARNING: can't report file flags; disregarding +f.

As a special note, when Linux lsof can report flag bits, it will not report 'R' for a read-only file. There is no read-only flag bit O\_\* symbol in <fcntl.h> (or <bits/fcntl.h>) and lsof reports only bits that are set. The absence of O\_RDWR and O\_WRONLY flag bits implies the file is read-only.

#### 10.3 Special Linux file types

### 10.3.1 Why is ``DEL" reported as a Linux file type?

Lsof usually reports entries from the Linux /proc/<PID>/maps file with ``mem" in the TYPE column. However, when lsof can't stat(2) a path in the process' ``maps" file and the ``maps" file entry contains ``(deleted)", indicating the file was deleted after it had been opened, lsof reports the file type as ``DEL".

### 10.3.2 Why is ``unknown" reported as a Linux file type?

Lsof may report a Linux file's type as ``unknown" in the TYPE column when lsof can't obtain complete stat(2) results for the file.

Usually the NAME column will contain a ``(stat: xxx)" error message, but that could have been suppressed with the lsof ``-w" option.

## 10.4 Linux ``mem" Entry Problems

### 10.4.1 What do ``path dev=xxx" and ``path inode=yyy" mean in the NAME column of Linux ``mem" file types?

When the device or inode number in the process' ``maps" file entry doesn't match the stat(2) results from the file path, lsof reports the inconsistent information from the stat(2) of the path parenthetically after the path in the NAME column in one of these forms:

(path dev=xxx)      only the device number, ``xxx", from a stat(2) of the ``maps" file entry path differs from the ``maps" file entry value reported in the DEVICE column.

(path inode=yyy)   only the inode number, ``yyy", from a stat(2) of the ``maps" file entry path differs from the ``maps" file entry value reported in the NODE column.

(path dev=xxx inode=yyy)   Both device and inode numbers differ.

Lsof reports the ``maps" file device number in the DEVICE column and the inode number in the NODE column.

When device and inode mismatches occur, lsof suppresses the reporting of link count and size. See the answer to the "Why is neither link count nor size reported for some Linux ``DEL" and ``mem" file types?" question for more information.

Device and inode inconsistencies can occur when a file at a ``maps" path is replaced after the process has started, or when a different file system with similar path names is mounted on top of the original file system.

The device inconsistency parenthetical messages can be suppressed with lsof's ``-w" option.

#### 10.4.2 Why is neither link count nor size reported for some Linux ``DEL" and ``mem" file types?

Link count and size are not reported for some entries from the process' ``maps" file because a stat(2) of the entry file path failed or stat(2) delivered device or inode numbers that don't match the ones in the ``maps" entry.

When the stat(2) device or inode numbers don't match those in the ``maps" file entry, it is likely that the stat(2) results don't apply to the file that was originally mapped by the process and whose path appears in the ``maps" file entry, so lsof tries to avoid reporting possibly incorrect information.

See the answer to the "What do ``path dev=xxx" and ``path inode=yyy" mean in the NAME column of Linux ``mem" file types?" for more information on how mismatched stat(2) device and inode numbers are reported.

### 10.5 Special Linux NAME column messages

#### 10.5.1 What does ``(stat: xxx)" mean in the NAME column of Linux files?

When lsof tried to stat(2) the path in the NAME column, the stat(2) system call failed and produced an error message of ``xxx".

This situation usually occurs if the lsof process lacks permission to stat(2) the path -- e.g., the lsof executable



lacks root permission, or lsof is attempting to stat(2) a path on an NFS device mounted with the root\_squash option.

The message can be suppressed with lsof's `-w` option.

#### 10.5.2 What does `(readlink: xxx)` mean in the NAME column of Linux files?

When lsof tried to convert the `/proc/<PID>/fd` path, reported in the NAME column, to its full and more meaningful path, the readlink(2) system call used to do the conversion failed. The readlink(2) failure message is `xxx`.

This situation usually occurs if the lsof process lacks permission to readlink(2) some part of the path -- e.g., the lsof executable lacks root permission, or lsof is attempting to stat(2) a path on an NFS device mounted with the root\_squash option.

The message can be suppressed with lsof's `-w` option.

#### 10.6 Why is `NOFD` reported as a Linux file type?

When lsof lacks permission to use opendir() on the fd/ subdirectory of a process' `/proc/<PID>` directory, it reports a single file of the type `NOFD` (for no file descriptors).

Lsof reports the `/proc/<PID>/path` in the NAME column, followed by `(opendir: xxx)`, where `xxx` is the error message returned by opendir().

The `NOFD` entry can be suppressed with lsof's `-w` option.

#### 10.7 Why does Linux lsof report a NAME column value that begins with `/proc`?

When lsof has problems processing a `/proc/<PID>` entry -- e.g., it can't convert the entry to a full and more meaningful path name, or it can't access the `/proc/<PID>/fd` subdirectory with opendir() -- it will report the `/proc/<PID>` path in the NAME column.

#### 10.8 Linux `/proc/net/tcp*` and `/proc/net/udp*` issues

##### 10.8.1 Why use the Linux `-X` option?

If you're not interested in TCP/IP socket information for a particular use of lsof, adding the -X option will make lsof run more quickly, because -X inhibits the reading of the /proc/net/tcp\* and /proc/net/udp\* files. For example, you may only be interested in knowing what process has a particular file open.

When the Linux system has a large number of open TCP/IP socket files, the time savings provided by -X can be significant.

#### 10.8.2 Why does lsof say ``-i is useless when -X is specified"?

If -X is specified, lsof can't report much information on open TCP/IP socket files. However, lsof's -i option requests that information. Hence, the two options conflict and can't be used together.

#### 10.8.3 Why does lsof say ``can't identify protocol (-X specified)"?

If the Linux lsof -X option is specified and an open socket file can't be identified without accessing the /proc/net/tcp\* and /proc/net/udp\* files, lsof will report that it can't identify the socket's protocol and that the failure may be caused by the -X specification

### 11.0 NetBSD Problems

#### 11.1 Why doesn't lsof report on open kernfs files?

Lsof doesn't report on open NetBSD kernfs files because the structures lsof needs aren't defined in the kernfs.h header file in /sys/misc/kernfs.

#### 11.2 Why doesn't lsof report on open files on: file descriptor file systems; /proc file systems; 9660 (CD-ROM) file systems; MS-DOS (floppy disk) file systems; or kernel file systems?

Lsof is not able to report on open files on certain file system if /usr/src/sys/msdosfs didn't exist when the lsof Configure script ran and lsof was made. /usr/src/sys/msdosfs contains header files lsof needs for collecting data on certain file system files.

You can tell if an lsof executable above) lacks support for a file system if the following test of `lsof -v` produces

nothing:

```
$ lsof -v 2>&1 | grep <support_enabled_definition>
```

The <support-enabled\_definition> will be:

File System Type Definition Note

-----

File descriptor HASFDESCFS

/proc HASPROCFS

9660 HAS9660FS

MS-DOS HASMSDOSFS (lsof 4.61 and above)

Kernel HASKERNFS

The work-around is to install /usr/src/sys, rerun the lsof Configure script, and remake lsof.

### 11.3 Why does lsof produce confusing results for nullfs file systems?

Consider this report from /sbin/mount:

```
/usr/home on /home type null (local)
```

(According to /sbin/mount /usr/home is the mounted-on device and /home is the mounted-on directory.)

When lsof is asked to report on open files on /home, it will report them as files on /usr/home instead. That's an artifact of the NetBSD kernel's dynamic name lookup cache (DNLC) and the way the kernel handles nullfs mounted-on directories.

While lsof will report all open files on /home when given /home as a file system directory argument, even though reporting them as located on /usr/home, lsof will not find the same files when asked to report on all open files on /usr/home when given /usr/home as a file system device argument. That's because from the mount perspective /usr/home is equivalent to a device, but from the device perspective it is still a directory.

So, what this lsof command reports:

```
$ lsof /home
... NAME
... /usr/home/...
```

Won't be duplicated by this lsof command:

```
$ lsof /usr/home
```

Another way to look at this confusing /home and /usr/home example is to consider what stat(2) reports. For /home stat(2) reports a device doublet that matches what lsof finds in open file node structures, while the device doublet stat(2) reports for /usr/home won't match what lsof finds. Nor does the mode reported by stat(2) indicate a block devices, as is the expected case.

There is no simple answer to this confusion, nor is there even a simple explanation. Simply be aware that when supplying file system arguments to lsof on NetBSD, use the mounted-on directory name for a nullfs as the lsof argument, and don't be surprised when the NAME column reports the mounted-on device name.

## 11.4 NetBSD header file problems

### 11.4.1 Why can't the compiler find some NetBSD header files?

If the compiler's pre-processor complains it can't find some header files when it compiles lsof source files, /usr/include and /usr/src may not have all the header files lsof needs.

As a work-around use the NETBSD\_SYS environment variable to specify to lsof the location of the additional header files -- e.g.,

```
% setenv NETBSD_SYS /my_source
% ./Configure -n netbsd
```

or

```
$ NETBSD_SYS=/mys_source ./Configure -n netbsd
```

Caution: using this work-around may cause the lsof Configure script to activate or omit different features, depending on where it finds the header files that determine the state of the features.

### 11.4.2 Why does NetBSD lsof produce incorrect output?

If the NetBSD system's kernel was built from header files that

don't match those in /usr/include -- e.g., //usr/src has the ones from which the kernel was built -- lsof may build, but won't produce correct output.

As a possible work-around, try directing the C compiler to select header files from /usr/src before it selects them from /usr/include. That can be done with the DEBUG make string -- e.g.,

```
$ make DEBUG="-I/usr/src -I/usr/include"
```

If that work-around fails, try using the LSOF\_INCLUDE and NETBSD\_SYS environment variables to swap /usr/include and /usr/src when running the Configure script, then use the make DEBUG string when running make -- e.g.,

```
$ LSOF_INCLUDE=/usr/src; export LSOF_INCLUDE
$ NETBSD_SYS=/usr/include; export NETBSD_SYS
$./Configure -n
netbsd
$ make DEBUG="-I/usr/src -I/usr/include"
```

#### 11.5 Why isn't lsof feature xxx enabled for NetBSD?

Lsof's Configure script enables NetBSD features by locating and examining header files associated with the features, and based on what it finds, setting compile-time definitions in Makefiles. (See 00PORTING for a list of the definitions.)

When Configure doesn't find header files or doesn't find appropriate values in header files, that may mean the header file tree lsof is searching is incomplete or out of date.

Lsof normally looks for NetBSD header files in /usr/include. It can also be directed to look in other directories -- e.g., /sys -- if told to do so with the contents of the LSOF\_INCLUDE and NETBSD\_SYS environment variables.

To determine what header file enables a missing feature, check the NetBSD stanza in the Configure script. Then check the locations it checks for the indicated header files and contents.

See 00XCONFIG for more information on LSOF\_INCLUDE and NETBSD\_SYS.

## 12.0 NEXTSTEP and OPENSTEP Problems

### 12.1 Why can't lsof report on 3.1 lockf() or fcntl(F\_SETLK) locks?

Lsof has code to test for locks defined with lockf() or fcntl(F\_SETLK) under NEXTSTEP 3.1, but that code has never been tested. I couldn't test it, because my NEXTSTEP 3.1 lockf() and fcntl(F\_SETLK) functions return "Invalid argument" every way I have tried to invoke them.

If your NEXTSTEP 3.1 system does allow you to use lockf() and fcntl(F\_SETLK) and lsof doesn't report locks set with them, then the code in `.../dialects/next/dnode.c` probably isn't correct. Please contact me via e-mail at [<abe@purdue.edu>](mailto:abe@purdue.edu) and tell me how you got your lockf() and fcntl(F\_SETLK) system calls to work. Make sure "lsof" appears in the "Subject:" line so my e-mail filter won't classify your letter as Spam.

### 12.2 Why doesn't lsof compile for NEXTSTEP with AFS?

I no longer have a NEXTSTEP test system that has AFS. Changes to lsof since I once had a test system have caused me to change the AFS code in NEXTSTEP without being able to test the changes.

If you need AFS support for NEXTSTEP and can't get it to compile, please contact me. Perhaps we can jointly fix the problems.

## 13.0 OpenBSD Problems

### 13.1 Why doesn't lsof support kernfs on my OpenBSD system?

Lsof supports the kernel file system on OpenBSD versions whose `/sys/miscfs/kernfs/kernfs.h` (or `<miscfs/kernfs/kernfs.h>`) header file correctly defines the `kern_target` structure. The lsof Configure script's `openbsd` stanza checks for the presence of the structure's `kt_name` element and activates kernfs support for the `CFLAGS -DHASKERNFS` definition only when it finds `kt_name`.

The `kernfs.h` header file is scheduled to be updated in the OpenBSD 2.1 release, according to Kenneth Stailey, who authored its changes.

## 13.2 Will lsof work on OpenBSD on non-x86-based architectures?

I've not tested lsof on an OpenBSD system that uses a non-x86-based architecture, but I've had one report that lsof 4.33 compiles and works on OpenBSD for the pmax architecture (decstation 3100).

## 13.3 <sys/pipe.h> problems

### 13.3.1 Why does the compiler claim nbpg isn't defined?

When compiling lsof on some (older) OpenBSD SPARC versions, the compiler may complain:

```
In file included from ../dlsof.h:191,
 from ../lsof.h:166,
 from fino.c:52:
/usr/include/sys/pipe.h:83: `nbpg' undeclared here
(not in a function)
/usr/include/sys/pipe.h:83: size of array `ms' has
non-integer type
```

This happens because <sys/pipe.h> uses NBPG from <machine/param.h> to size the `ms' array, and some OpenBSD systems define NBPG in terms of a kernel integer variable, nbpg.

Lsof revisions 4.46 and above have a hack to dlsof.h, developed by Volker Borchert that avoids the compiler problem for SPARC OpenBSD 2.3. The hack might work for other OpenBSD SPARC versions, but hasn't been tested there.

If you want to enable the hack for your OpenBSD SPARC version, modify this code in ../dialects/n+obsd/dlsof.h:

```
if defined(OPENBSDV)
if OPENBSDV==2030 && defined(__sparc__)
if defined(nbpg)
#undef nbpg
endif /* defined(nbpg) */
#define nbpg 4096 /* WARNING!!! ... */
endif /* OPENBSDV==2030 && defined(__sparc__) */
#include <sys/pipe.h>
#endif /* defined(OPENBSDV) */
```

You will probably want to change the second #if test to

match your OpenBSD version. You may also want to change what value is assigned to nbpg. See the next section, "What value should I assign to nbpg?"

### 13.3.2 What value should I assign to nbpg?

If you need to enable the nbpg hack, described in "Why does the compiler claim nbpg isn't defined?", you may also need to assign a value other than 4096 to nbpg. 4096 works for the sun4c processor and should work for sun4m, but 8192 may be needed for sun4.

Check <machine/param.h> and other OpenBSD documentation to determine the correct nbpg assignment.

### 13.4 Why doesn't lsof report on open MS-DOS file system (floppy disk) files?

Lsof is not able to report on open MS-DOS file system files if /usr/src/sys/msdosfs didn't exist when the lsof Configure script ran and lsof was made. /usr/src/sys/msdosfs contains header files lsof needs for collecting data on MS-DOS file system files.

You can tell if an lsof executable (revisions 4.61 and above) lacks MS-DOS file system support if the following command reports nothing:

```
$ lsof -v 2>&1 | grep HASMSDOSFS
```

The work-around is to install /usr/src/sys, rerun the lsof Configure script, and remake lsof.

### 13.5 Why isn't lsof feature xxx enabled for OpenBSD?

Lsof's Configure script enables OpenBSD features by locating and examining header files associated with the features, and based on what it finds, setting compile-time definitions in Makefiles. (See 00PORTING for a list of the definitions.)

When Configure doesn't find header files or doesn't find appropriate values in header files, that may mean the header file tree lsof is searching is incomplete or out of date.

Lsof normally looks for OpenBSD header files in /usr/include and /sys. It can also be directed to look in other



directories if told to do so with the contents of the  
LSOF\_INCLUDE and NETBSD\_SYS environment variables.

To determine what header file enables a missing feature,  
check the OpenBSD stanza in the Configure script. Then  
check the locations it checks for the indicated header  
files and contents.

See 00XCONFIG for more information on LSOF\_INCLUDE and  
and NETBSD\_SYS.

## 14.0 Output Problems

### 14.1 Why do the lsof column sizes change?

Lsof dynamically sizes its output columns each time it runs  
to make sure that each column takes the minimum space.  
Column parsing -- e.g., with awk -- is possible, because  
each column is guaranteed to be separated from the preceding  
one by at least one space, and no column except the last  
(NAME) contains embedded  
spaces.

### 14.2 Why does the offset have ``0t' and ``0x" prefixes?

The offset value that appears in the SIZE/OFF column has  
``0t' and ``0x" prefixes to distinguish it from size values  
that may appear in the same column.

Normally if the offset value is less than 100,000,000 (8  
digits), it appears in decimal with a ``0t' prefix; over  
99,999,999, in hexadecimal with a ``0x" prefix.

A decimal offset is handy, for example, when tracking the  
progress of an outbound ftp transfer. When lsof reports  
on the ftp process, it will report the size of the file  
being sent with its open descriptor; it will report the  
progress of the transfer via the offset of the outbound  
open ftp data socket descriptor.

The ``-o [n]" option may be used to specify the maximum  
number of decimal digits to be printed after ``0t" before  
lsof switches to the hexadecimal digits after ``0x". As  
already noted, the default decimal digit count is 8.

### 14.3 What are the values printed in the FILE\_FLAG column and

why is 0x<value> sometimes included?

The two comma separated lists, separated by a semicolon, printed in the FILE-FLAG column (when the "+fg" option is specified), are short-hand names or hexadecimal values for the bits lsof finds in the f\_flag or f\_flags member of file structures for files (the first list, the one before the semicolon), and process open files flags found in various kernel structures, often named "pofile" (the second list, the one after the semicolon).

Lsof determines the short-hand names from symbols in the <fcntl.h>, <linux/fs.h>, <sys/fcntl.h>, <sys/fcntlcom.h>, <sys/file.h>, and <sys/user.h> header files.

See the discussion of FILE-FLAG in the OUTPUT section of the lsof man page, and the FF\_\* and POF\_\* symbols in lsof.h for a list of the names.

Bits with no names defined for them are represented by an 0x<value> member of the comma-separated list -- a hexadecimal integer. When "+fG" is specified (instead of "+fg"), lsof will list all flag values as two hexadecimal integers, separated by a semicolon.

When "-FG" is specified to get the flags in an output field, the format defaults to hexadecimal. You can get names instead by following "-FG" with "+fg" -- e.g.,

```
$ lsof -FG +fg ...
```

However, when you precede "-FG" with "+fg" -- e.g.,

```
$ lsof +fg -FG
```

the format will be hexadecimal; order is important.

#### 14.3.1 Why doesn't lsof display FILE\_FLAG values for my dialect?

All versions of lsof except the /proc-based Linux lsof report FILE-FLAG values. Lsof can't obtain FILE-FLAG information from the Linux /proc interface.

### 14.4 Network Addresses

#### 14.4.1 Why does lsof's -n option cause IPv4 addresses, mapped to IPv6, to be displayed in IPv6 notation?

When you use the -n option to tell lsof to display numeric network addresses, and an IPv4 address has been mapped to IPv6, lsof displays the address in IPv6 format and puts "ipv4" in the TYPE column. That combination indicates the IPv4 address has been mapped to IPv6.

For example, the IPv4 address 1.2.3.4, when mapped to an IPv6 address, will be displayed by lsof as:

```
[::ffff:1.2.3.4]
```

The enclosing brackets are lsof's signal that this is an IPv6 address. Inside the brackets is a standard IPv6 address, reported by inet\_ntop(). The first two colons, signifying zeroes in the first 64 bits of the IPv6 address, and the hexadecimal ffff in the next 32 bits, indicate that the last 32 bits contains a mapped IPv4 address, which is then displayed in IPv4 dot notation.

14.5 Why does lsof output \x, ^x, or \xnn for characters sometimes?

Lsof displays only printable ASCII characters. Lsof considers a character printable if isprint(3) says it is. If isprint(3) says a character isn't printable, the lsof man page explains:

"... Non-printable characters are printed in one of three forms: the C ``\[bfrnt]' form; the control character `^' form (e.g., ``^@"); or hexadecimal leading ``\x" form (e.g., ``\xab"). Space is non-printable in the COMMAND column (``\x20") and printable elsewhere."

14.5.1 Why is space considered a non-printable character in command names?

Space is considered an unprintable character in command names because it is sometimes possible to hide the full command name from scripts that parse ps(1) output by embedding a space in the name.

14.6 Why doesn't lsof print all the characters of a command name?

By default lsof prints the first nine characters of the

names of commands associated with processes. If more characters are required, the "w" value of the "+c w" option may be used to specify a larger width.

If "w" is zero (0) lsof will print all characters of all command names up to the limit of the number of characters supplied by the particular UNIX dialect. When reporting command names, lsof replaces non-printable characters as discussed in the answer to " Why does lsof output \x, ^x, or \xnn for characters sometimes?"

See

the answer to the "Why is space considered a non-printable character in command names?" question for an explanation of why spaces are replaced by the "\x20" representation in command names.

The number of command name characters supplied to lsof by UNIX dialects in files and structures varies by dialect. For example, Linux 2.4.27 supplies lsof the first 15 characters of command names and Solaris 9 supplies 16. Thus, even if "w" is zero (0), lsof can't report more characters for command names on those two UNIX dialects than they provide lsof.

14.7 Why does lsof reject some -c command names, saying their lengths are "> what system provides (nn)"?

The command name length that a specific system provides varies from dialect to dialect. As noted in the answer to the "Why doesn't lsof print all the characters of a command name?" question, Linux and Solaris provide a limited number of command name characters.

When more characters are specified in the parameter to the -c option, lsof considers it an error and issues a fatal error message -- e.g.,

lsof: "-c xxxxyyyy" length (8) > what system provides (7)

The only work-around is to specify no more characters to -c than the system provides to lsof.

14.8 Why does lsof sometimes print TYPE numbers instead of names?

When lsof can't convert a type number to a name for printing in the TYPE column, it will report the number as four octets.

## 14.9 Marker line format problems

### 14.9.1 Why won't lsof accept a marker line format?

lsof's Configure script must find the localtime(3) and strftime(3) functions in the dialect's C library in order to enable support for marker line formats.

Check the output of lsof's -v option for the presence of -DHAS\_STRFTIME in the compiler flags. If it isn't there, Configure didn't find the necessary two C library functions.

If you think lsof should have found the functions, make a copy of the C test program in the Configure script that it uses to find the functions. Then use the copy, or a more informative modification of it, to learn why Configure can't find the functions. You can find that program by searching for strftime.

### 14.9.2 Why does lsof reject the NL (%n) marker line format?

When repeat mode and field output (with -F) have both been specified, lsof won't allow new line (NL) formats to be specified with ``%n''. That's because the marker line is always guaranteed to be a single line.

There is no work-around to this restriction.

## 14.10 How are protocol state name exclusion and inclusion used?

Protocol state name inclusion and exclusion with the ``-s p:s'' option and its arguments have some issues to consider.

First, there is the problem of determining what state names, if any, the dialect produces. Try running this lsof command to find them:

```
$ lsof -i
```

Knowing the state names of interest, the next problem is to decide on the lsof options and their parameters that will produce the desired output.

Here some examples are probably the most useful.

To list only TCP socket files in LISTEN and CLOSE\_WAIT states, use:

```
$ lsof -itcp -stcp:listen,close_wait
or
$ lsof -iTCP -sTCP:LISTEN,CLOSE_WAIT
```

Case isn't important to lsof in protocol and state names.

To exclude TCP socket files in CLOSE\_WAIT state, use:

```
$ lsof -itcp -stcp:^close_wait
```

Note the `^' preceding close\_wait; it selects exclusion. You can mix included and excluded names in a comma separated list, but you may not include and exclude the same name for the same protocol.

To list TCP files in LISTEN state and UDP files in Idle state, use:

```
$ lsof -i -stcp:listen -sudp:idle
```

Note: if you don't accompany the ``-s p:s" list option and arguments with the -i option, lsof will list all other regular files, while applying the specified inclusion and exclusion specifications to network files. Generally, then, you want to use -i with -s.

#### 14.10.1 Why doesn't my dialect support state name exclusion and inclusion?

When state name inclusion and exclusion was added, I had access to test systems for AIX, Darwin, FreeBSD, Linux, PSTAT-based HP-UX and Solaris.

Therefore, I was unable to add and test the support to any other UNIX dialects.

If a dialect has the support, then the HASTCPUDPSTATE definition in its machine.h header file will be active; if not, it will be absent or commented out.

If your dialect doesn't have the support and you want it added, you will have to provide me Internet access to a test host, where I can compile lsof and have the credentials to test the changes the support requires. If that's possible for you, please contact me via e-mail at <abe@purdue.edu>. Make sure "lsof" appears in the "Subject:" line so my e-mail filter won't classify your letter as Spam.

## 15.0 Pyramid Version Problems

### 15.0.5 Statement of deprecation

As of Isof revision 4.52 support for all Pyramid versions has been dropped. Contact me via e-mail at <abe@purdue.edu> if you are interested in obtaining the last Isof Pyramid distribution. Make sure "Isof" appears in the "Subject:" line so my e-mail filter won't classify your letter as Spam.

## 16.0 SCO Problems

### 16.1 SCO OpenServer Problems

#### 16.1.1 How can I avoid segmentation faults when compiling Isof?

If you have an older SCO OpenServer compiler, it may get a segmentation fault when compiling some Isof modules. That appears to happen because of the -Ox optimization action requested in the Isof Makefile.

Try changing -Ox to -O with this make invocation:

```
$ make DEBUG=-O
```

Bela Lubkin supplied this tip and Steve Williams verified it.

#### 16.1.2 Where is libsocket.a?

If you compile Isof and the loader says it can't find the socket library, libsocket.a, called by the -lsocket option in the Isof compile flags, you probably are running an SCO OpenServer release earlier than 5.0 and don't have the TCP/IP Development System package installed.

You may have the necessary header files, because you have the TCP/IP run-time package installed, but if you don't have the TCP/IP Development System package installed, you won't have libsocket.a.

Your choices are to install the TCP/IP Development System package or upgrade to OpenServer Release 5.0. You will

find libsocket.a in 5.0 -- you'll find all the libraries and header files there, in fact -- and you can use gcc to compile lsof if you don't want to install the 5.0 Development System package.

### 16.1.3 Why do I get "warning C4200" messages when I compile lsof?

When you compile lsof under OSR 3.2v4.2 (and perhaps under earlier versions as well), you may get many compiler warning messages of the form:

```
node.c(183) : warning C4200: previous declarator is not
compatible with default argument promotion
```

In my opinion this is a bug in the OSR compiler. Because the compiler cannot handle full ANSI-C prototypes, it assumes default types for function parameters as it encounters untyped in a function prototype -- e.g., in this function declaration from node.c,

```
readrnode(ra, r)
KA_T ra;
struct rnode *r;
{
...

```

the compiler assigns default int types to the ra and r arguments.

Then, when the compiler encounters the fully typed parameters after the function skeleton and sees parameters with types that don't match the assumptions it previously made, it whines about its own assumptions.

You can ignore these messages.

## 16.2 SCO|Caldera UnixWare Problems

### 16.2.1 Why doesn't lsof compile on my UnixWare 7.1.1 or above system?

When you Configure lsof with the "uw" abbreviation and try to compile it for UnixWare 7.1.1, you may get compiler error messages like this:

```
UX:acomp: ERROR: "dproc.c", line 98:
undefined struct/union member: p_pgidp
```



This suggest that you probably have a non-stop cluster UnixWare 7.1.1 system. Its <sys/proc.h> header file differs from the one on the system where I did the lsof port to UnixWare 7.1.1. I currently don't have access to a non-stop cluster system to be able to develop changes to lsof that would make it compile and work there.

If you have a non-stop cluster UnixWare 7.1.1 system, want lsof for it, and can offer me a test account on the system, please contact me via e-mail at <abe@purdue.edu>. Make sure "lsof" appears in the "Subject:" line so my e-mail filter won't classify your letter as Spam.

If you have a system with nsc\_cfs and can offer me a test account on it, please contact me via e-mail at <abe@purdue.edu>. Make sure "lsof" appears in the "Subject:" line so my e-mail filter won't classify your letter as Spam.

#### 16.2.2 Why does lsof complain about node\_self() on my UnixWare 7.1.1 or above system?

If lsof exits immediately after issuing this message:

```
can't identify process NSC node; node_self(): <message>
```

It means that lsof has been built to run on a NonStop Cluster (NSC) UnixWare 7.1.1 or higher system and can't get the number of the node on which it is running. Lsof uses the node number to determine the path to the kernel boot file.

You can tell if lsof has been built for NSC by looking for "-DHAS\_UW\_NSC" in lsof's "-v" option output.

If the system on which you're trying to run lsof isn't running an NSC kernel, you will need to build a non-NSC lsof.

#### 16.2.3 Why does UnixWare 7.1.1 or above complain about -lcluster, node\_self(), or libcluster.so?

When you build, compile, and load lsof for UnixWare 7.1.1 and above, ld may complain that it can't find the -lcluster library or that the node\_self symbol is undefined. When you try to run an existing lsof binary it may complain that

libcluster.so can't be found.

These messages mean the tests made by Configure on your system led it to believe your system is running a NonStop Cluster (NSC) kernel, or the lsof binary you're trying to use was built on a NonStop Cluster system. If an lsof binary was built for NSC, this shell command produces output:

```
$ strings
<lsof_binary> | grep HAS_UW_NSC
```

If that's not the case, and you can rebuild lsof, set the UW\_HAS\_NSC environment variable to "N" and do this:

```
$ Configure -n clean
$ UW_HAS_NSC=N
$ export UW_HAS_NSC
$ Configure -n uw
$ make
```

You can also edit Makefile and lib/Makefile. Remove -DHAS\_UW\_NSC from the CFGF strings. Remove -lcluster from the CFGF strings. Then run make again.

If you have an existing NSC lsof binary and you want one for a non-NSC system, you will have to build lsof yourself on the system where you want to use it. (That's always a good idea anyway.)

#### 16.2.4 Why does UnixWare 7.1.1 or above lsof complain it can't read the kernel name list?

If lsof complains:

```
can't read kernel name list from <path>
```

It means that lsof can't find the booted kernel image file at <path>. On NonStop Cluster (NSC) UnixWare 7.1.1 or higher systems lsof determines the booted file path by examining this file:

```
/stand/^node_self^/boot
```

If examining that file doesn't lead to an NSC path, lsof uses:

/stand/1/unix

On non-NSC systems lsof expects the booted kernel image to be in /stand/unix.

If your booted kernel image is in a different place, use lsof's "-k <path>" option to specify its path.

16.2.5 Why doesn't lsof report link count, node number, and size for some UnixWare 7.1.1 or above CFS files?

Lsof reports link count, node number, and size for open CFS files as recorded in their kernel node structure's cached attributes. Sometimes not all attributes are cached on the node where lsof runs, so lsof cannot report them.

16.2.6 Why doesn't lsof report open files on all UnixWare 7.1.1 NonStop Cluster (NSC) nodes?

Lsof can only report on files open on the node on which it runs, because the information lsof reports comes from the private kernel memory of the node. This may mean that asking lsof to find a specific open file, or use of a specific Internet address or port, may not report all open instances on nodes other than the one used to run lsof.

You can use the NSC onnode(1) command to run lsof on specific nodes, or the onall(1) command to run lsof on all nodes -- e.g.,

```
$ onall lsof [options] 2>&1 | less
```

or

```
$ onnode node-number lsof [options] 2>&1 | less
```

Note that, when lsof is run all nodes, the path name component assembly results it reports in its NAME column may vary, because the dynamic name cache from which lsof gets the components is private to the kernel of each node.

Also note the use of shell redirection in the examples to merge the standard error file information from onnode and onall with lsof's standard output file output. That will put the onnode and onall node announcements in proper sequence with lsof's output.

16.2.7 Why doesn't lsof report the UnixWare 7.1.1 NonStop Cluster

(NSC) node a process is using?

To induce lsof to report the node on which a process runs would be a significant, non-standard modification to lsof.

It

has much wider implications than merely the printing of a number in an output column. I'm not currently (April 2001) prepared to undertake such a modification.

If you want node-specific NSC information about open files, run lsof under the control of onall(1) or onnode(1).

```
$ onall lsof [options] 2>&1 | less
```

or

```
$ onnode node-number lsof [options] 2>&1 | less
```

16.2.8 Why does the compiler complain about missing UnixWare 2.1[.x] header files?

SCO|Caldera didn't ship the following header files with UnixWare 2.1 through 2.1.3:

```
<fs/proc/prdata.h>
<fs/procfs/prdata.h>
<sys/fs/fifonode.h>
<sys/fs/namenode.h>
```

Lsof needs those header files for its compilation. Contact SCO|Caldera to get copies of those header files.

If you can't get the header files from SCO|Caldera, please contact me via e-mail at <abe@purdue.edu>. Make sure "lsof" appears in the "Subject:" line so my e-mail filter won't classify your letter as Spam.

## 17.0 Sun Problems

### 17.0.5 Statement of deprecation

Lsof support for SunOS 4.1.x was last tested at revision 4.51. Contact me via e-mail at <abe@purdue.edu> if you're interested in obtaining it. Make sure "lsof" appears in the "Subject:" line so my e-mail filter won't classify your letter as Spam.

### 17.1 My Sun gcc-compiled lsof doesn't work -- why?

Gcc can be used to build lsof successfully. However, an improperly installed Sun gcc compiler will usually not produce a working lsof.

If your Sun gcc-compiled lsof doesn't report anything, or reports ``can't read proc table," or gcc refuses to compile lsof without error, check that the gcc step that "fixes" Sun header files was run on the system where you're using gcc to compile lsof. As an alternative, if you have the SunPro C 5.0 compiler or later available, use it to compile lsof -- e.g., use the solariscc Configure abbreviations.

#### 17.2 How can I make lsof compile with gcc under Solaris 2.[456], 2.5.1, 7, 8 or 9?

Presuming your gcc-specific header files are wrong for Solaris, edit the lsof Configure-generated Makefile and lib/Makefile and make this change:

```
CFGF= -Dsolaris=20400 ...
to
CFGF= -Dsolaris=20400 -D__STDC__=0 -I/usr/include ...
```

or change:

```
CFGF= -Dsolaris=20500 ...
to
CFGF= -Dsolaris=20500 -D__STDC__=0 -I/usr/include ...
```

or change:

```
CFGF= -Dsolaris=20501 ...
to
CFGF= -Dsolaris=20501 -D__STDC__=0 -I/usr/include ...
```

This is only a temporary work-around. You really should instruct gcc to update your gcc-specific header files or install a recent gcc (e.g., 3.2), which has no need for private copies of Solaris include files.

#### 17.3 Why does Solaris Sun C complain about system header files?

You're probably trying to use /usr/ucb/cc if you get compiler complaints like:

```
cc -O -Dsun -Dsolaris=20300 ...
"/usr/include/sys/machsig.h", line 81: macro BUS_OBJERR
```

redefines previous macro at "/usr/ucbinclude/sys/signal.h",  
line 444

Note the reference to "/usr/ucbinclude/sys/signal.h".

It

reveals that the BSD Compatibility Package C compiler is  
in use. Lsof requires the ANSI C version of the Solaris  
C compiler, usually found in /usr/opt/bin/cc or  
/opt/SUNWspro/bin/cc.

Try adding a CC string to the lsof Makefile that points to  
the Sun ANSI C version of the Sun C compiler -- e.g.,

```
CC= /usr/opt/bin/cc
```

or

```
CC= /opt/SUNWspro/bin/cc.
```

#### 17.4 Why doesn't lsof work under my Solaris 2.4 system?

If lsof doesn't work under your Solaris 2.4 system -- e.g.,  
it produces no output, little output, or the output is  
missing command names or file descriptors -- you may have  
a pair of conflicting Sun patches installed.

Solaris patch 101945-32 installs a kernel that was built  
with a <sys/auxv.h> header file whose NUM\_\*\_VECTORS  
definitions don't match the ones in the <sys/auxv.h> updated  
by Solaris patch 102303-02.

NUM\_\*\_VECTORS in the kernel of patch 101945-32 are smaller  
than the ones in the <sys/auxv.h> of patch 102303-02.

The

consequence is that when lsof is compiled with the <sys/auxv.h>  
whose NUM\_\*\_VECTORS definitions are larger than the ones  
used to compile the patched kernel, lsof's user structure  
does not align with the one that the kernel employs.

If you have these two patches installed, contact Sun and  
complain about the mis-match.

You may be able to work around the problem by editing  
/usr/include/sys/auxv.h to have the following NUM\_\*\_VECTORS  
definitions:

```
#define NUM_GEN_VECTORS 4
#define NUM_SUN_VECTORS 8
```

The Configure script issues a prominent WARNING that you should

try the work-around.

I thank Leif Hedstrom for identifying the offending patches.

#### 17.5 Where are the Solaris header files?

If you try to compile lsof under Solaris and get a compiler complaint that it can't find system header files, perhaps you forgot to add the header file package, SUNWhea.

#### 17.6 Where is the Solaris /usr/src/uts/<architecture>/sys/machparam.h?

When you try to Configure lsof for Solaris 2.[23456], 2.5.1, and 7 -- e.g., on a `uname -m` == sun4m system -- Configure complains:

```
grep: /usr/src/uts/sun4m/sys/machparam.h:
No such file or directory
grep: /usr/src/uts/sun4m/sys/machparam.h:
No such file or directory
```

And when you try to compile the configured lsof, cc or gcc complains:

```
dproc.c:530: `KERNELBASE' undeclared (first use this function)
```

The explanation is that somehow your Solaris system doesn't have the header files in /usr/src/uts it should have. Perhaps someone removed the directory to save space. Perhaps you're using a gcc installation, copied from another system. In any event, you will have to load the header files from the SUNWhea package of your Solaris distribution.

KERNELBASE is an important symbol to lsof -- it keeps lsof from sending an illegal kernel value to kvm\_read() where a segmentation violation might result (a bug in the kvm library). Lsof can get illegal kernel values because it reads kernel values slowly with kvm\_read() calls that the kernel is changing rapidly.

Lsof doesn't need KERNELBASE at Solaris 2.5 and above, because it has a KERNELBASE value whose address lsof can find with /dev/ksyms and whose value it can read with kvm\_read(). Under Solaris 2.5 /usr/src/uts has moved to /usr/platform.

## 17.7 Why does Solaris lsof say ``can't read proc table'`?

When lsof collects data on processes, using the `kvm_*`() functions to scan the kernel's proc structure table, it checks to make sure it has identified a reasonable number of them -- a minimum of three. When lsof can't identify three processes during a scan, it repeats the scan.

When five scans fail to yield three processes, lsof issues the fatal message:

lsof: can't read proc table

and exits.

Usually lsof fails to identify three processes during a scan because its idea of the form of the proc structure differs from that being used by the kernel. Since the proc structure is defined in `<sys/proc.h>` and other `/usr/include` header files, the root cause of a proc structure discrepancy usually can be found in the composition of `/usr/include`.

One common way that `/usr/include` header files can be incorrect is that gcc was used to compile lsof, gcc used its special (i.e., "fixed") header files instead of the ones in `/usr/include`, and the special gcc header files weren't updated when Solaris was. Answers to these questions:

My Sun gcc-compiled lsof doesn't work -- why?

How can I make lsof compile with gcc under Solaris 2.[456], 2.5.1, 7, 8 or 9?

Why does Solaris Sun C complain about system header files?

discuss the gcc header file problem and offer suggestions on how to fix it or work around it.

It may also be that you are trying to run a version of lsof that was compiled on an older version of Solaris. For example, an lsof executable, compiled for Solaris 2.4, will produce the ``can't read proc table" message if you try to run it under Solaris 2.5.

If you have compiled lsof under Solaris 2.5 and it still won't work, see if the header files in `/usr/include` have been updated to 2.5, or still represent a previous version of Solaris.



Another source of header file discrepancies to consider is the Solaris patch level and whether a binary kernel patch was not matched with a corresponding header file update. See the "Why doesn't lsof work under my Solaris 2.4 system?" question for an example of one in Solaris 2.4 -- there may be other such patch conflicts I don't know about.

#### 17.8 Why does Solaris lsof complain about a bad cached clone device?

When lsof revisions below 4.04 have been run on a Solaris system and have been allowed to create a device cache file, the running of revisions 4.04 and above on the same systems may produce this complaint:

```
lsof: bad cached clone device: ...
lsof: WARNING: created device cache file: ...
```

This is the result of a change in the device cache file that took place at lsof revision 4.04. The change introduced a node number into the clone device lines of the device cache file and was done in such a way that lsof could detect device cache files whose clone lines don't have node numbers (lines created by previous lsof revisions) and recognize the need to regenerate the device cache file.

#### 17.9 Why doesn't Solaris make generate .o files?

Solaris /usr/ccs/bin/make won't generate .o files from .c files if /usr/share/lib/make/make.rules is missing. It may be found in and installed from the SUNWsport package.

#### 17.10 Why does lsof report some Solaris 2.3 and 2.4 lock types as `N'?

For Solaris 2.3 with patch P101318 installed at level 45 or above, and for all versions of Solaris 2.4, NFS locks are represented by a NFS-specific kernel lock structure that sometimes lacks a read or write lock type indicator. When lsof encounters such a lock structure, it reports the lock type as `N'.

#### 17.11 Why does lsof Configure say "WARNING: no cc in ..."?

When lsof's Configure script is executed with the solariscc abbreviation it tries to make sure it's using the Sun C compiler and not the UCB substitute from /usr/ucb/cc.

Thus, it looks for cc in the "standard" Sun compiler location, /opt/SUNWspro/bin.

If Configure can't find cc there, it issues the warning:

```
lsof: WARNING: no cc in /opt/SUNWspro/bin;
using cc without path.
```

and uses cc for the compiler name, letting the shell find cc with its PATH environment variable.

You can tell Configure where to find your cc with the SOLARIS\_CCDIR cross-configuration environment variable. (See 00XCONFIG for more information on SOLARIS\_CCDIR). For example, use this Configure shell command:

```
SOLARIS_CCDIR=/usr/special/bin Configure -n solarisc
```

(SOLARIS\_CCDIR should be the full path to the directory containing your cc.)

## 17.12 Solaris 7, 8 and 9 Problems

### 17.12.1 Why does lsof say the compiler isn't adequate for Solaris 7, 8 or 9?

Solaris 7, 8 and 9 kernels come in two flavors, 32 and 64 bit. 64 bit kernels run on machines that support the SPARC v9 instruction set architecture. Separate executables for some programs, -- e.g., ones using libkvm like lsof -- must be built for 32 and 64 bit kernels.

Previous Sun (e.g., SC4.0) and earlier gcc compilers will build lsof for 32 bit kernels, but they won't build it for 64 bit kernels. Compilers that will build lsof for 64 bit Solaris 7, 8 and 9 kernels are the Sun WorkShop Compilers C 5.0 and above, and recent gcc versions, e.g., 3.2.

When given the ``-xarch=v9" flag, the C 5.0 compiler and above, and associated loader and 64 bit libraries will build a 64 bit lsof executable; when given the "-m64" or "-mcpu=v9" (deprecated) flags, an appropriate gcc compiler will build a 64 bit lsof executable.

When the lsof Configure script detects a 64 bit kernel is in use (e.g., by executing `/bin/isainfo -kv`), and when it finds that the specified compiler is inappropriate,

it complains with these  
messages:

For gcc:

```
!!!WARNING!!!=====!!!WARNING!!!=====!!!WARNING!!!
"! !"
"! LSOF NEEDS TO BE CONFIGURED FOR A 64 BIT KERNEL, BUT !"
"! THIS GCC DOESN'T SUPPORT THE BUILDING OF 64 BIT !"
"! SOLARIS EXECUTABLES. LSOF WILL BE CONFIGURED FOR A !"
"! 32 BIT echo KERNEL. !"
"! !"
!!!WARNING!!!=====!!!WARNING!!!=====!!!WARNING!!!
```

For Sun C:

```
!!!WARNING!!!=====!!!WARNING!!!=====!!!WARNING!!!
! !
! LSOF NEEDS TO BE CONFIGURED FOR A 64 BIT KERNEL, BUT |
! THE VERSION OF SUN C AVAILABLE DOESN'T SUPPORT THE !
! -xarch=v9 FLAG. LSOF WILL BE CONFIGURED FOR A 32 BIT !
! KERNEL. !
! !
!!!WARNING!!!=====!!!WARNING!!!=====!!!WARNING!!!
```

17.12.2 Why does Solaris 7, 8 or 9 lsof say "FATAL: lsof was compiled  
for..."?

Solaris 7, 8 or 9 lsof may say:

lsof: FATAL: lsof was compiled for a xx bit kernel,  
but this machine has booted a yy bit kernel.

Where: xx = 32 or 64  
yy = 64 or 32

(xx and yy won't match.)

This message indicates that lsof was compiled for one size  
kernel and is being asked to execute on a different size  
one. That's not possible for programs like lsof that use  
libkvm.

Depending on the instruction sets for which you need Solaris  
7, 8 or 9 lsof, you may need two or more versions of lsof,  
compiled for each kernel size, installed for use with  
/usr/lib/isaexec. See the "How do I install lsof for

Solaris 7, 8 or 9?" section of this document for more information on that.

#### 17.12.3 How do I build lsof for a 64 bit Solaris kernel under a 32 bit Solaris kernel?

If your Solaris system has an appropriate compiler (e.g., Workshop Compilers C 5.0 and above, or a recent gcc like 3.2) and the 64 bit libraries have been installed, you can force lsof's Configure script to build a 64 bit version of lsof with:

```
$ SOLARIS_KERNBITS=64 Configure -n solariscc
```

The SOLARIS\_KERNBITS environment variable is part of the lsof cross-configuration support, described in the 00XCONFIG file of the lsof distribution.

#### 17.12.4 How do I install lsof for Solaris 7, 8 or 9?

If you are installing lsof where it will be used only under the bit size kernel for which it was built, no special installation is required.

If, however, you are installing different versions of lsof for different bit sizes -- e.g., for use on a 64 bit NFS server and from its 32 bit clients -- you should read the man page for isaexec(3C) and install lsof according to its instructions.

The executable at the directory where lsof is to be found should be a hard link to /usr/lib/isaexec or a copy of it.

In the directory there must be instruction architecture subdirectories -- e.g., .../sparc/ and .../sparcv9/. The lsof for 64 bit size kernels is installed in the .../sparcv9/ subdirectory; the one for 32 bit size kernels, in .../sparc/.

For example, if you're installing 32 and 64 bit lsof executables in /usr/local/etc, you would:

```
cd /usr/local/etc
ln /usr/lib/isaexec lsof
mkdir sparc sparcv9
install the 32 bit lsof as sparc/lsof
install the 64 bit lsof as sparcv9/lsof
chmod, chown, and chgrp sparc/lsof and
```

sparcv9/lsof appropriately

Lsof permissions and ownerships are the same whether one or more lsof executables are being installed, with or without the /usr/lib/isaexec hard link.

17.12.5 Why does my Solaris 7, 8 or 9 system say it cannot execute lsof?

When you attempt to execute lsof, your Solaris 7, 8 or 9 shell may complain:

```
ksh: ./lsof: cannot execute
```

If the lsof executable exists and has the proper execution permissions, this error may be the result of trying to execute an lsof, built for a 64 bit kernel, on a 32 bit kernel.

This will tell you about the lsof executable:

```
$ file lsof
lsof: ELF 64-bit MSB executable SPARCV9 Version 1,
dynamically linked, not stripped
```

The "64-bit" notation indicates the binary was built for a 64 bit kernel. To see the running kernel bit size, use this command:

```
$ isainfo -kv
32-bit sparc kernel modules
```

The "32-bit" notation indicates a 32 bit kernel has been booted.

The only work-around is to obtain, or Configure and make, an lsof for the appropriate kernel bit size. If you Configure and make lsof on the kernel where you wish to run it the proper compiler, the lsof Configure step will generate Makefiles that can be used with make to build an appropriate lsof executable.

To compile a 64 bit lsof, you must have an appropriate compiler -- i.e., Sun WorkShop Compilers C 5.0 or higher or a recent gcc like 3.2.

17.12.6 What gcc will produce 64 bit Solaris

7, 8 and 9 executables?

8 and 9 executables?

Properly built and installed recent gcc versions -- e.g.,  
3.2 -- will build lsof for 64 bit Solaris kernels.

If you update your gcc version to 3.2 or later, make sure the private gcc header files become current -- i.e., clear out any private header files from a previous gcc or Solaris installation before installing the new ones, or build to a new --prefix root and replace the old root with it after the build and installation are complete.

17.12.7 Why does lsof on my Solaris 7, 8 or 9 system say, "can't read namelist from /dev/ksyms?"

You're probably trying to use an lsof executable built for an earlier Solaris release on a 64 bit Solaris 7, 8 or 9 kernel. The output from ``lsof -v`` will tell you the build environment of your lsof executable. You should also have gotten a warning message that lsof is compiled for a different Solaris version than the one under which it is running -- something like this:

lsof: WARNING:  
compiled for Solaris release X; this is Y

You need to build lsof on the system where you want to use it. For 64 bit Solaris 7, 8 and 9 you need a compiler that can generate 64 bit Solaris executables -- e.g., the Sun Workshop 5 C compiler or later, or a recent gcc version like 3.2. See the "Why does lsof say the compiler isn't adequate for Solaris 7, 8 or 9?" section and the ones following it for a discussion of building lsof for 64 bit Solaris 7, 8 or 9.

17.13 Solaris and COMMON

17.13.1 What does COMMON mean in the NAME column for a Solaris VCHR file?

When lsof puts COMMON or (COMMON) in the NAME column of a Solaris VCHR file, it means that the file is handled by the special file system functions of the kernel through a common vnode.

17.13.2 Why does a COMMON Solaris VCHR file sometimes seem to have an incorrect minor device number?

When lsof reports on an open file in a Solaris special file system that uses a COMMON vnode, and the file is a VCHR file, lsof tries to locate the associated device node by looking for matches on the major and minor device numbers first.

If no major and minor match results, lsof then looks for a match on pseudo and clone device files. (See /devices/pseudo.) Those device nodes are matched specially by either their major or minor device numbers, but not both. Hence, when lsof finds a match under those special conditions, it may report a value in its output DEVICE column that differs from one of the major and minor numbers of the device node.

Here's an example from a sun4m Solaris 7 system:

```
$ ls -li /devices/pseudo/pm@0:pm
151261 crw-rw-rw- 1 root sys 117, 0 ...
$ lsof /devices/pseudo/pm@0:pm
COMMAND ... DEVICE ... NODE NAME
powerd 117,1 ... 151261 /devices/pseudo/pm@0:pm (COMMON)
Xsun ... 117,0 ... 151261 /devices/pseudo/pm@0:pm
```

Note that the DEVICE value for the file with (COMMON) in its name field has a different minor device number (1) from what ls reports (0), while the DEVICE value for the file without (COMMON) matches the ls output exactly. Both match on the major device number, 117. The minor device number mis-match is a result of the way the Solaris kernel handles special file system common vnodes, and it's the reason lsof puts (COMMON) after the name to signal that a mis-match is possible.

#### 17.14 Why don't lsof and Solaris pfiles reports always match?

/usr/proc/bin/pfiles for Solaris 2.6, 7, 8, and 9 also reports information on open files for processes. Sometimes the information it reports differs from what lsof reports.

There are several reasons why this might be true. First, because pfiles is a Sun product, based on Sun kernel features, its developers have a better chance of knowing exactly how open file information is organized. I sometimes have to guess at how kernel file structure linkages are constructed by gleaning hints from header files.

Second, lsof is aimed at providing information, specifically device and node numbers, that can be used to identify named file system objects -- i.e., path names. Thus, lsof tries to make sure its device and node numbers match those reported by stat(2). Pfiles doesn't always report numbers that match stat(2) -- e.g., for files using clone and pseudo devices via common vnodes like the nlist() /dev/ksyms usage.

Here's the Solaris 7 COMMON VCHR example again with additional pfiles output:

```
$ ls -li /devices/pseudo/pm@0:pm
151261 crw-rw-rw- 1 root sys 117, 0 ...
$ lsof /devices/pseudo/pm@0:pm
vic1: 10 = lsof /dev/pm
COMMAND ... DEVICE ... NODE NAME
powerd ... 117,1 ... 151261 /devices/pseudo/pm@0:pm (COMMON)
Xsun ... 117,0 ... 151261 /devices/pseudo/pm@0:pm
$ pfiles ...
0: S_IFCHR ... dev:32,24 ino:61945 ... rdev:117,1
...
14: S_IFCHR ... dev:32,24 ino:151261 ... rdev:117,0
```

Note that the NODE number, reported by lsof, matches what ls(1) and stat(2) report, while the ino value pfiles reports doesn't. Lsof also indicates with the (COMMON) notation that the DEVICE number is a pseudo one, derived from the character device's value. The lsof DEVICE value matches the pfiles rdev value, correct behavior for a character device, but pfiles gives no sign that it's not possible to find that character device number in /devices with ls(1) or stat(2).

17.15 Why does lsof say, "kvm\_open(namelist=default, core=default): Permission denied?"

Lsof needs permission to read from the /dev/kmem and /dev/mem memory devices. Access to them is opened via a call to the kvm\_open() library function and it reports the indicated message.

You must give lsof permission to read the memory devices. The super user can almost always do that, but other lsof users can do it if some group -- e.g., sys -- has permission to read the memory devices, and the lsof binary is installed



with the group's ownership and with the setgid permission bit enabled.

#### 17.16 Why is lsof slow on my busy Solaris UFS file system?

Lsof may be slow on a busy Solaris UFS file system when UFS logging has been enabled with the "logging" mount option. That option can significantly increase disk operations under certain conditions -- e.g., when a lot of files are accessed quickly.

When only the "logging" option is specified to mount, all file accesses (atime updates) are logged to the UFS logging queue. Each atime update requires two writes to the disk to complete it.

If you want to do UFS logging -- and there are reliability advantages to it -- consider using the "logging,noatime" mount options instead. That will shift atime updates from the logging queue to fewer and independent asynchronous operations, consequently making the UFS logging queue a smaller bottleneck.

Consult mount\_ufs(1M) for more information on the logging and noatime options.

(My thanks to Casper Dik for this tip on improving the performance of UFS logging.)

#### 17.17 Why is lsof so slow on my Solaris 8 or 9 system?

Solaris 8 has a post-release feature upgrade modifying kernel name cache (DNLC) handling that can slow lsof throughput dramatically. The feature, sometimes called negative DNLC caching, is standard in Solaris 9.

As best I can tell, when you install the Solaris 8 MU1 package, you get negative DNLC caching. If this pipe produces any output, your system has negative DNLC caching.

```
$ nm /dev/ksyms | grep negative_cache_vnode
```

The reason negative DNLC caching perturbs lsof is that a single vnode address (found in the negative\_cache\_vnode kernel variable) is used to mark entries in the DNLC that are not (the negative part) found on disk.

Since a single vnode address (the DNLC key lsof uses) can represent many (I've seen upwards of 30,000.) DNLC entries, their presence overloads lsof's internal DNLC hashing function. An overloaded hash function is a slow hash function, and lsof's slows to a crawl when it encounters thousands of keys that produce the same value when the lsof DNLC hash function is applied to them.

The solution is simple -- ignore negative DNLC cache keys. They don't represent path name components lsof can use. Lsof revisions 4.50 and above have an addition that ignores them and the performance of those lsof revisions improves significantly when presented with negative DNLC cache keys.

If you don't have an lsof revision at 4.51 or later, there's a work-around. Use lsof's ``-C" option. It disables lsof's DNLC caching. Of course, that also inhibits the reporting of any path name components from the kernel DNLC. When ``-c" is used, lsof will continue to report file system and character device paths.

## 17.18 Solaris and VxFS

### 17.18.1 Why doesn't lsof support VxFS 3.4 on Solaris 2.6, and above?

Lsof will not support VxFS version 3.4 on Solaris 2.6 and above unless some files from VxFS Update 2 have been installed. VxFS 3.4 FCS and VxFS 3.4 update 1 lack the header files lsof normally uses to obtain information from the VxFS 3.4 kernel node structure, vx\_inode. VxFS 3.4 Update 2 provides a method whereby lsof can obtain the necessary vx\_inode information from the vxfsu\_get\_ioffsets() function in Veritas utility libraries.

The utility libraries (32 bit and 64 bit versions) may be found in /opt/VRTSvxfs/lib. An ancillary header file may be found in /opt/VRTSvxfs/include/sys/fs/vx\_libutil.h. Documentation of the vxfsu\_get\_ioffsets(3) function may be found in /opt/VRTS/man/man3/vxfsu\_get\_ioffsets.3.

Those files of VxFS 3.4 Update 2 may be downloaded from:

[ftp://ftp.veritas.com/pub/support/vxfs\\_34.i64243.tar](ftp://ftp.veritas.com/pub/support/vxfs_34.i64243.tar)

The vxfs\_34.i64243.tar archive will unpack into an i64243

directory containing these files:

```
$ ls i64243
README
libvxfsutil.sol26.sums
libvxfsutil.sol26.tar.Z
libvxfsutil.sol27.sums
libvxfsutil.sol27.tar.Z
libvxfsutil.sol28.sums
libvxfsutil.sol28.tar.Z
```

Read README. Select the \*.tar.Z file appropriate for your Solaris version. Its contents will unpack into /opt/VRTS and /opt/VRTSvxfs, so you will need sufficient permission -- e.g., do it as root -- to unpack the uncompressed archive. Once you've done that, it's a good idea to compare the checksums of the archive you unpacked with the ones recorded in the appropriate \*.sums file. Use `sum -r` to verify the checksums.

For example, if you want the Solaris 8 version, uncompress and unpack libvxfsutil.sol28.tar.Z -- e.g.,

```
$ su
...
cd i6423
zcat libvxfsutil.sol28.tar.Z | tar xf -
```

That should create these new files and subdirectories with the indicated checksums:

```
File or subdirectory sum -r

/opt/VRTSvxfs/include/vxfsutil.h 03938
/opt/VRTSvxfs/lib/libvxfsutil.a 51794
/opt/VRTSvxfs/lib/sparcv9/
/opt/VRTSvxfs/lib/sparcv9/libvxfsutil.a 07420
/opt/VRTS/man/man3/
/opt/VRTS/man/man3/vxfsu_get_ioffsets.3 62480
```

Once these files are in place, run lsof's Configure script for the solaris or solariscc abbreviation. Configure will locate the appropriate VxFS 3.4 Update 2 files and set up for the making of an lsof that will properly display open VxFS 3.4 file information.

17.18.2 Why does lsof report "vx\_inode: vxfsu\_get\_iooffsets error" for open Solaris 2.6 and above VxFS 3.4 and above files?

Even when lsof supports VxFS 3.4 and above on Solaris 2.6 and above, it may report "vx\_inode: vxfsu\_get\_iooffsets error" in the NAME column for all VxFS files.

The usual cause is that lsof doesn't have permission to read the file at the end of the /dev/vxportal symbolic link. If, for example, lsof has been installed setgid(sys), then the /dev/vxportal symbolic link destination should be owned by the sys group and readable by it.

Update 2 for VxFS 3.4 sets the modes of the /dev/vxportal symbolic link destination to 0640 and the group ownership to sys. But I have had a report that the modes are wrong in a VxFS 4.0 installation.

Another cause may be that the system has more than one version of VxFS installed (Only one can be active.), and lsof's Configure script did not choose the header files and libraries for the active VxFS version. Configure opts for VxFS 4.0 and above header files and libraries (in /opt/VRTS) in preference to those for VxFS below 4.0 (in /opt/VRTSvxfs).

Look for the directories /opt/VRTS and /opt/VRTSvxfs. If you have /opt/VRTS, make sure its header and library symbolic links point to those of the active VxFS version.

If you have both directories, look at the CFLAGS that Configure constructed for making lsof and see which directory path follows a -I option. If that doesn't match the directory path of the active VxFS version, try pointing Configure at the correct directory with the SOLARIS\_VXFSINCL environment variable -- e.g.,

```
$ SOLARIS_VXFSINCL=/opt/.../include ./Configure -n solaris
```

17.18.3 Why does Solaris Configure claim there is no VxFS library?

The lsof Configure script, when configuring for Solaris, may report:

```
FATAL: no VxFS .../libvxfsutil.a
```

That fatal error message indicates lsof has found the VxFS

utility library's header files, but can't find the library itself in the expected location adjacent to the header files.

One possible cause is an incorrect symbolic link from `/opt/VRTS/lib/sparcv9/libvxfsutil.a` to the library's real location. (Some VxFS distributions declared the link incorrectly.) Use ``ls -lL`` on that path to see if it exists. If it doesn't exist, the link may be missing an additional leading `"../"` component.

If the problem is a missing `"../"` from the library's link, you can correct the link or check with Veritas/Symantec for the patch that corrects it.

If the problem is not a missing `"../"`, and you know the `libvxfsutil.a` location, you can define its path in the `SOLARIS_VXFSLIB` environment variable before running the `lsof` Configure script. (See `00XCONFIG` for information about using the `SOLARIS_VXFSLIB` environment variable.)

If you have no `libvxfsutil.a`, you must obtain it from Veritas/Symantec or find it in your VxFS installation package.

#### 17.18.4 Why doesn't Solaris `lsof` report VxFS path name components?

Solaris `lsof` will report path name components for VxFS versions that use the common Solaris Dynamic Name Lookup Cache (DNLC) or on some file systems of VxFS versions that support the VxFS Reverse Name Lookup (RNL) facility.

VxFS versions 3.3 (approximately) and below use the common Solaris DNLC. (I haven't been able to determine exactly when VxFS stopped using the DNLC.) For versions above that boundary, but below 4.0, `lsof` can't report path name components.

At VxFS 4.0 and above, `lsof` can be compiled to use the VxFS RNL facility for reporting path names. If `"-DHASVXFSRNL"` appears in the compiler flags section of `lsof "-v"` option output, then the `lsof` Configure script detected the VxFS RNL facility and `lsof` has been compiled to use it.

`lsof`'s use of the RNL facility can fail when the VxFS file system disk layout version is below 6. In that case, `lsof` can report no path name components. For more information, see the `vxfs_inotopath(3)` manual page. any of the following commands will show the disk layout version for a VxFS file system, when

supplied the block device or mount point on which the file system is mounted.

```
fstyp -v <block_device>
or
mkfs -m <block_device>
or
vxupgrade <mount_point>
```

You must have permission to read the block device -- e.g., be the root user.

You may also be able to upgrade an older disk layout to one that will work with the RNL. See the vxupgrade(1M) man page for more information on that.

When lsof can't report VxFS path name components, it reports the file system mount point and the path name of device on which it is mounted. The device path name is enclosed in parentheses.

#### 17.18.5 Why does Solaris 10 lsof report scrambled VxFS paths?

Solaris

10 lsof may report a bogus, scrambled path for an open VxFS file, when lsof obtains the path from a vnode's cached path. Veritas/Symantec reports that their Solaris 10 implementation has bugs in the way it handles the Solaris 10 vnode cached path and those bugs will be fixed in an upcoming patch some time after August 15, 2005.

When Solaris 10 lsof reports a path for an open VxFS file obtained via the VxFS Reverse Name Lookup facility, the path will be correct.

Also see the answers to the questions "Why does Solaris 10 lsof sometimes report the wrong path name?" and "Why doesn't Solaris lsof report VxFS path name components?"

#### 17.19 Large file problems

##### 17.19.1 Why does lsof complain it can't stat(2) a Solaris 2.5.1 large file?

When given an argument that is the path to a Solaris 2.5.1 file, enable for large file operations with the O\_LARGEFILE open(2) option, lsof complains that it can't stat(2) the file. That's because lsof isn't using a stat(2) call and

associated  
structure enabled for large files.

This error has been fixed, starting at lsof revision 4.58 for Solaris 2.6 and above. That fix won't work on Solaris 2.5.1 and I no longer have access to a Solaris 2.5.1 test system to develop a separate fix.

The work-around is to avoid specifying a O\_LARGEFILE path as an argument to lsof on Solaris 2.5.1. Instead use a combination of lsof and grep to achieve the same results, albeit more clumsily.

17.20 Why does lsof get a segmentation fault on 64 bit Solaris 8 using NIS+?

I have received a report from Gary Craig that lsof produces a segmentation fault on his 64 bit Solaris 8 system using NIS+. Via an independent test program we have exonerated lsof and tracked the fault to the NIS+ `__nis_server_name()` function in the C name server library, -lnsl.

Lsof causes the `__nis_server_name()` NIS+ function to be called by calling `getservent()` to read entries of the port number to service name map.

The only Sun bug ID that appears to describe the problem is 4304244, although its text is unclear enough to leave room for doubt.

Until Sun eliminates the `__nis_server_name()` segmentation fault cause, a work-around for lsof is to use its "-P" option, causing lsof to avoid port to service name lookups.

17.21 Will lsof crash the Solaris kernel?

I've received and investigated one report that it has when the Sun hardware (a QME interface) was faulty. Today (May 23, 2002) I've learned that Sun has reports of kernel crashes caused by adb, lsof, and mdb.

The Sun investigation pinpointed a problem in the `/dev/kmem` kernel driver and there is a Sun bug report, 4344513, about the problem. There is a fix in Solaris 9, and patches for Solaris 7 and 8 (SPARC and x86).

To see if your Solaris system is fixed, look for a

/devices/pseudo/\*allkmem node.

Extensive address filtering was added to lsof revision 4.50 to forestall what I then (July 2001) believed to be only the possibility that lsof might crash Solaris. However, the filtering isn't perfect, since a filtered address might become invalid after lsof has filtered it but before lsof has delivered it to /dev/kmem. That filtering work is described in ../dialects/sun/solaris\_kaddr\_filters, also available at:

[ftp://lsof.itap.purdue.edu/pub/tools/unix/lsof/solaris\\_kaddr\\_filters](ftp://lsof.itap.purdue.edu/pub/tools/unix/lsof/solaris_kaddr_filters)

The best and safest work-around is to upgrade to Solaris 9 or install an appropriate patch or its equivalent from this list:

	Solaris SPARC	x86
Version	Patch	Patch
=====	=====	=====
7	106541-20	106542-20
8	108528-14	108529-14

17.22 Why does lsof on Solaris 7, 8, or 9 report a kvm\_open() failure?

When lsof is started on some Solaris 7, 8, and 9 systems it may report:

```
lsof: kvm_open(namelist=default, corefile=default): \
No such file or directory
```

Lsof revisions 4.65 and later will first report:

```
lsof: cannot stat /dev/allkmem
```

The second message, not delivered in lsof revisions below 4.65, explains the cause of the kvm\_open() failure; it can't find /dev/allkmem.

/dev/allkmem is a device added to Solaris 7 and 8 in patches and in the Solaris 9 FCS. See the preceding "Will lsof crash the Solaris kernel?" section for more information on /dev/allkmem and the patches.

The kvm\_open(3KVM) function in the KVM library of patched



Solaris 7 and 8 systems and in Solaris 9 expects to find /dev/allkmem and exits on error when it does not.

If you have installed the patch that updated your KVM library to a version that expects /dev/allkmem to be present and it is not, you may need to reconfigure your system's devices with devfsadm(1M) or enter "boot -r" to the OpenBoot monitor's prompt (usually "ok").

## 17.23 Solaris and SAM-FS

### 17.23.1 Why does Solaris lsof report "(limited SAM-FS info)"?

Lsof 4.68 and above report "(limited SAM-FS info)" on Solaris in the NAME column after the path or file system name for all files it finds on SAM-FS file systems.

That's because no more information is known about the composition of the nodes that follow SAM-FS vnodes. If you can provide that information, please contact me via e-mail at <abe@purdue.edu>. Make sure "lsof" appears in the "Subject:" line so my e-mail filter won't classify your letter as Spam.

### 17.23.2 Why can't lsof locate named SAM-GS files?

Solaris lsof 4.68 and above can't locate files on SAM-FS file systems when the files are named as lsof arguments because lsof doesn't know how to locate open SAM-FS file device and node number information. (See also 'Why does Solaris lsof report "(limited SAM-FS info)?)

## 17.24 Lsof and Solaris 10 zones

### 17.24.1 How can I make lsof list the Solaris zone?

Use the lsof "-z [z]" option.

### 17.24.2 Why doesn't lsof work in a Solaris 10 zone?

When run from within a Solaris 10 zone, lsof will usually report:

lsof: can't stat(/devices): No such file or directory

That's because a Solaris zone usually has no /devices subdirectory, a restriction

of the zone implementation intended to limit the ability of zone processes to control global system resources, including physical devices.

While a zone may have a /dev subdirectory, that subdirectory usually lacks the /dev/allkmem, /dev/mem and /dev/kmem devices lsof and the KVM library it uses require.

The work-around is to run lsof in the global zone. When it is run in a global zone lsof will be able to report on processes running in any zone, including the global zone.

### 17.24.3 Why does lsof complain it can't stat() Solaris 10 zone file systems?

When run from the global zone on Solaris 10 lsof may complain:

```
lsof: WARNING: can't stat() 15 zone file systems;
using dev= options
```

The warning message means lsof found the reported number of file system entries in the mount table for which it didn't have permission to get stat(2) results, but which had "zone=" and "dev=" mount table options.

That is a normal restriction of Solaris 10 zones. Since the lsof warning message indicates it was able to find "dev=" options for the file systems, lsof will probably work correctly.

One work-around is to relax the restrictions on zone mount points, so that lsof can stat() them. While that may be possible by changing directory modes or group ownerships, it is probably not a good idea, because it weakens the restrictions zones are intended to provide.

Another work-around is to suppress the warning message with lsof's "-w" option. The down side of that is that it causes the suppression of all warning messages, leading to the possibility that some non-stat() warning messages will be suppressed.

### 17.25 Solaris 10 problems

#### 17.25.1 Why does Solaris 10 lsof sometimes report the wrong path name?

When a path name component is renamed -- e.g., with mv(1) --

Solaris 10 lsof may report the old component for an open file that used the component in its path before the rename. That's because Solaris 10 lsof reports the path name cached in the open file's vnode and the Solaris 10 kernel doesn't update the open vnode's cached path name when a component of it is changed.

When an open file is deleted -- e.g., with `rm(1)` -- the path name by which it was opened remains cached in the vnode. Lsof can be instructed to display that path name with the `-X` option. The path name might be incorrect because of the rename problem described above. See the answer to the 'What does "(deleted)" mean in the NAME column of a Solaris 10 open file?' question for more information.

Lsof is sometimes able to detect that cached path name is incorrect. In that case lsof may report only the mounted-on directory and device of the file system or it may report that the path name is of questionable accuracy by appending a trailing "(?)" to it in the NAME column.

See the answer to the "Why does Solaris 10 lsof sometimes report only the mounted-on directory and device?" and "What does "(?)" mean in the NAME column of a Solaris 10 open file?" questions for more information.

#### 17.25.2 Why does Solaris 10 lsof sometimes report only the mounted-on directory and device?

For some regular open files lsof may report only the mounted-on directory and device of the file system on which the file resides. That's because lsof was able to determine that the path name cached in the open file's vnode is incorrect.

Lsof detects the cached path name is incorrect by applying `stat(2)` to it, provided that no error was detected when `stat(2)` was applied to the file system mounted-on directory during lsof setup. If a mounted-on directory `stat(2)` error was detected during setup, lsof does no cached path name analysis and simply reports it.

When the application of `stat(2)` to the cached path name returns a no-entry reply (the `ENOENT` error number), lsof concludes the path no longer exists (i.e., has been unlinked) and reports the mounted-on directory and device of the file system. That behavior can be modified with

the -X option in lsof revisions

4.77 and above. See the answer to the 'What does "(deleted)" mean in the NAME column of a Solaris 10 open file?' for more information.

When the application of stat(2) to the cached path name returns a permission error reply (the EACCES or EPERM error numbers), lsof reports the cached path name and adds a trailing "(?)" to indicate the reported path name is of questionable accuracy. See the answer to the question 'What does "(?)" mean in the NAME column of a Solaris 10 open file?' for more information.

If the application of stat(2) to the cached path name yields any other error reply, lsof reports the mounted-on directory and device of the file system.

When the application of stat(2) to the cached path name succeeds, lsof compares the reported device and node numbers to what it has obtained for the open file from kernel structures. If they match, lsof reports the cached path name. If they don't match, lsof instead reports the mounted-on directory and device of the file system.

A work-around that allows lsof to apply stat(2) successfully to cached path names is to give lsof sufficient permission to do it -- i.e., run lsof as the root user.

17.25.3 What does "(deleted)" mean in the NAME column of a Solaris 10 open file?

When the -X option is specified to Solaris 10 lsof, it will report in its NAME column the path name cached for a deleted file in its vnode. The path name will be followed by "(deleted)".

Note that the path name cached in a file's vnode is the path name by which the file was opened. It is not updated by the Solaris kernel when any path name component is changed. Hence, it may not represent the final path name the open file had.

See the answer to the "Why does Solaris 10 lsof sometimes report the wrong path name?" question for more information on how changing a path name component affects the correctness of a what lsof reports.

17.25.4 What does "(?)" mean in the NAME column

of a Solaris 10 open file?

When lsof encounters a path name cached in the open file's vnode that stat(2) reports lsof lacks permission to access, lsof adds "(?)" to the path name reported in the NAME column to indicate the path name is of questionable accuracy.

See the answers to the "Why does Solaris 10 lsof sometimes report the wrong path name?" and "Why does Solaris 10 lsof sometimes report only the mounted-on directory and device?" questions for more information on why lsof may report a path name of questionable accuracy.

A work-around that allows lsof to apply stat(2) successfully to cached path names is to give lsof sufficient permission to do it -- i.e., run lsof as the root user.

## 17.26 Solaris contract file problems

### 17.26.1 Why doesn't lsof report size, link count and node number for Solaris 10 contract files?

Lsof doesn't report size, link count or node number for Solaris 10 contract files because I don't know how to obtain them from contract file kernel structures.

### 17.26.2 Why can't lsof locate a Solaris 10 contract file by path name?

Because lsof can't find the node number of Solaris contract files, it can't match the device and node numbers it gets from applying stat(2) to the contract file path name with what it finds in kernel data.

## 17.27 Solaris 10 ZFS problems

### 17.27.1 Why does Configure ask for the location of ZFS header files?

To provide ZFS support when lsof is compiled it needs to have access to the definitions of ZFS structures used by the kernel. Those definitions are contained in header files that Sun does not distribute with Solaris 10.

When the Configure script detects the system might support ZFS by finding the <sys/fs/zfs.h> header file, it checks for the required ZFS kernel structure definition header files. When they are not found, it asks if ZFS support should be included

and if so, with what definitions.

Two sources can be declared for definitions: 1) lsof's internal ones; or 2) the necessary header files at some location other than /usr/include/sys.

The necessary header files are:

```
dmu.h zfs_acl.h zfs_debug.h zfs_rlock.h zil.h
spa.h zfs_context.h zfs_dir.h zfs_vfsops.h zio.h
txg.h zfs_ctldir.h zfs_ioctl.h zfs_znode.h zio_impl.h
```

The necessary header files might have been obtained, for example, from the <http://src.opensolaris.org> Open Solaris source site. However, the Open Solaris header files might not be adequate -- see the answer to the "Why don't the Open Solaris ZFS header files provide correct ZFS kernel structure definitions?" question for information on why the Open Solaris ZFS header files might not provide correct ZFS kernel structure definitions.

The supplied header file path must point to a directory that contains a sys/ subdirectory where the matching header files are located -- e.g., if the supplied path is /tmp/zfs, then /tmp/zfs/sys must contain the necessary header files.

See the answer to the "Why do -h and -v output warn about possibly inaccurate ZFS kernel structure definitions?" question for information on the risks associated with using lsof's internal definitions.

17.27.2 Why do -h and -v output warn about possibly inaccurate ZFS kernel structure definitions?

When lsof is configured to use its internal ZFS kernel structure definitions, there is the chance that the definitions may be out of date. Hence, an lsof built with them may report incorrect device numbers, file sizes, node numbers and link counts.

Please contact me via e-mail at <[abe@purdue.edu](mailto:abe@purdue.edu)> for work-around suggestions. Make sure "lsof" appears in the "Subject:" line so my e-mail filter won't classify your letter as Spam.

17.27.3 Why don't the Open Solaris ZFS header files provide correct ZFS kernel structure definitions?

The Open Solaris ZFS header files may not provide correct ZFS kernel definitions. An lsof built with them may report incorrect device numbers, file sizes, node numbers and link counts.

The definitions may be incorrect because the Open Solaris header files are not synchronized with any particular Solaris 10 release. Consequently they might contain modifications to the structures not in the structure definitions used to build the running kernel. It may be that only Sun has header files that match the kernel structures of the running Solaris 10 kernel.

Please contact me via e-mail at <abe@purdue.edu> for work-around suggestions. Make sure "lsof" appears in the "Subject:" line so my e-mail filter won't classify your letter as Spam.

## 17.28 Problems with Solaris 9 and above

### 17.28.1 Why does the compiler complain about lgrp\_root on Solaris 9 and above?

When compiling lsof 4.84 on later Solaris 9 and 10 systems, the compiler may report the following error:

```
/usr/include/sys/lgrp.h", line ...: identifier redeclared: lgrp_root
```

This error results from a conflict between usage of lgrp\_root in both <sys/lgrp.h> and <sys/lgrp\_user.h> when \_KMEMUSER or \_KERNEL is #define'd before <sys/lgrp.h> is #include'd. This problem is noted in Sunsolve bug ID 5064229.

The work-around is to use lsof revision 4.85 sources.

## 18.0 Lsof Features

### 18.1 Why doesn't lsof report on /proc entries on my system?

/proc file system support is generally available only for BSD, SYSV R4 dialects, and Tru64 UNIX (Digital UNIX, DEC OSF/1). It's also available for Linux, and Pyramid DC/OSx and Reliant UNIX.

Even on some SYSV R4 dialects I encountered many problems while trying to incorporate /proc file system support. The chief problem is that some vendors don't distribute the header file that describes the /proc file system node -- usually called prdata.h.

18.2 How do I disable the device cache file feature or alter it's behavior?

To disable the device cache file feature for a dialect, remove the HASDCACHE definition from the machine.h file of the dialect's machine.h header file. You can also use HASDCACHE to change the default prefix ("`lsof") of the device cache file.

Be sure you consider disabling the device cache file feature carefully. Having a device cache file significantly reduces lsof startup overhead by eliminating a full scan of /dev (or /devices) once the device cache file has been created. That full scan also overloads the kernel's name cache with the names of the /dev (or /devices) nodes, reducing the opportunity for lsof to find path name components of open files.

If you're worried about the presence of mode 0600 device cache files in the home directories of the real user IDs that execute lsof, consider these checks that lsof makes on the file before using it:

1. To read the device cache file, lsof must gain permission from access(2).
2. The device cache file's modes must be 0600 (0644 if lsof is reading a system-wide device cache file) and its size non-zero.
3. There must be a correctly formatted section count line at the beginning of the file.
4. Each section must have a header line with a count that properly numbers the lines in the section. Legal sections are device, clone, pseudo-device, and CRC.
5. The lines of a section must have the proper format.



6. All lines are included in a 16 bit CRC, and it is recorded in a non-checksummed section line at the end of the file.

7. The checksum computed when the file is read must match the checksum recorded when the file was written.

8. The checksum section line must be followed by end-of-information.

9. Lsof must be able to get matching results from stat(2) on a randomly chosen entry of the device section.

For more information on the device cache file, read the 00DCACHE file of the lsof distribution.

#### 18.2.1 What's the risk with a perverted device cache file?

Even with the checks that lsof makes on the device cache file, it's conceivable that an intruder could modify it so it would pass lsof's tests.

The only serious consequence I know of this change is the removal of a file whose major device number identifies a socket from some user ID's device cache file. When such a device has been removed from the device cache file, and when lsof doesn't detect the removal, lsof may not be able to identify socket files when executed by the affected user ID. Only certain dialects are at risk to this attack -- e.g., SCO OpenServer and Solaris 2.x, 7, 8, and 9.

If you're tracking a network intruder with lsof, that could be important to you. If you suspect that someone has corrupted the device cache file you're using, I recommend you use lsof's -Di option to tell it to ignore it and use the contents of /dev (or /devices) instead; or remove the device cache file (usually .lsof\_hostname, where hostname is the first component of the host's name returned by gethostname(2)) from the user ID's home directory and let lsof create a new one for you.

#### 18.2.2 How do I put the full host name in a personal device cache file path?

Lsof constructs the personal device cache file path name from a format specified in the HASPERSDC #define in the dialect's machine.h header file. As distributed HASPERSDC declares the path to be ``.lsof\_" plus the first component of the host name with the format ``.lsof\_%L".

If you want to change the way lsof constructs the personal device cache file path name, you can change the HASPERSDC #define and recompile lsof. If, for example, you #define HASPERSDC to be ``.lsof\_%l" (note the lower case `l'), Configure and remake lsof, then the personal device cache file path will be ``.lsof\_" plus the host name returned by gethostname(2).

See the 00DCACHE file of the lsof distribution for more information on the formation of the personal device cache file path and the use of the HASPERSDC #define.

### 18.2.3 How do I put the personal device cache file in /tmp?

Change the HASPERSDC definition in your dialect's machine.h header file.

When you redefine HASPERSDC, make sure you put at least one user identification conversion in it to keep separate the device cache files for each user of lsof. Also give some thought to including the ``%0" conversion to define an alternate path for setuid-root and root processes.

Here's a definition that puts a personal device cache file in /tmp with the name ``.lsof\_login\_hostname\_pers".

```
#define HASPERSDC "/tmp/.lsof_%u_%l_pers"
```

Thus the /tmp personal device cache file path for login "abe" on host "lsof.itap.purdue.edu" would be:

```
/tmp/.lsof_abe_lsof.itap.purdue.edu_pers
```

You can add the User ID (UID) with the "%U" conversion and the first host name component with the ``%L" conversion.

CAUTION: be careful using absolute paths like /tmp lest lsof processes that are setuid-root or whose real UID is root be used to exploit some security weakness via /tmp. Elect instead to add an alternate path for those processes

with the ``%0" conversion.

Here's an extension of the previous HASPERSDC format for /tmp that declares an alternate path:

```
#define HASPERSDC "/tmp/.lsof_%u_%l_pers%0%h/.lsof_%L"
```

When the lsof process is setuid-root or its real UID is root, presuming root's home directory is `/ and the host's name is `lsof.itap.purdue.edu", the extended format yields:

```
/.lsof_vic
```

### 18.3 Why doesn't lsof know about AFS files on my favorite dialect?

lsof currently supports AFS for these dialects:

- AIX 4.1.4 (AFS 3.4a)
- Linux 1.2.13 (AFS 3.3)
- NEXTSTEP 3.2 (AFS 3.3)
- Solaris 2.[56] (AFS 3.4a)

It may recognize AFS files on other versions of these dialects, but I have no way to test that. lsof may report correct information for AFS files on other dialects, but I can't test that either.

AFS support must be custom crafted for each UNIX dialect and then tested. If lsof supports your favorite dialect, but doesn't recognize its AFS files, probably I don't have access to a test system. If you want AFS support badly for your dialect, consider helping me do the development and testing.

#### 18.3.1 Why doesn't lsof report node numbers for all AFS volume files, or how do I reveal dynamic module addresses to lsof?

When AFS is implemented via dynamic kernel modules -- e.g., in NEXTSTEP -- lsof can't obtain the addresses of AFS variables in the kernel that it uses to identify AFS vnodes. It can guess that a vnode is assigned to an AFS file and it can obtain other information about AFS files, but it has trouble computing AFS volume node numbers.

To determine node numbers for AFS volumes other than the root volume, /afs, lsof needs access to a hashed volume structure pointer table. When it can't find the address

of that table, because AFS support is implemented via dynamic kernel modules, lsof will return blanks in the INODE column for AFS volume files. Lsof can identify the root volume's node number (0), and can compute the node numbers for all other AFS files.

If

you have a name list file that contains the addresses of the AFS dynamic modules -- e.g., you saved module symbols when you created a loadable module kernel with modload(8) by specifying -sym -- lsof may be able to find the kernel addresses it needs in that file.

Lsof looks up AFS dynamic kernel addresses for these dialects at these default paths:

NEXTSTEP 3.2 /usr/vice/etc/afs\_loadable

A different path to a name list file with AFS dynamic kernel addresses may be specified with the -A option, when the -A option description appears in lsof's -h or -? (help) output.

If any addresses appear in the -A name list file that also appear in the regular kernel name list file -- e.g., /vmunix -- they must match, or lsof will silently ignore the -A addresses on the presumption that they are out of date.

Found in path(s):

\* /lsof-4-85-zip/00FAQ

No license file was found, but licenses were detected in source scan.

/\*

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- \*/

Found in path(s):

\* /Isof-4-85-zip/dialects/darwin/kmem/dfile.c

No license file was found, but licenses were detected in source scan.

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Found in path(s):

\* /Isof-4-85-zip/dialects/aix/dnode2.c

No license file was found, but licenses were detected in source scan.

#### Making and Installing Isof 4

\*\*\*\*\*

| The latest release of Isof is always available via anonymous ftp |  
 | from Isof.itap.purdue.edu. Look in pub/tools/unix/Isof. |

\*\*\*\*\*

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=====

## Pre-built Lsof Binaries

=====

Avoid using pre-built Lsof binaries if you can; build your own instead.

I do not support Lsof binaries built and packaged by third parties nor Lsof binaries built from anything but the latest Lsof revision. (See the Bug Reports section for more information on the details of Lsof support.)

One important reason for those support restrictions is that when Lsof is built its Configure script tunes Lsof to the features available on the building system, often embodied in supporting header files and libraries. If the building system doesn't have support for a particular feature, Lsof won't be built to support the feature on any system.

The Veritas VxFS file system is a good example of a feature that requires build-time support.

UNIX dialect version differences -- Solaris 8 versus 9, AIX 4.3.3 versus 5.2, etc. -- can also render a pre-built Lsof binary useless on a different version. So can kernel bit size.

There are so many potential pitfalls to using an Lsof binary improperly that I strongly recommend Lsof be used only where it is built.

=====

## Making Lsof

=====

```
$ cd <lsof source directory>
$./Configure <your dialect's abbreviation>
$ make
```

(Consult the 00FAQ and 00XCONFIG files of the lsof distribution for information about using make command invocations and environment variables to override lsof default Makefile strings.)

This lsof distribution can be used with many UNIX dialects. However, it must be configured specifically for each dialect. Configuration is done in three ways: 1) by changing definitions in the machine.h header file of the UNIX dialect of interest; 2) by defining environment variable values prior to calling Configure (see the 00XCONFIG file, the Environment Variables and Environment Variables Affecting the Configure Script sections of this file); and 3) by running the Configure shell script found in the top level of the distribution directory.

You may not need to change any machine.h definitions, but you might want to look at them anyway. Pay particular attention to the definitions that are discussed in the Security section of this file. Please read that section.

The Configure script calls three other scripts in the lsof distribution: AFSConfig; Inventory; and Customize. The AFSConfig script is called for selected dialects (AIX, HP-UX, NEXTSTEP, and Solaris) to locate AFS header files and determine the AFS version. See The AFSConfig Script section of this file for more information.

The Inventory script checks the completeness of the lsof distribution. Configure calls Inventory after it has accepted the dialect abbreviation, but before it configures the top-level directory for the dialect. See The Inventory Script section of this file for more information.

Configure calls the Customize script after it has configured the top-level lsof directory for the declared dialect. Customize helps you modify some of the important compile-time definitions of machine.h. See the The Customize Script section.

You should also think about where you will install lsof and its man page, and whom you will let execute lsof. Please read the Installing Lsof section of this file for information on installation considerations.

Once you have inspected the machine.h file for the



dialect for which you want to build lsof, and made any changes you need, run the Configure script, supplying it with the abbreviation for the dialect. (See the following table.) Configure selects the appropriate options for the dialect and runs the Mksrc shell script in the dialect sub-directory to construct the appropriate source files in the top-level distribution directory.

Configure may also run the MkKernOpts script in the dialect sub-directory to propagate kernel build options to the dialect Makefile. This is done for only a few dialects -- e.g., DC/OSx, and Reliant UNIX.

Configure creates a dialect-specific Makefile. You may want to inspect or edit this Makefile to make it conform to local conventions. If you want the Makefile to install lsof and its man page, you will have to create an appropriate install rule.

Lsof may be configured using UNIX dialect abbreviations from the following table. Alternative abbreviations are indicated by a separating `|'. For example, for SCO OpenServer you can use either the ``osr" or the ``sco" abbreviation:

```
$ Configure osr
or
$ Configure sco
```

#### Abbreviations UNIX Dialect

-----

```

aix IBM AIX 5.[23] and 5.3-ML1 using IBM's C Compiler
aixgcc IBM AIX 5.[12] and 5.3-ML1 using gcc
darwin Apple Darwin 7.x and 8.x for Power Macintosh systems
decosf DEC OSF/1, Digital UNIX, Tru64 UNIX 4.0 and 5.1
digital_unix Digital UNIX, DEC OSF/1, Tru64 UNIX 4.0 and 5.1
du Digital UNIX, DEC OSF/1, Tru64 UNIX 4.0 and 5.1
freebsd FreeBSD 4.x, 4.1x, 5.x and [67].x
hpux HP-UX 11.00, 11.11 and 11.23, using HP's C
 Compiler, both /dev/kmem-based and PSTAT-based
hpuxgcc HP-UX 11.00, 11.11 and 11.23, using gcc, both
 /dev/kmem-based and PSTAT-based
linux Linux 2.1.72 and above for x86-based systems
netbsd NetBSD 1.[456], 2.x and 3.x
next NEXTSTEP 3.[13]
nextstep NEXTSTEP 3.[13]
ns NEXTSTEP 3.[13]
nxt NEXTSTEP 3.[13]
```

openbsd OpenBSD  
 2.[89] and 3.[0-9]  
 openstep OPENSTEP 4.x  
 os OPENSTEP 4.x  
 osr SCO OpenServer Release 5.0.6, using the C compiler  
 from the SCO developer's kit  
 osrgcc SCO OpenServer Release 5.0.6, using gcc  
 osr6 SCO Openserver 6.0.0, using the SCO C compiler  
 sco SCO OpenServer Release 5.0.6, using the C compiler  
 from the SCO developer's kit  
 scogcc SCO OpenServer Release 5.0.6, using gcc  
 solaris Solaris 2.x, 7, 8, 9 and 10 using gcc  
 solariscs Solaris 2.x, 7, 8, 9 and 10 using Sun's cc  
 tru64 Tru64 UNIX, DEC OSF/1, Digital UNIX 4.0 and 5.1  
 unixware SCO|Caldera UnixWare 7.1.4  
 uw SCO|Caldera UnixWare 7.1.4

If you have an earlier version of a dialect not named in the above list, lsof may still work on your system. I have no way of testing that myself. Try configuring for the named dialect -- e.g., if you're using Solaris 2.1, try configuring for Solaris 2.5.1.

After you have configured lsof for your UNIX dialect and have selected options

via the Customize script (See the The Customize Script section.) , use the make command to build lsof -- e.g.,

\$ make

#### Other Configure Script Options

=====

There are three other useful options to the Configure script besides the dialect abbreviation:

-clean      may be specified to remove all traces of a dialect configuration, including the Makefile, symbolic links, and library files.

-h          may be specified to obtain a list of  
-help      Configure options, including dialect abbreviations.

-n          may be specified to stop the Configure script from calling the Customize and Inventory scripts.

Caution: -n also suppresses the AFSConfig step.

## Environment Variables

=====

Lsof configuration, building, and execution may be affected by environment variable settings. See the Definitions That Affect Compilation section in the 00PORTING file, the General Environment Variables section in the 00XCONFIG file, the Dialect-Specific Environment Variables section in the 00XCONFIG file, and the Environment Variables Affecting the Configure Script section of this file for more information.

Note in the General Environment Variables section of the 00XCONFIG file that there are five environment variables that can be used to pre-define values in lsof's -v output: LSOF\_BLDCMT, LSOF\_HOST, LSOF\_LOGNAME, LSOF\_SYSINFO, and LSOF\_USER.

## Security

=====

If the symbol HASSECURITY is defined, a security mode is enabled, and lsof will allow only the root user to list all open files.

Non-root users may list only open files whose processes have the same user ID as the real user ID of the lsof process (the one that its user logged on with).

However, if HASNOSOCKSECURITY is also defined, anyone may list anyone else's open socket files, provided their listing is enabled with the "-i" option.

Lsof is distributed with the security mode disabled -- HASSECURITY is not defined. (When HASSECURITY is not defined, the definition of HASNOSOCKSECURITY has no meaning.) You can enable the security mode by defining HASSECURITY in the Makefile or in the machine.h header file for the specific dialect you're using -- e.g. dialects/aix/machine.h.

The Customize script, run by Configure when it has finished its work, gives you the opportunity to define HASSECURITY and HASNOSOCKSECURITY. (See the The Customize Script section.)

The lsof -h output indicates the state HASSECURITY and HASNOSOCKSECURITY had when lsof was built, reporting:

"Only root can list all files;"  
if HASSECURITY was defined and HASNOSOCKSECURITY wasn't defined;

"Only root can list all files, but anyone can list socket files."  
if HASSECURITY and HASNOSOCKSECURITY were both defined;

"Anyone can list all files;"  
if HASSECURITY wasn't defined. (The definition of HASNOSOCKSECURITY doesn't matter when HASSECURITY isn't defined.)

You should carefully consider the implications of using the default security mode.

When lsof is compiled in the absence of the HASSECURITY definition, anyone who can execute lsof may be able to see the presence of all open files. This may allow the lsof user to observe open files -- e.g., log files used to track intrusions -- whose presence you would rather not disclose.

All pre-compiled binaries on lsof.itap.purdue.edu and mirrored from it were constructed without the HASSECURITY definition.

As distributed, lsof writes a user-readable and user-writable device cache file in the home directory of the real user ID executing lsof. There are other options for constructing the device cache file path, and they each have security implications.

The 00DCACHE file in the lsof distribution discusses device cache file path construction in great detail. It tells how to disable the various device cache file path options, or how to disable the entire device cache file feature by removing the HASDCACHE definition from the dialect's machine.h file. There is also information on the device cache file feature in the 00FAQ file. (The 00DCACHE and 00FAQ files are part of the lsof distribution package.)

The Customize script, run by Configure after it has finished its work, gives you the opportunity to change the compile-time options related to the device cache file. (See The Customize Script section.)

Since lsof may need setgid or setuid-root permission (See the Setgid Lsof Dialects and Setuid-root Lsof Dialects sections.), its security should always be viewed with skepticism. Lest the setgid and

setuid-root permissions allow lsof to read kernel name list or memory files, declared with the -k and -m options, that the lsof user can't normally access, lsof uses access(2) to establish its real user's authority to read such files when it can't surrender its power before opening them. This change was added at the suggestion of Tim Ramsey.

Lsof surrenders setgid permission on most dialects when it has gained access to the kernel's memory devices. There are exceptions to this rule, and some lsof implementations need to run setuid-root. (The Setgid Lsof Dialects and Setuid-root Lsof Dialects sections contains a list of lsof implementations and the permissions recommended in the distribution's Makefiles.)

The surrendering of setgid permission is controlled by the WILLDROPID definition in the dialect machine.h header files.

In the end you must judge for yourself and your installation the risks that lsof presents and restrict access to it according to your circumstances and judgement.

#### Run-time Warnings

=====

Lsof can issue warning messages when it runs -- e.g., about the state of the device cache file, about an inability to access an NFS file system, etc. Issuance of warnings are enabled by default in the lsof distribution.

Issuance of warnings may be disabled by default by defining WARNINGSTATE in the dialect's machine.h. The Customize script may also be used to change the default warning message issuance state. (See The Customize Script section.)

The ``-w" option description of the ``-h" option (help) output will indicate the default warning issuance state. Whatever the state may be, it can be reversed with ``-w".

#### Device Access Warnings

=====

When lsof encounters a /dev (or /devices) directory, one of its sub-directories, or one of their files that it cannot access with opendir(3) or stat(2), it issues a warning message and continues.

Lsof will be more likely to issue such a warning when it has been installed with `setgid(<some group name>)` permission; it won't have trouble if it has been installed with `setuid(root)` permission or is being run under the root login.

The lsof caller can inhibit or enable the warning with the `-w` option, depending on the issuance state of run-time warnings. (See the Run-time Warnings section.)

The warning messages do not appear when lsof obtains device information from a device cache file that it has built and believes to be current or when warning message issuance is disabled by default. (See the "Caches -- Name and Device" section for more information on the device cache file.)

The lsof builder can inhibit the warning by disabling the definition of `WARNDEVACCESS` in the dialect's `machine.h` or disable all warnings by defining `WARNINGSTATE`. `WARNDEVACCESS` is defined by default for most dialects. However, some dialects have some device directory elements that are private -- e.g., HP-UX -- and it is more convenient for the lsof user if warning messages about them are inhibited.

Output from lsof's `-h` option indicates the status of `WARNDEVACCESS`. If it was defined when lsof was compiled, this message will appear:

```
/dev warnings = enabled
```

If `WARNDEVACCESS` was not defined when lsof was compiled, this message will appear instead:

```
/dev warnings = disabled
```

The Customize script, run by Configure after it has finished its work, gives you the opportunity to change the `WARNDEVACCESS` definition. (See The Customize Script section.)

## NFS

### Blocks

=====

Lsof is susceptible to NFS blocks when it tries to `lstat()` mounted file systems and when it does further processing -- `lstat()` and `readlink()` -- on its optional file and file system arguments.

Lsof tries to avoid being stopped completely by NFS blocks by doing the `lstat()` and `readlink()` functions in a child process, which

returns the function response via a pipe. The lsof parent limits the wait for data to arrive in the pipe with a SIGALRM, and, if the alarm trips, terminates the child process with a SIGINT and a SIGKILL.

This is as reliable and portable a method for breaking NFS deadlocks as I have found, although it still fails under some combinations of NFS version, UNIX dialect, and NFS file system mount options. It generally succeeds when the "intr" or "soft" mount options are used; it generally fails when the "hard" mount option is used.

When lsof cannot kill the child process, a second timeout causes it to stop waiting for the killed child to complete.

While the second timeout allows lsof to complete, it may leave behind a hung child process. Unless warnings are inhibited by default or with the -w option, lsof reports the possible hung child.

NFS block handling was updated with suggestions made by Andreas Stolcke. Andreas suggested using the alternate device numbers that appear in the mount tables of some dialects when it is not possible to stat(2) the mount points.

The -b option was added to direct lsof to avoid the stat(2) and readlink(2) calls that might block on NFS mount points and always use the alternate device numbers. If warning message issuance is enabled and you don't want warning messages about what lsof is doing, use the -w option, too.

The -O option directs lsof to avoid doing the potentially blocking operations in child processes. Instead, when -O is specified, lsof does them directly. While this consumes far less system overhead, it can cause lsof to hang, so I advise you to use -O sparingly.

## Caches

-- Name and Device

=====

Robert Ehrlich suggested that lsof obtain path name components for open files from the kernel's name cache. Where possible, lsof dialect implementations do that. The -C option inhibits kernel name cache examination.

Since AFS apparently does not use the kernel's name cache, where lsof supports AFS it is unable to identify AFS files with path name components.

Robert also suggested that lsof cache the information it obtains via stat(2) for nodes in /dev (or /devices) to reduce subsequent running time. Lsof does that, too.

In the default distribution the device cache file is stored in .lsof\_hostname, mode 0600, in the home directory of the login of the user ID that executes lsof. The suffix, hostname, is the first component of the host's name returned by gethostname(2). If lsof is executed by a user ID whose home directory is NFS-mounted from several hosts, the user ID's home directory may collect several device cache files, one for each host from which it was executed.

Lsof senses accidental or malicious damage to the device cache file with extensive integrity checks, including the use of a 16 bit CRC. It also tries to sense changes in /dev (or /devices) that indicate the device cache file is out of date.

There are other options for forming the device cache file path. Methods the lsof builder can use to control and employ them are documented in the separate 00DCACHE file of the lsof distribution.

#### Raw Sockets

=====

On many UNIX systems raw sockets use a separate network control block structure. Display of files for applications using raw sockets -- ping, using ICMP, for example -- need special support for displaying their information. This support is so dialect-specific and information to provide it so difficult to find that not all dialect revisions of lsof handle raw sockets completely.

#### Other Compile-time Definitions

=====

The machine.h and dlsof.h header files for each dialect contains definitions that affect the compilation of lsof. Check the Definitions That Affect Compilation section of the 00PORTING file of the lsof distribution for their descriptions. (Also see The Customize Script section.)

#### The AFSCfg Script

=====



Lsof supports AFS on some combinations of UNIX dialect and AFS version. See the AFS section of this document for a list of supported combinations.

When configuring for dialects where AFS is supported, the Configure script calls the AFSScript script to determine the location of AFS header files and the AFS version. Configure will not call AFSScript, even for the selected dialects, unless the file /usr/vice/etc/ThisCell exists.

The AFS header file location is recorded in the AFSHeaders file; version, AFSVersion. Once these values have been recorded, Configure can be told to skip the calling of AFSScript by specifying its (Configure's) -n option.

### The Inventory Script

=====

The lsof distribution contains a script, called Inventory, that checks the distribution for completeness. It uses the file 00MANIFEST in the distribution as a reference point.

After the Configure script has accepted the dialect abbreviation, it normally calls the Inventory script to make sure the distribution is complete.

After Inventory has run, it creates the file ".ck00MAN" in the top-level directory to record for itself the fact that the inventory has been check. Should Inventory be called again, it senses this file and asks the caller if another check is in order, or if the check should be skipped.

The -n option may be supplied to Configure to make it bypass the calling of the Inventory script. (The option also causes Configure to avoid calling the Customize script.)

The lsof power user may want to define (touch) the file ".neverInv". Configure avoids calling the Inventory script when ".neverInv" exists.

### The Customize Script

=====

Normally when the Configure script has finished

its work, it calls  
another shell script in the lsof distribution called Customize.  
(You can tell Configure to bypass Customize with its -n option.)

Customize leads you through the specification of these important  
compile-time definitions for the dialect's machine.h header file:

HASDCACHE device cache file control  
    HASENVDC device cache file environment  
    variable name  
    HASPERSDC personal device cache file path  
    format  
    HASPERSDCPATH name of environment variable that  
    provides an additional component  
    of the personal device cache file  
    path  
    HASSYSDC system-wide device cache file path  
HASKERNIDCK the build-time to run-time kernel  
    identity check  
HASSECURITY the security option  
HASNOSOCKSECURITY the open socket listing option whe  
    HASSECURITY is defined  
WARNDEVACCESS /dev (or /devices) warning message  
    control  
WARNINGSTATE warning message issuance state

The Customize script accompanies its prompting for entry of new  
values for these  
definitions with brief descriptions of each of  
them. More information on these definitions may be found in this  
file or in the 00DCACHE and 00FAQ files of the lsof distribution.

You don't need to run Customize after Configure. You can run it  
later or you can edit machine.h directly.

The -n option may be supplied to Configure to make it bypass the  
calling of the Customize script. (The option also causes Configure  
to avoid calling the Inventory script.)

The lsof power user may want to define (touch) the file ".neverCust".  
Configure avoids calling the Customize script when ".neverCust"  
exists.

Customize CAUTION: the Customize script works best when it is  
applied to a newly configured lsof source base -- i.e., the machine.h  
header file has not been previously modified by the Customize  
script. If you have previously configured lsof, and want to rerun  
the Customize script, I recommend you clean out the previous

configuration and create a new one:

```
$ Configure -clean
```

```
$ Configure
```

```
<dialect_abbreviation>
```

```
...
```

Customize in response to the Customize script prompts.

## Cautions

=====

Lsof is a tool that is closely tied to the UNIX operating system version. It uses header files that describe kernel structures and reads kernel structures that typically change from OS version to OS version, and even within a version as vendor patches are applied.

DON'T TRY TO USE AN LSOF BINARY, COMPILED FOR ONE UNIX OS VERSION, ON ANOTHER. VENDOR PATCHES INFLUENCE THE VERSION IDENTITY.

On some UNIX dialects lsof versions may be even more restricted by architecture type.

The bottom line is use lsof where you built it. If you intend to use a common lsof binary on multiple systems, make sure all systems run exactly the same OS version and have exactly the same patches.

## Warranty

=====

Lsof is provided as-is without any warranty of any kind, either expressed or implied, including, but not limited to, the implied warranties of merchantability and fitness for a particular purpose.

The

entire risk as to the quality and performance of lsof is with you. Should lsof prove defective, you assume the cost of all necessary servicing, repair, or correction.

## License

=====

Lsof has no license. Its use and distribution are subject to these terms and conditions, found in each lsof source file. (The copyright year in or format of the notice may vary slightly.)

/\*

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\*/

## Bug Reports

=====

Now that the obligatory disclaimer is out of the way, let me hasten to add that I accept lsof bug reports and try hard to respond to them. I will also consider and discuss requests for new features, ports to new dialects, or ports to new OS versions.

PLEASE DON'T SEND BUG REPORTS ABOUT LSOF TO THE UNIX DIALECT OR DIALECT OPTION VENDOR.

At worst such bug reports will confuse the vendor; at best, the vendor will forward the bug report to me.

PLEASE DON'T SEND BUG REPORTS  
ABOUT LSOF BINARIES BUILT OR DISTRIBUTED  
BY SOMEONE ELSE, BECAUSE I CAN'T SUPPORT THEM.

I do support binaries I built, obtained ONLY from lsof.itap.purdue.edu.

Before reporting a problem with a lsof.itap.purdue.edu binary, please verify the correctness of the signatures found in its associated CHECKSUMS file.

Before you send me a bug report, please do these things:

- \* Make sure you try the latest lsof revision.

- + Download the latest revision from:

- `ftp://lsof.itap.purdue.edu/pub/tools/unix/lsof`

- + Verify the signatures of what you have downloaded;

- + While connected to lsof.itap.purdue.edu, check for patches:

- `ftp://lsof.itap.purdue.edu/pub/tools/unix/lsof/patches`

- + If patches exist, install them in the latest revision you just downloaded. Then build the latest revision and see if it fixes your bug.

- \* If you're having trouble compiling lsof with gcc, try the UNIX dialect vendor's compiler. I don't have access to gcc on all test systems, so my support for it is hit-and-miss, and so is my ability to respond to gcc compilation problem reports.

- \* Check the lsof frequently asked questions file, 00FAQ, to see if there's a question and answer relevant to your problem.

- \* Make sure you're running the lsof you think you are by checking the path to it with `which(1)`. When in doubt, use an absolute path to lsof. Make sure that lsof binary has sufficient permissions to do what you ask, including internal permissions given it (e.g., restrictions on what files lsof may report for whom) during its build.

When you send a bug report, make sure you include output from your running of lsof's Configure script. If you were able to compile a running lsof, please also include:

- \* Output from `which(1)` that shows the absolute path to the lsof binary in question;

- \* Output from running lsof with its `-h` and `-v` options at

lsof's absolute path;

\* Output from "ls -l" directed to lsof's absolute path.

If you weren't able to compile a running lsof, please send me: the compiler error output; identification of the lsof revision you're using (contents of the lsof version.c file); identification of your system (full uname output or output from whatever other tool identifies the system); and compiler identification (e.g., gcc -v output).

Either set of output will help me understand how lsof was configured and what UNIX dialect and lsof revision is involved.

Please send all bug reports, requests, etc. to me via e-mail at <abe@purdue.edu>. Make sure "lsof" appears in the "Subject:" line so my e-mail filter won't classify your letter as Spam.

#### The 00FAQ File

=====

The lsof distribution contains an extensive frequently asked questions file on lsof features and problems. I recommend you consult it before sending me e-mail. Use your favorite editor or pager to search 00FAQ -- e.g., supplying  
as a search argument some  
fixed text from an lsof error message.

#### The lsof-l Mailing List

=====

Information about lsof, including notices about the availability of new revisions, may be found in mailings of the lsof-l listserv. For more information about it, including instructions on how to subscribe, read the 00LSOF-L file of the lsof distribution.

#### Field Output Example Scripts

=====

Example AWK and Perl 4 or 5 scripts for post-processing lsof field output are located in the scripts sub-directory of the lsof distribution. The scripts sub-directory contains a 00README file with information about the scripts.

#### Field Output C Library

=====

The lsof test suite (See "Testing Lsof."), checks basic lsof operations using field output. The test suite has its own library of C functions for common test program operations, including processing of field output. The library or selections of its functions could be adapted for use by C programs that want to process lsof field output. See the library in the file LTlib.c in the tests/ sub-directory

## Testing Lsof

=====

Lsof has an automated test suite in the tests/ sub-directory that can be used to test some basic lsof features -- once lsof has been configured and made. Tests are arranged in three groups: basic tests that should run on all dialects; standard tests that should run on all dialects; and optional tests that may not run on all dialects or may need special resources to run. See 00TEST for more information.)

CAUTION!!! Before you attempt to use the test suite make sure that the lsof you want to test can access the necessary kernel resources -- e.g., /dev/mem, /dev/kmem, /proc, etc. Usually you want to test the lsof you just built, so this is an important check. (See 00TEST.)

To run the basic and standard tests, using the lsof in the parent directory of tests/, do this:

```
$ cd tests
$ make test
 or $ make std
 or $ make standard
```

The basic and standard tests may be run as silently as possible, using the lsof in the parent directory of tests/, with:

```
$ cd tests
$ make auto
```

This is the "automatic" test mode, designed for use by scripts that build lsof. The caller is expected to test the make exit code to determine if the tests succeeded. The caller should divert standard output and standard error to /dev/null to suppress make's error

exit message.

The optional tests may be run, using the lsof in the parent directory of tests/, with:

```
$ cd tests
$ make opt
or $ make optional
```

It's possible to execute individual tests, too. See the 00TEST file of this distribution for more information on the tests, what they do, and how to run and possibly customize each test.

It's possible to run the tests, using an lsof other than the one in the parent directory of /tests, too. See 00TEST for information about using the LT\_LSOF\_PATH environment variable to do that.

```
=====
Dialect Notes
=====
```

AFS  
===

Lsof  
recognizes AFS files on the following combinations of UNIX dialect and AFS versions:

AIX 4.1.4 (AFS 3.4a)  
Linux 1.2.13 (AFS 3.3)  
NEXTSTEP 3.2 (AFS 3.3) (untested on recent lsof revisions)  
Solaris 2.6 (AFS 3.4a)  
Ultrix 4.2 RISC (AFS 3.2b) (no longer available)

Lsof has not been tested under other combinations -- e.g. HP-UX 10.10 and AFS 3.4a -- and probably won't even compile there. Often when a UNIX dialect version or AFS version changes, the new header files come into conflict, causing compiler objections.

AIX  
===

Specify the aix Configure abbreviation for AIX 4.1.[45], 4.2[.1], 4.3[.123], 5L, and 5.[123].



Specify aixgcc on AIX above 4.1 to use the gcc compiler. (Gcc can't be used to compile lsof on AIX 4.1 and below because of kernel structure alignment differences between it and xlc.) Gcc results sometimes depend on the version of the gcc compiler that is used.

Compilation of lsof with gcc on AIX 4.3[.123], 5L, and 5.[123] has been sparsely tested with varying degrees of success: it has been reported to succeed on AIX 4.3.3 and 32 bit Power AIX 5.1; to fail on ia64 AIX 5.1 and 64 bit Power AIX 5.1; and to succeed on 32 and 64 bit Power AIX 5.2. Lsof compilation with gcc hasn't been tested on AIX 5.3.

At revision 4.61 and above lsof is configured and built to match the bit size of the kernel of Power architecture AIX 5.1 systems. Lsof binaries built for 32 and 64 bit kernels are not interchangeable. See 00FAQ for more information.

The Configure script uses /usr/bin/oslevel to determine the AIX version for AIX less than 5 and ``uname -rv" for AIX 5 and higher. If /usr/bin/oslevel isn't executable on AIX less than 5, the Configure script issues a warning message and uses ``uname -rv" to determine the AIX version.

When Configure must use ``uname -rv" on AIX less than 5 to determine the AIX version, the result will lack a correct third component -- e.g., the `4' of ``4.1.4". If your AIX less than 5 system lacks an executable oslevel,

I suggest you edit the Configure-produced Makefile and complete the \_AIXV definition in the CFGF string.

By default lsof avoids using the kernel's readx() function, causing it to be unable to report information on some text and library file references. The ``-X" option allows the lsof user to ask for the information readx() supplies.

Lsof avoids readx() to avoid the possibility of triggering a kernel problem, known as the Stale Segment ID kernel bug. Kevin Ruderman reported this bug to me. The bug shows up when the kernel's dir\_search() function hangs, hanging the application process that called it so completely that the application process can neither be killed nor stopped. The hang is the consequence of another process (perhaps lsof) making legitimate use of the kernel's readx() function to access the kernel memory that dir\_search() is examining. IBM has indicated they have no plans to fix the bug.

A fuller discussion of this bug may be found in the 00FAQ file of the lsof distribution.

There you will find a description of the Stale Segment ID bug, the APAR on it, and a discussion of the sequence of events that exposes it.

I added the ``-X" function so you can tell lsof to use readx(), but if you use ``-X", you should be alert to its possibly serious side effects. Although readx() is normally disabled, its state is controlled with the HASXOPT, HASXOPT\_ROOT, and HASXOPT\_VALUE definitions in dialects/aix/machine.h, and you can change its default state by changing those definitions. You can also change HASXOPT\_ROOT via the Customize script.

You can also compile lsof with readx() use permanently enabled or disabled -- see the comments about the definitions in the dialects/aix/machine.h header file. You may want to permanently disable lsof's use of readx() if you plan to make lsof publicly executable. You can also restrict -X to processes whose real UID is root by defining HASXOPT\_ROOT.

I have never seen lsof cause the Stale Segment ID bug to occur and haven't had a report that it has, but I believe there is a possibility it could.

AFS support for AIX was added with help from Bob Cook and Jan Tax who provided test systems.

Henry Grebler and David J. Wilson helped with lsof for AIX 4.2.

Bill Pemberton provided an AIX 4.3 test system. Andrew Kephart and Tom Weaver provided AIX 4.3 technical assistance. Niklas Edmundsson did 4.3.1 testing. Doug Crabill provided an AIX 4.3.2 test system. Jeff W. Stewart provided an AIX 4.3.3 test system.

The SMT file type for AIX 4.1.[45], 4.2[.1], and 4.3[.12] is my fabrication. See the 00FAQ file more information on it.

Loc Le and Nasser Momtaheni of IBM provided test systems for AIX 5L and 5.1. lsof for AIX 5L and 5.1 needs setuid-root permission to process the -X option on systems whose architecture type is ia64.

Dale Talcott of Purdue provided AIX 5.1 and 5.2 test systems. Dale and John Jackson of Purdue provided an AIX 5.3 test system.

Apple Darwin  
=====

## The Apple Darwin

port was provided by Allan Nathanson for version

1.2. Allan also arranged for access to a test system for maintenance and regression testing. Dale Talcott provided a test system, too.

Allan supplied patches for updates to 1.4, 5.x, 6.x, 7.x and 8.x.

## BSDI BSD/OS

=====

As of lsof revision 4.77 support for BSDI BSD/OS has been discontinued. Lsof revision 4.76 with BSDI BSD/OS support may be found on [lsof.itap.purdue.edu](http://lsof.itap.purdue.edu) in `pub/tools/unix/lsof/src`.

## DEC OSF/1, Digital UNIX, Tru64 UNIX

=====

Robert Benites, Dean Brock, Angel Li, Dwight McKay, Berkley Shands, Ron Young and Steve Wilson have kindly provided test systems. Jeffrey Mogul has provided technical assistance. Dave Morrison and Lawrence MacIntyre did Digital UNIX V3.2 testing.

Lsof supports the ADVFS/MSFS layered file system product. Lsof can locate all the open files of an ADVFS/MSFS file system when its path is specified, provided the file system is listed in `/etc/fstab` with an ```advfs"` type. (This `/etc/fstab` caveat applies only to Digital UNIX 2.0.) At Digital UNIX 4.0 and Tru64 UNIX, using code provided by David Brock, lsof 4.20 and above can locate ADVFS file paths.

Testing of lsof on DEC OSF/1 and Digital UNIX 4.0 ended with lsof revision 4.74. Hence, the lsof documentation has dropped the claim that it works there. For a distribution of lsof 4.74 that was tested on DEC OSF/1 and Digital UNIX 4.0, check `pub/tools/unix/lsof/OLD/src` on the lsof ftp home, [lsof.itap.purdue.edu](http://lsof.itap.purdue.edu).

Lsof revisions past 4.74 have only been tested on Tru64 UNIX 5.1.

## FreeBSD

=====

Bill Bormann of Purdue University provided access to several FreeBSD test systems. Ade Barkah, John Clear, Ralph Forsythe, Michael Haro, Kurt Jaeger, and William McVey have also provided FreeBSD

test systems.

The FreeBSD distribution header files are augmented by header files in the `dialects/freebsd/include` directory.

David O'Brien maintains the lsof FreeBSD port package.

## HP-UX

=====

Lsof has

two HP-UX bases: `/dev/kmem` for HP-UX 11.0 and earlier; and `PSTAT` for HP-UX 11.11 and later. The `lsof Configure` script will pick the appropriate base.

To use the CCITT x.25 socket support for HP-UX, you must have the x.25 header files in `/etc/conf/x25`

Pasi Kaara helped with the HP-UX port, especially with its CCITT x.25 socket support.

Richard Allen provided HP-UX 10.x and 11.x test systems, as did Mark Bixby, and Elias Halldor Agustsson. Marc Winkler helped test the 10.20 port. Richard J. Rauenzahn provided a 64 bit HP-UX 11 test system and an HP-UX 11.11 development system.

AFS support for HP-UX was added thanks to help from Chaskiel Moses Grundman, who provided a test system.

The `/dev/kmem`-based HP-UX 11.00 support is extremely fragile. It depends on privately developed kernel structure definitions. (See `../dialects/hpux/hpux11` for the header files making the definitions.) Those header files and their definitions will not be updated by HP-UX 11.00 patches, making it likely that any patch changing a kernel structure critical to lsof will break lsof in some way.

It's possible to build a 64 bit lsof for 64 bit HP-UX 11.00 with gcc, but you must have a gcc compiler capable of producing 64 bit executables. See the `00FAQ` file for more information.

The `PSTAT`-based lsof for HP-UX 11.11 and later is much more solid. I am indebted to the vision of HP for providing an lsof kernel API through the `PSTAT` implementation. Specifically I appreciate the help of HP staff members Carl Davidson, Louis Huemiller, Rich Rauenzahn, and Sailu Yallapragada that made `PSTAT`-based HP-UX lsof possible.

## IPv6

=====

Lsof has IPv6 support that has been tested for these UNIX dialects: AIX 4.3.x; Apple Darwin 5.[12] and 6.0; the INRIA and KAME FreeBSD IPv6 implementations; PSTAT-based HP-UX; /proc-based Linux; the INRIA and KAME NetBSD implementations; and Solaris 8 and 9. Lsof has IPv6 support that hasn't been tested for: OpenBSD (KAME); OpenUNIX 8; Tru64 Unix 5.[01]; and UnixWare 7.1.[34].

Please let me know if your UNIX dialect has IPv6 support and I'll see if it can be supported by lsof.

## Linux

=====

Tim Korb, Steve Logue, Joseph J. Nuspl Jr., and Jonathan Sergent have provided Linux test systems.

Michael Shields helped add and test automatic handling of ELF/COFF form names in /System.map, Marty Leisner and Keith Parks have helped test many lsof revisions. Marty has provided valuable suggestions, Linux hints, and code, too.

The 00FAQ file gives some Linux tips, including information on coping with system map file problems.

To determine the state of the Linux 2.1.x C library lseek() function, the lsof Configure script runs a test program that must have permission to read /dev/kmem. The test determines if the lseek() function properly handles kernel offsets, which appear to be negative because their high order bit is set. If the lseek() test reveals a faulty lseek(), Configure activates the use of a private lseek() function for kernel offset positioning.

See the Linux problems section of the 00FAQ file of the lsof distribution for more information.

## NetBSD

=====

Greg Earle and Paul Kranenburg have assisted with the NetBSD ports. Paul has provided test systems. Ray Phillips provided a NetBSA

Alpha test system. Andrew Brown also provided a test system.

The NetBSD dialect version of lsof is compiled using the dialect sources it shares with OpenBSD in the n+obsd dialect sub-directory.

#### NEXTSTEP and OPENSTEP

=====

Virtual memory header files that allow lsof to display text references were derived from the contents of /usr/include/vm of NEXTSTEP 2.0. NeXT did not ship the virtual memory header files with other NEXTSTEP or OPENSTEP versions.

You may use the RC\_FLAGS environment variable to declare compiler options outside the Makefile. A common use of this variable is to define the architecture types to be included in a "fat" executable. See the comments in dialects/next/Makefile for an example.

#### OpenBSD

=====

David

Mazieres has provided OpenBSD test systems. The OpenBSD dialect version of lsof is compiled using the dialect sources it shares with NetBSD in the n+obsd dialect sub-directory.

Kenneth Stailey has provided OpenBSD testing and advice.

John Dzuber (Zube) reports, "lsof 4.33 compiles and runs on OpenBSD 2.3 for the pmax architecture (decstation 3100)."

I have not tested lsof on OpenBSD 3.8, but David Mazieres reports revision 4.76 worked on OpenBSD 3.8.

#### Pyramid DC/OSx and Reliant UNIX

=====

As of lsof revision 4.52 support for all Pyramid dialects has been discontinued. Lsof revision 4.51 with Pyramid support may be obtained upon request. Send the request to [abe@purdue.edu](mailto:abe@purdue.edu).

These two UNIX dialects are very similar and share dialect-specific source files from the pyramid sub-directory.

The Reliant Unix Pyramid C compiler issues warning messages that

I haven't found a convenient way to suppress. You can ignore warning messages about casts and conversions that lose bits. The message "warning: undefining \_\_STDC\_\_" is intentionally caused by the lsof MkKernOpts configuration script to suppress warning messages about cast and conversion problems in standard system header files, such as <stdio.h> and <string.h>.

Bruce Beare and Kevin Smith provided test systems.

## Caldera OpenUNIX

=====

Larry Rosenman provided an OpenUNIX 8 test system. Matthew Thurmaier provided technical assistance, along with these people from Caldera: Jack Craig, Robert Lipe, and Bela Lubkin.

Robert Lipe supplied changes to lsof for OpenUNIX 8.0.1. Those changes were also incorporated in UnixWare 7.1.3 when it became the release name for OpenUNIX 8.0.1.

Support for lsof on OpenUNIX ended at lsof revision 4.74. The last lsof revision, 4.74, tested on OpenUNIX, may be found at the lsof "home" ftp site, lsof.itap.purdue.edu, in pub/tools/unix/lsof/OLD/src.

## SCO OpenServer

=====

Dion Johnson, Bela Lubkin, and Nathan Peterson of SCO gave me copies of SCO OpenServer and the SCO OpenServer Development System 3.0 and provided technical advice for the lsof port.

Hugh Dickins, Bela Lubkin, Craig B. Olofson, and Nathan Peterson provided version 5.0 and gave technical advice for porting lsof to it. Bela provided the 5.0.4 changes. D. Chris Daniels provided a 5.0.4 test system, Lee Penn provided one for 5.0.5, and John Dubois for 5.0.6.

The <netdb.h> header file was accidentally omitted from some SCO OpenServer Development System releases. The Configure script will sense its absence and substitute an equivalent from the BSD distribution. The BSD <netdb.h> and the <sys/cdefs.h> header file it includes are located in the dialects/os/include sub-directory tree.

To compile lsof from its distribution sources you must have the TCP/IP and NSF headers in /usr/include. While those are optional OpenServer packages, I have access to no system that doesn't have them, so I'm unable to build lsof for such a configuration.

However,  
it should be possible to modify the lsof Configure script and sources so lsof would compile and work without those optional packages.

If you have an OpenServer system configured without the TCP/IP and NFS packages, and want to tackle the job of building lsof for it, contact me via e-mail at <abe@purdue.edu>. I'll identify the Configure script, header file, and source file changes you will need to make. (Caution: this is not a simple task, or I would have already done it.)

The optional osrgcc and scogcc Configure abbreviations construct Makefiles for compiling lsof with gcc.

The UnixWare 7.1.4 sources are used for OpenServer Release 6.0.0. Hence there is a separate Configure abbreviation for it, "osr6". Richard of SCO provided a test system and technical assistance.

SCO|Caldera UnixWare

=====

D. Chris Daniels, John Hughes, Ken Laing, Andrew Merril, Lee Penn, and Matthew Thurmaier provided test systems. Bela Lubkin provided technical assistance. Larry Rosenman provided 7.1.[34] test systems.

Solaris 2.x, 7, 8, 9 and 10

=====

SEE THE CAUTIONS SECTION OF THIS DOCUMENT.

The latest Solaris revision of lsof 4 might work under Solaris 2.[1-4] and 2.5[.1] and 7 but hasn't been tested there. I have no test systems for those Solaris versions.

Lsof will compile with gcc and the Sun C compiler under Solaris. If you want to use the Sun compiler, use the solariscc Configure abbreviation. If you use a gcc version less than 2.8 on Solaris, make sure the gcc-specific includes have been updated for your version of Solaris -- i.e., run the gcc fixincludes script.



Solaris 7, 8, 9 and 10 support for 64 bit kernels depends on a Sun WorkShop or Forte C compiler version that supports the "-xarch=v9" flag -- usually 5.0 or greater. Gcc versions 2.95 and above \*may\* be configured and built for 64 bit support, but it takes some extra work, the resulting compiler may be fragile, and the gcc developers discourage it. I've built 64 bit capable gcc compilers for Solaris 7, 8 and 9 from gcc versions 2.95 through 3.0.1 and produced working lsof executables with them. More information on 64 bit gcc for Solaris may be found in the 00FAQ file.

Solaris 10 ZFS support is questionable, because Sun does not distribute the ZFS kernel structure definition header files. The lsof Configure script and source code use some risky work-arounds. ZFS file system support was made possible with help from Horst Scheuermann.

Dave Curry and Steve Kirsch provided resources for Solaris 2.x ports. Casper Dik and Gerry Singleton consulted and provided valuable assistance.

Henry Katz, Joseph Kowalski, Charles Stephens, Mike Sullivan, and Mike Tracy provided technical assistance.

AFS support was added to Solaris lsof with help from Curt Freeland, Heidi Hornstein, Michael L. Lewis, Terry McCoy, Phillip Moore, and Sushila R. Subramanian.

Casper Dik provided valuable assistance for the Solaris 8 support.

Sun has graciously provided me access to BETA versions of Solaris 2.5, 2.6, 7, 8, and 9.

John Dzuberka provided Solaris 7 and 8 test systems.

Mike Miscevic provided Solaris 10 test systems.

Ultrix  
=====

As of lsof revision 4.52 support for Ultrix is no longer available, because I no longer have an Ultrix test system.

Terry Friedrichsen, Dwight McKay, and Jeffrey Mogul helped me with this port.

DECnet support was added to Ultrix lsof with the help of John

Beacom, who kindly provided a test system. The Configure script decides that DECnet support is available if /usr/lib/libdnet.a and /usr/include/netdnet/dn.h exist and are readable.

## Veritas VxFS and VxVM

Lsof supports some versions of Veritas VxFS and VxVM on some UNIX dialects. Consult the Lsof Configure script for the specific dialect, and consult the Lsof dialect-specific source files for the UNIX dialect of interest. Veritas support will usually be found in a source file named dnode[1-9].c.

Since Veritas rarely has a version number that can be extracted with shell commands, Lsof doesn't use it. Instead, when Lsof supports Veritas, the Configure script will form compile-time definitions starting with HASVXFS. Check the Lsof 00PORTING documentation file for more information.

Lsof Veritas support requires that the supporting Veritas header files be installed -- e.g., in /usr/include/sys/fs. (The location will depend in the dialect's header file conventions.)

Some information on Lsof support for Veritas extensions may be found in the Lsof 00DIST file.

Chris Kordish and Andy Thomas have provided Solaris VxFS test systems.

## User-contributed Dialect Support

There are some user-contributed dialect versions of Lsof; more information on them can be found at:

<ftp://lsof.itap.purdue.edu/pub/tools/unix/lsof/contrib>

Check the 00INDEX file there for details.

## Dialects No Longer Supported

Because

I don't have access to test systems, these UNIX dialects  
are no longer supported by lsof:

CDC EP/IX

/dev/kmem-based Linux

MIPS RISC/os

Motorola V/88

Pyramid DC/OSx

Pyramid Reliant UNIX

Sequent DYNIX

SGI IRIX

SunOS 4.x

Ultrix

UnixWare below 7.0

Remnants of the support lsof once provided for these dialects may  
be found in:

<ftp://lsof.itap.purdue.edu/pub/tools/unix/lsof/OLD/binaries>  
and  
<ftp://lsof.itap.purdue.edu/pub/tools/unix/lsof/OLD/dialects>

=====  
Installing Lsof  
=====

The distributed Makefiles do not have actions that will install  
lsof. I've come to the conclusion there is no standard for installing  
lsof or its man page, so I no longer distribute make rules for  
installing them. You should adjust the Makefile for your local  
preferences.

The Makefile does have an install rule that will cause lsof to  
compile by virtue of its dependency clause. Some Makefiles also  
have a dependency that causes the production of a man page that is  
ready to install.

However, the actions of the install rule will  
not cause the lsof executable or its man page to be installed in  
any UNIX system-wide directory.

Instead, after the compilation and optional man page production  
are completed, the install rule will produce a brief description  
of what actions you might add to the install rule. The description  
will suggest the possible modes, ownerships, permissions, and  
destinations your install rule might employ to install the lsof  
executable and man page.

As you form your install rule, keep in mind that lsof usually needs some type of special permission to do its job. That may be permission to read memory devices such as /dev/kmem, /dev/mem, or /dev/swap, or it may be authorization to read entries in the /proc file system.

Memory device access can usually be provided by setting the modes of the lsof executable so that its effective group identifier when it runs is the same as the group that has permission to read the memory devices -- i.e., it is setgid-group. The privileged group is usually kmem, sys, or system.

Don't overlook using ACLs -- e.g., on AIX or Solaris 8 -- to give lsof permission to access memory devices. ACLs, coupled to a separate group like kmem, can be safer than giving lsof setgid authorization to a commonly used system group.

When lsof needs to read /proc file system entries, it must be installed with modes that make its effective user identifier root when it runs -- i.e., it must be setuid-root. If lsof must be installed setuid-root (only the AIX 5L, PSTAT-based HP-UX, and /proc-based Linux, ports need such power.), then access to memory devices is automatic (or not needed in the case of /proc-based Linux).

Your choice of permissions for lsof may also be affected by your desire to allow anyone to use it or your need to restrict its usage to specific individuals. You will have to be guided by local policy and convention in this case.

The next two sections, Setgid Lsof Dialect Versions and Setuid-root Lsof

Dialect Versions, list recommended install permissions.

The system directory where you install the lsof executable is also open to choice. A traditional place for a tool like lsof is /usr/local/etc, but recent changes in directory structure organization suggest that somewhere in /opt may be more suitable.

Bear one other factor in mind when choosing a location for the lsof executable -- it usually is a shared executable, requiring access to shared libraries. Thus, locations like /sbin or /usr/sbin are probably unsuitable.

Once you've chosen a location for the executable you may find that the location for the man page follows -- e.g., if the executable goes in /usr/local/etc, then the man page goes in /usr/local/man.

If the executable location doesn't imply a location for the man page, you'll have to let local custom guide you.

#### Setuid-root Lsof Dialect Versions

=====

These dialect versions should be installed with setuid-root permission -- i.e., the lsof binary should be owned by root and its setuid execution bit (04000) should be set.

AIX 5L and above for full use of the -X option  
Apple Darwin 8.x for Power Macintosh systems  
PSTAT-based HP-UX 11.11 and 11.23  
/proc-based Linux (generally 2.1.72 and above)

#### Setgid Lsof Dialect Versions

=====

These dialect versions should be installed with setgid permission, owned by the group that can read kernel memory devices such as /dev/drum, /dev/kmem, /dev/ksyms, /dev/mem, /dev/swap. ACLs may be another mechanism (e.g., under AIX or Solaris 8) you can use to grant read permission to the kernel memory devices.

AIX 4.1.[45], 4.2[.1], and 4.3[.123]  
Apple Darwin 7.x for Power Macintosh systems  
DEC OSF/1, Digital UNIX, Tru64 UNIX 2.0, 3.2, 4.0, and 5.[01]  
FreeBSD 2.1.6, 2.2[.x], 3.x, 4.x, 5.x and [67].x  
/dev/kmem-based 11.00  
NetBSD 1.[456], 2.x and 3.x  
NEXTSTEP 3.[13]  
OpenBSD 2.[89] and 3.[0-9]  
OPENSTEP 4.x  
Caldera OpenUNIX 8  
SCO OpenServer 5.0.[46]  
SCO  
UnixWare 7.0 and 7.1.[0134]  
Solaris 2.6, 8, 9 and 10  
Ultrix 4.2 (no longer available)

=====

#### Porting Lsof 4 to a New UNIX Dialect

=====

If you're brave enough to consider this, look at the 00PORTING

file. Please contact me before you start. I might be able to help you or even do the port myself.

Don't overlook the contrib/ directory in pub/tools/unix/lsof on my ftp server, lsof.itap.purdue.edu. It contains user-contributed ports of lsof to dialects I don't distribute, because I can't test new revisions of lsof on them.

=====

## Quick Start to Using Lsof

=====

For information on how to get started quickly using lsof, consult the 00QUICKSTART file of the lsof distribution. It cuts past the formal density of the lsof man page to provide quick examples of using lsof to solve common open file display problems.

=====

## Cross-configuring Lsof

=====

Using environment variables it is possible to Configure (and possibly build) lsof for one UNIX dialect on a different one -- e.g., you are running Configure on a Linux 2.3 system and you want to Configure and build lsof for Linux 2.4.

See the 00XCONFIG file of the lsof distribution for a discussion of how to do this.

=====

## Environment Variables Affecting the Configure Script

=====

Configure script actions can be modified by introducing values to the script via environment variables. In many cases the environment variable values take the place of test operations the Configure script makes.

For more information on environment variables that can affect Configure, consult the 00XCONFIG file of the lsof distribution. See the General Environment Variables sections for descriptions of ones that affect all dialects. Consult the Dialect-Specific Environment Variables section for ones that might

affect the dialect  
you are trying to configure.

Vic Abell <abe@purdue.edu>  
April 24, 2007

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/\*

\* If this is a regular file with a non-numeric FD, it may be the  
\* executable.

\*/

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\* /Isof-4-85-zip/tests/LTbasic.c

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 \* /Isof-4-85-zip/dialects/hpux/pstat/dfile.c  
 \* /Isof-4-85-zip/dialects/hpux/pstat/dproc.c  
 \* /Isof-4-85-zip/dialects/hpux/pstat/dstore.c  
 \* /Isof-4-85-zip/dialects/hpux/pstat/dproto.h  
 \* /Isof-4-85-zip/dialects/hpux/pstat/machine.h  
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/\*

\* GetOpt() -- Local get option

\*

\* Borrowed from lsof's main.c source file.

\*

\* Liberally adapted from the public domain AT&T getopt() source,  
\* distributed at the 1985 UNIFORM conference in Dallas

\*

\* The modifications allow '?' to be an option character and allow  
\* the caller to decide that an option that may be followed by a  
\* value doesn't have one -- e.g., has a default instead.

\*/

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 \* SUCH DAMAGE.  
 \*  
 \* @(#)cdefs.h 8.2 (Berkeley) 10/4/93  
 \*/

Found in path(s):

\* /lsof-4-85-zip/dialects/osr/include/sys/cdefs.h

# 1.417 syslinux 6.03

## 1.417.1 Available under license :

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Version 2, June 1991

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Version 2, June 1991

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# 1.420 util-linux 2.22.2

## 1.420.1 Available under license :

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Version 2.1, February 1999

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## Constant-time SSSE3 AES core implementation.

## version 0.1

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## By Mike Hamburg (Stanford University), 2009

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## 1.425 attr 2.4.47

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Version 2.1, February 1999

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Found in path(s):

```
* /swagger-annotations-2-1-9-sources-1-jar/io/swagger/v3/oas/annotations/callbacks/Callbacks.java
* /swagger-annotations-2-1-9-sources-1-jar/io/swagger/v3/oas/annotations/responses/ApiResponses.java
* /swagger-annotations-2-1-9-sources-1-jar/io/swagger/v3/oas/annotations/security/OAuthScope.java
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*
* /swagger-annotations-2-1-9-sources-1-jar/io/swagger/v3/oas/annotations/media/Content.java
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* /swagger-annotations-2-1-9-sources-1-jar/io/swagger/v3/oas/annotations/servers/Server.java
* /swagger-annotations-2-1-9-sources-1-jar/io/swagger/v3/oas/annotations/tags/Tag.java
* /swagger-annotations-2-1-9-sources-1-jar/io/swagger/v3/oas/annotations/callbacks/Callback.java
* /swagger-annotations-2-1-9-sources-1-jar/io/swagger/v3/oas/annotations/links/Link.java
* /swagger-annotations-2-1-9-sources-1-jar/io/swagger/v3/oas/annotations/security/SecurityRequirement.java
*
```



```

/swagger-annotations-2-1-9-sources-1-jar/io/swagger/v3/oas/annotations/Parameters.java
* /swagger-annotations-2-1-9-sources-1-jar/io/swagger/v3/oas/annotations/extensions/Extensions.java
* /swagger-annotations-2-1-9-sources-1-jar/io/swagger/v3/oas/annotations/security/OAuthFlow.java
* /swagger-annotations-2-1-9-sources-1-jar/io/swagger/v3/oas/annotations/security/SecurityScheme.java
* /swagger-annotations-2-1-9-sources-1-jar/io/swagger/v3/oas/annotations/media/ExampleObject.java
* /swagger-annotations-2-1-9-sources-1-jar/io/swagger/v3/oas/annotations/media/Encoding.java
* /swagger-annotations-2-1-9-sources-1-jar/io/swagger/v3/oas/annotations/Parameter.java
* /swagger-annotations-2-1-9-sources-1-jar/io/swagger/v3/oas/annotations/ExternalDocumentation.java
* /swagger-annotations-2-1-9-sources-1-jar/io/swagger/v3/oas/annotations/parameters/RequestBody.java
* /swagger-annotations-2-1-9-sources-1-jar/io/swagger/v3/oas/annotations/Operation.java
*
/swagger-annotations-2-1-9-sources-1-jar/io/swagger/v3/oas/annotations/info/License.java
* /swagger-annotations-2-1-9-sources-1-jar/io/swagger/v3/oas/annotations/servers/ServerVariable.java
* /swagger-annotations-2-1-9-sources-1-jar/io/swagger/v3/oas/annotations/security/SecuritySchemes.java
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* /swagger-annotations-2-1-9-sources-1-jar/io/swagger/v3/oas/annotations/Hidden.java
* /swagger-annotations-2-1-9-sources-1-jar/io/swagger/v3/oas/annotations/info/Info.java

```

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```
* /servlet-api-4-0-0-sources-7-jar/org/xipki/http/servlet/AbstractHttpServlet.java
* /servlet-api-4-0-0-sources-7-jar/org/xipki/http/servlet/package-info.java
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* /servlet-api-4-0-0-sources-7-jar/org/xipki/http/servlet/ServletURI.java
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\* /servlet-api-4-0-0-sources-7-jar/META-INF/maven/org.xipki/servlet-api/pom.xml

## 1.433 activation 1.2.2

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Finally, any free program is threatened constantly by software patents. We wish to avoid the danger that companies distributing free software will individually obtain patent licenses, thus in effect transforming the program into proprietary software. To prevent this, we have made it clear that any patent must be licensed for everyone's free use or not licensed at all.

Most GNU software, including some libraries, is covered by the ordinary GNU General Public License, which was designed for utility programs. This license, the GNU Library General Public License, applies to certain designated libraries. This license is quite different from the ordinary one; be sure to read it in full, and don't assume that anything in it is

the same as in the ordinary license.

The reason we have a separate public license for some libraries is that they blur the distinction we usually make between modifying or adding to a program and simply using it. Linking a program with a library, without changing the library, is in some sense simply using the library, and is analogous to running a utility program or application program. However, in a textual and legal sense, the linked executable is a combined work, a derivative of the original library, and the ordinary General Public License treats it as such.

Because of this blurred distinction, using the ordinary General Public License for libraries did not effectively promote software sharing, because most developers did not use the libraries. We concluded that weaker conditions might promote sharing better.

However, unrestricted linking of non-free programs would deprive the users of those programs of all benefit from the free status of the libraries themselves. This Library General Public License is intended to permit developers of non-free programs to use free libraries, while preserving your freedom as a user of such programs to change the free libraries that are incorporated in them. (We have not seen how to achieve this as regards changes in header files, but we have achieved it as regards changes in the actual functions of the Library.) The hope is that this will lead to faster development of free libraries.

The precise terms and conditions for copying, distribution and modification follow. Pay close attention to the difference between a "work based on the library" and a "work that uses the library". The former contains code derived from the library, while the latter only works together with the library.

Note that it is possible for a library to be covered by the ordinary General Public License rather than by this special one.

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A "library" means a collection of software functions and/or data prepared so as to be conveniently linked with application programs (which use some of those functions and data) to form executables.

The "Library", below, refers to any such software library or work which has

been distributed under these terms. A "work based on the Library" means either the Library or any derivative work under copyright law: that is to say, a work containing the Library or a portion of it, either verbatim or with modifications and/or translated straightforwardly into another language. (Hereinafter, translation is included without limitation in the term "modification".)

"Source code" for a work means the preferred form of the work for making modifications to it. For a library, complete source code means all the source code for all modules it contains, plus any associated interface definition files, plus the scripts used to control compilation and installation of the library.

Activities other than copying, distribution and modification are not covered by this License; they are outside its scope. The act of running a program using the Library is not restricted, and output from such a program is covered only if its contents constitute a work based on the Library (independent of the use of the Library in a tool for writing it). Whether that is true depends on what the Library does and what the program that uses the Library does.

1. You may copy and distribute verbatim copies of the Library's complete source code as you receive it, in any medium, provided that you conspicuously and appropriately publish on each copy an appropriate copyright notice and disclaimer of warranty; keep intact all the notices that refer to this License and to the absence of any warranty; and distribute a copy of this License along with the Library.

You may charge a fee for the physical act of transferring a copy, and you may at your option offer warranty protection in exchange for a fee.

2. You may modify your copy or copies of the Library or any portion of it, thus forming a work based on the Library, and copy and distribute such modifications or work under the terms of Section 1 above, provided that you also meet all of these conditions:

a) The modified work must itself be a software library.

b) You must cause the files modified to carry prominent notices stating that you changed the files and the date of any change.

c) You must cause the whole of the work to be licensed at no charge to all third parties under the terms of this License.

d) If a facility in the modified Library refers to a function or a table of data to be supplied by an application program that uses the facility, other than as an argument passed when the facility is invoked, then you must make a good faith effort to ensure that, in the event an application does not supply such function or table, the facility still operates, and performs whatever part of its purpose remains meaningful.

(For example, a function in a library to compute square roots has a purpose that is entirely well-defined independent of the application. Therefore, Subsection 2d requires that any application-supplied function or table used by this function must be optional: if the application does not supply it, the square root function must still compute square roots.)

These requirements apply to the modified work as a whole. If identifiable sections of that work are not derived from the Library, and can be reasonably considered independent and separate works in themselves, then this License, and its terms, do not apply to those sections when you distribute them as separate works. But when you distribute the same sections as part of a whole which is a work based on the Library, the distribution of the whole must be on the terms of this License, whose permissions for other licensees extend to the entire whole, and thus to each and every part regardless of who wrote it.

Thus, it is not the intent of this section to claim rights or contest your rights to work written entirely by you; rather, the intent is to exercise the right to control the distribution of derivative or collective works based on the Library.

In addition, mere aggregation of another work not based on the Library with the Library (or with a work based on the Library) on a volume of a storage or distribution medium does not bring the other work under the scope of this License.

3. You may opt to apply the terms of the ordinary GNU General Public License instead of this License to a given copy of the Library. To do this, you must alter all the notices that refer to this License, so that they refer to the ordinary GNU General Public License, version 2, instead of to this License. (If a newer version than version 2 of the ordinary GNU General Public License has appeared, then you can specify that version instead if you wish.) Do not make any other change in

these notices.

Once this change is made in a given copy, it is irreversible for that copy, so the ordinary GNU General Public License applies to all subsequent copies and derivative works made from that copy.

This option is useful when you wish to copy part of the code of the Library into a program that is not a library.

4. You may copy and distribute the Library (or a portion or derivative of it, under Section 2) in object code or executable form under the terms of Sections 1 and 2 above provided that you accompany it with the complete corresponding machine-readable source code, which must be distributed under the terms of Sections 1 and 2 above on a medium customarily used for software interchange.

If distribution of object code is made by offering access to copy from a designated place, then offering equivalent access to copy the source code from the same place satisfies the requirement to distribute the source code, even though third parties are not compelled to copy the source along with the object code.

5. A program that contains no derivative of any portion of the Library, but is designed to work with the Library by being compiled or linked with it, is called a "work that uses the Library". Such a work, in isolation, is not a derivative work of the Library, and therefore falls outside the scope of this License.

However, linking a "work that uses the Library" with the Library creates an executable that is a derivative of the Library (because it contains portions of the Library), rather than a "work that uses the library". The executable is therefore covered by this License. Section 6 states terms for distribution of such executables.

When a "work that uses the Library" uses material from a header file that is part of the Library, the object code for the work may be a derivative work of the Library even though the source code is not. Whether this is true is especially significant if the work can be linked without the Library, or if the work is itself a library. The threshold for this to be true is not precisely defined by law.

If such an object file uses only numerical parameters, data structure layouts and accessors, and small macros and small inline functions (ten lines or less in length), then the use of the object file is unrestricted, regardless of whether it is legally a derivative

work. (Executables containing this object code plus portions of the Library will still fall under Section 6.)

Otherwise, if the work is a derivative of the Library, you may distribute the object code for the work under the terms of Section 6. Any executables containing that work also fall under Section 6, whether or not they are linked directly with the Library itself.

6. As an exception to the Sections above, you may also compile or link a "work that uses the Library" with the Library to produce a work containing portions of the Library, and distribute that work under terms of your choice, provided that the terms permit modification of the work for the customer's own use and reverse engineering for debugging such modifications.

You must give prominent notice with each copy of the work that the Library is used in it and that the Library and its use are covered by this License. You must

supply a copy of this License. If the work during execution displays copyright notices, you must include the copyright notice for the Library among them, as well as a reference directing the user to the copy of this License. Also, you must do one of these things:

a) Accompany the work with the complete corresponding machine-readable source code for the Library including whatever changes were used in the work (which must be distributed under Sections 1 and 2 above); and, if the work is an executable linked with the Library, with the complete machine-readable "work that uses the Library", as object code and/or source code, so that the user can modify the Library and then relink to produce a modified executable containing the modified Library. (It is understood that the user who changes the contents of definitions files in the Library will not necessarily be able to recompile the application to use the modified definitions.)

b) Accompany

the work with a written offer, valid for at

least three years, to give the same user the materials specified in Subsection 6a, above, for a charge no more than the cost of performing this distribution.

c) If distribution of the work is made by offering access to copy from a designated place, offer equivalent access to copy the above specified materials from the same place.

d) Verify that the user has already received a copy of these materials or that you have already sent this user a copy.



For an executable, the required form of the "work that uses the Library" must include any data and utility programs needed for reproducing the executable from it. However, as a special exception, the source code distributed need not include anything that is normally distributed (in either source or binary form) with the major components (compiler, kernel, and so on) of the operating system on which the executable runs, unless that component itself accompanies the executable.

It may happen that this requirement contradicts the license restrictions of other proprietary libraries that do not normally accompany the operating system. Such a contradiction means you cannot use both them and the Library together in an executable that you distribute.

7. You may place library facilities that are a work based on the Library side-by-side in a single library together with other library facilities not covered by this License, and distribute such a combined library, provided that the separate distribution of the work based on the Library and of the other library facilities is otherwise permitted, and provided that you do these two things:

- a) Accompany the combined library with a copy of the same work based on the Library, uncombined with any other library facilities. This must be distributed under the terms of the Sections above.
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<one line to give the library's name and a brief idea of what it does.>

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<signature of Ty Coon>, 1 April 1990

Ty Coon, President of Vice

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Version 3, 29 June 2007

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Some devices are designed to deny users access to install or run modified versions of the software inside them, although the manufacturer can do so. This is fundamentally incompatible with the aim of protecting users' freedom to change the software. The systematic pattern of such abuse occurs in the area of products for individuals to use, which is precisely where it is most unacceptable. Therefore, we have designed this version of the GPL to prohibit the practice for those products. If such problems arise substantially in other domains, we stand

ready to extend this provision to those domains in future versions of the GPL, as needed to protect the freedom of users.

Finally, every program is threatened constantly by software patents. States should not allow patents to restrict development and use of software on general-purpose computers, but in those that do, we wish to avoid the special danger that patents applied to a free program could make it effectively proprietary. To prevent this, the GPL assures that patents cannot be used to render the program non-free.

The precise terms and conditions for copying, distribution and modification follow.

## TERMS AND CONDITIONS

### 0. Definitions.

"This License" refers to version 3 of the GNU General Public License.

"Copyright" also means copyright-like laws that apply to other kinds of works, such as semiconductor masks.

"The Program" refers to any copyrightable work licensed under this License. Each licensee is addressed as "you". "Licensees" and "recipients" may be individuals or organizations.

To "modify" a work means to copy from or adapt all or part of the work in a fashion requiring copyright permission, other than the making of an exact copy. The resulting work is called a "modified version" of the

earlier work or a work "based on" the earlier work.

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#### 1. Source Code.

The "source code" for a work means the preferred form of the work for making modifications to it. "Object code" means any non-source form of a work.

A "Standard Interface" means an interface that either is an official standard defined by a recognized standards body, or, in the case of interfaces specified for a particular programming language, one that is widely used among developers working in that language.

The

"System Libraries" of an executable work include anything, other than the work as a whole, that (a) is included in the normal form of packaging a Major Component, but which is not part of that Major Component, and (b) serves only to enable use of the work with that Major Component, or to implement a Standard Interface for which an implementation is available to the public in source code form. A "Major Component", in this context, means a major essential component (kernel, window system, and so on) of the specific operating system (if any) on which the executable work runs, or a compiler used to produce the work, or an object code interpreter used to run it.

The "Corresponding Source" for a work in object code form means all the source code needed to generate, install, and (for an executable work) run the object code and to modify the work, including scripts to control those activities. However, it does not include the work's System Libraries, or general-purpose tools or generally available free programs which are used unmodified in performing those activities but which are not part of the work. For example, Corresponding Source includes interface definition files associated with source files for the work, and the source code for shared libraries and dynamically linked subprograms that the work is specifically designed to require, such as by intimate data communication or control flow between those subprograms and other parts of the work.

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section 10

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- c) You must license the entire work, as a whole, under this License to anyone who comes into possession of a copy. This

License will therefore apply, along with any applicable section 7 additional terms, to the whole of the work, and all its parts, regardless of how they are packaged. This License gives no permission to license the work in any other way, but it does not invalidate such permission if you have separately received it.

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## 6. Conveying Non-Source Forms.

You may convey a covered work in object code form under the terms of sections 4 and 5, provided that you also convey the machine-readable Corresponding Source under the terms of this License, in one of these ways:

a) Convey the object code in, or embodied in, a physical product (including a physical distribution medium), accompanied by the Corresponding Source fixed on a durable physical medium customarily used for software interchange.

b) Convey the object code in, or embodied in, a physical product (including a physical distribution medium), accompanied by a written offer, valid for at least three years and valid for as long as you offer spare parts or customer support for that product model, to give anyone who possesses the object code either (1) a copy of the Corresponding Source for all the software in the product that is covered by this License, on a durable physical medium customarily used for software interchange, for a price no more than your reasonable cost of physically performing this conveying of source, or (2) access to copy the Corresponding Source from a network server at no charge.

c) Convey individual copies of the object code with a copy of the

written offer to provide the Corresponding Source. This alternative is allowed only occasionally and noncommercially, and only if you received the object code with such an offer, in accord with subsection 6b.

d) Convey the object code by offering access from a designated place (gratis or for a charge), and offer equivalent access to the Corresponding Source in the same way through the same place at no further charge. You need not require recipients to copy the Corresponding Source along with the object code. If the place to copy the object code is a network server, the Corresponding Source may be on a different server (operated by you or a third party) that supports equivalent copying facilities, provided you maintain clear directions next to the object code saying where to find the Corresponding Source. Regardless of what server hosts the Corresponding Source, you remain obligated to ensure that it is available for as long as needed to satisfy these requirements.

e) Convey the object code using peer-to-peer transmission, provided you inform other peers where the object code and Corresponding Source of the work are being offered to the general public at no charge under subsection 6d.

A separable portion of the object code, whose source code is excluded from the Corresponding Source as a System Library, need not be included in conveying the object code work.

A "User Product" is either (1) a "consumer product", which means any tangible personal property which is normally used for personal, family, or household purposes, or (2) anything designed or sold for incorporation into a dwelling. In determining whether a product is a consumer product, doubtful cases shall be resolved in favor of coverage. For a particular product received by a particular user, "normally used" refers to a typical or common use of that class of product, regardless of the status of the particular user or of the way in which the particular user actually uses, or expects or is expected to use, the product. A product is a consumer product regardless of whether the product has substantial commercial, industrial or non-consumer uses, unless such uses represent the only significant mode of use of the product.

"Installation Information" for a User Product means any methods, procedures, authorization keys, or other information required to install and execute modified versions of a covered work in that User Product from a modified version of its Corresponding Source. The information must suffice to ensure that the continued functioning of the modified object

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 \*  
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 \* /jline-3-11-0-sources-2-jar/org/jline/terminal/impl/ExecPty.java  
 \* /jline-3-11-0-sources-2-jar/org/jline/reader/impl/UndoTree.java

- \* /jline-3-11-0-sources-2-jar/org/jline/builtins/Commands.java
- \* /jline-3-11-0-sources-2-jar/org/jline/reader/Highlighter.java
- \* /jline-3-11-0-sources-2-jar/org/jline/reader/impl/completer/EnumCompleter.java
- \* /jline-3-11-0-sources-2-jar/org/jline/reader/Widget.java
- \* /jline-3-11-0-sources-2-jar/org/jline/keymap/KeyMap.java
- \* /jline-3-11-0-sources-2-jar/org/jline/reader/impl/completer/NullCompleter.java
- \* /jline-3-11-0-sources-2-jar/org/jline/utils/DiffHelper.java
- \*
- /jline-3-11-0-sources-2-jar/org/jline/terminal/impl/MouseSupport.java
- \* /jline-3-11-0-sources-2-jar/org/jline/utils/Log.java
- \* /jline-3-11-0-sources-2-jar/org/jline/terminal/impl/package-info.java
- \* /jline-3-11-0-sources-2-jar/org/jline/utils/ExecHelper.java
- \* /jline-3-11-0-sources-2-jar/org/jline/reader/package-info.java
- \* /jline-3-11-0-sources-2-jar/org/jline/utils/Levenshtein.java
- \* /jline-3-11-0-sources-2-jar/org/jline/builtins/Tmux.java
- \* /jline-3-11-0-sources-2-jar/org/jline/terminal/impl/jna/linux/LinuxNativePty.java
- \* /jline-3-11-0-sources-2-jar/org/jline/reader/impl/completer/package-info.java
- \* /jline-3-11-0-sources-2-jar/org/jline/terminal/impl/CursorSupport.java
- \* /jline-3-11-0-sources-2-jar/org/jline/reader/Expander.java
- \* /jline-3-11-0-sources-2-jar/org/jline/reader/impl/ReaderUtils.java
- \* /jline-3-11-0-sources-2-jar/org/jline/terminal/impl/jna/win/WindowsAnsiWriter.java
- \* /jline-3-11-0-sources-2-jar/org/jline/terminal/impl/jna/osx/CLibrary.java
- \*
- /jline-3-11-0-sources-2-jar/org/jline/terminal/impl/jna/linux/CLibrary.java
- \* /jline-3-11-0-sources-2-jar/org/jline/terminal/impl/jna/osx/OsXNativePty.java
- \* /jline-3-11-0-sources-2-jar/org/jline/reader/Macro.java
- \* /jline-3-11-0-sources-2-jar/org/jline/terminal/Attributes.java
- \* /jline-3-11-0-sources-2-jar/org/jline/terminal/MouseEvent.java
- \* /jline-3-11-0-sources-2-jar/org/jline/terminal/impl/jna/JnaNativePty.java
- \* /jline-3-11-0-sources-2-jar/org/jline/terminal/impl/AbstractPosixTerminal.java
- \* /jline-3-11-0-sources-2-jar/org/jline/terminal/impl/NativeSignalHandler.java
- \* /jline-3-11-0-sources-2-jar/org/jline/reader/impl/DefaultHighlighter.java
- \* /jline-3-11-0-sources-2-jar/org/jline/builtins/TTop.java
- \* /jline-3-11-0-sources-2-jar/org/jline/utils/WCWidth.java
- \* /jline-3-11-0-sources-2-jar/org/jline/reader/Reference.java
- \* /jline-3-11-0-sources-2-jar/org/jline/reader/Binding.java
- \* /jline-3-11-0-sources-2-jar/org/jline/utils/AttributedString.java
- \* /jline-3-11-0-sources-2-jar/org/jline/utils/Signals.java
- \*
- /jline-3-11-0-sources-2-jar/org/jline/terminal/impl/jna/solaris/SolarisNativePty.java
- \* /jline-3-11-0-sources-2-jar/org/jline/terminal/spi/Pty.java
- \* /jline-3-11-0-sources-2-jar/org/jline/reader/Parser.java
- \* /jline-3-11-0-sources-2-jar/org/jline/reader/EndOfFileException.java
- \* /jline-3-11-0-sources-2-jar/org/jline/utils/InputStreamReader.java
- \* /jline-3-11-0-sources-2-jar/org/jline/reader/impl/history/package-info.java
- \* /jline-3-11-0-sources-2-jar/org/jline/reader/UserInterruptException.java
- \* /jline-3-11-0-sources-2-jar/org/jline/terminal/impl/jna/freebsd/CLibrary.java
- \* /jline-3-11-0-sources-2-jar/org/jline/terminal/impl/jna/freebsd/FreeBsdNativePty.java

- \* /jline-3-11-0-sources-2-jar/org/jline/utils/ClosedException.java
- \* /jline-3-11-0-sources-2-jar/org/jline/utils/OSUtils.java
- \* /jline-3-11-0-sources-2-jar/org/jline/builtins/Source.java
- \* /jline-3-11-0-sources-2-jar/org/jline/terminal/Cursor.java
- \* /jline-3-11-0-sources-2-jar/org/jline/reader/impl/DefaultExpander.java
- \*
- /jline-3-11-0-sources-2-jar/org/jline/utils/ShutdownHooks.java
- \* /jline-3-11-0-sources-2-jar/org/jline/utils/package-info.java
- \* /jline-3-11-0-sources-2-jar/org/jline/reader/impl/completer/StringsCompleter.java
- \* /jline-3-11-0-sources-2-jar/org/jline/reader/impl/completer/AggregateCompleter.java

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- \* /jline-3-11-0-sources-2-jar/org/jline/reader/impl/DefaultParser.java
- \* /jline-3-11-0-sources-2-jar/org/jline/terminal/Size.java
- \* /jline-3-11-0-sources-2-jar/org/jline/builtins/Completers.java
- \* /jline-3-11-0-sources-2-jar/org/jline/utils/NonBlockingInputStream.java
- \* /jline-3-11-0-sources-2-jar/org/jline/terminal/impl/PosixSysTerminal.java
- \* /jline-3-11-0-sources-2-jar/org/jline/reader/ParsedLine.java
- \* /jline-3-11-0-sources-2-jar/org/jline/builtins/Less.java
- \* /jline-3-11-0-sources-2-jar/org/jline/utils/NonBlockingInputStreamImpl.java
- \* /jline-3-11-0-sources-2-jar/org/jline/reader/impl/completer/FileNameCompleter.java

```

* /jline-3-11-0-sources-2-jar/org/jline/reader/CompletingParsedLine.java
*
/jline-3-11-0-sources-2-jar/org/jline/utils/AttributedStringBuilder.java
* /jline-3-11-0-sources-2-jar/org/jline/terminal/impl/AbstractTerminal.java
* /jline-3-11-0-sources-2-jar/org/jline/utils/Curses.java
* /jline-3-11-0-sources-2-jar/org/jline/reader/MaskingCallback.java
* /jline-3-11-0-sources-2-jar/org/jline/style/StyleExpression.java
* /jline-3-11-0-sources-2-jar/org/jline/terminal/Terminal.java
* /jline-3-11-0-sources-2-jar/org/jline/utils/Status.java
* /jline-3-11-0-sources-2-jar/org/jline/utils/Colors.java
* /jline-3-11-0-sources-2-jar/org/jline/utils/Display.java
* /jline-3-11-0-sources-2-jar/org/jline/style/StyleFactory.java
* /jline-3-11-0-sources-2-jar/org/jline/keymap/BindingReader.java
* /jline-3-11-0-sources-2-jar/org/jline/utils/NonBlocking.java
* /jline-3-11-0-sources-2-jar/org/jline/reader/LineReader.java
* /jline-3-11-0-sources-2-jar/org/jline/builtins/InputRC.java
* /jline-3-11-0-sources-2-jar/org/jline/terminal/impl/ExternalTerminal.java
*
/jline-3-11-0-sources-2-jar/org/jline/terminal/impl/jna/win/Kernel32.java
* /jline-3-11-0-sources-2-jar/org/jline/utils/NonBlockingReader.java
* /jline-3-11-0-sources-2-jar/org/jline/builtins/NfaMatcher.java
* /jline-3-11-0-sources-2-jar/org/jline/utils/NonBlockingReaderImpl.java
* /jline-3-11-0-sources-2-jar/org/jline/reader/impl/KillRing.java
* /jline-3-11-0-sources-2-jar/org/jline/reader/impl/completer/ArgumentCompleter.java
* /jline-3-11-0-sources-2-jar/org/jline/utils/StyleResolver.java
* /jline-3-11-0-sources-2-jar/org/jline/utils/AttributedStyle.java
* /jline-3-11-0-sources-2-jar/org/jline/reader/LineReaderBuilder.java
* /jline-3-11-0-sources-2-jar/org/jline/terminal/impl/PosixPtyTerminal.java
* /jline-3-11-0-sources-2-jar/org/jline/reader/impl/history/DefaultHistory.java
* /jline-3-11-0-sources-2-jar/org/jline/terminal/impl/LineDisciplineTerminal.java
* /jline-3-11-0-sources-2-jar/org/jline/reader/History.java
* /jline-3-11-0-sources-2-jar/org/jline/terminal/impl/DumbTerminal.java
*
/jline-3-11-0-sources-2-jar/org/jline/style/Styler.java
* /jline-3-11-0-sources-2-jar/org/jline/style/StyleSource.java
* /jline-3-11-0-sources-2-jar/org/jline/reader/Candidate.java
* /jline-3-11-0-sources-2-jar/org/jline/reader/Completer.java

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- \* /jline-3-11-0-sources-2-jar/org/jline/builtins/telnet/TelnetIO.java
- \* /jline-3-11-0-sources-2-jar/org/jline/builtins/telnet/ConnectionData.java
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- \* /jline-3-11-0-sources-2-jar/org/jline/terminal/spi/JnaSupport.java
- \* /jline-3-11-0-sources-2-jar/org/jline/terminal/impl/jna/win/JnaWinSysTerminal.java
- \* /jline-3-11-0-sources-2-jar/org/jline/terminal/impl/AbstractPty.java
- \* /jline-3-11-0-sources-2-jar/org/jline/terminal/impl/jansi/win/JansiWinSysTerminal.java
- \* /jline-3-11-0-sources-2-jar/org/jline/terminal/spi/JansiSupport.java
- \* /jline-3-11-0-sources-2-jar/org/jline/reader/impl/LineReaderImpl.java
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- \* /jline-3-11-0-sources-2-jar/org/jline/terminal/impl/jansi/win/JansiWinConsoleWriter.java
- \* /jline-3-11-0-sources-2-jar/org/jline/utils/NonBlockingPumpInputStream.java
- \* /jline-3-11-0-sources-2-jar/org/jline/builtins/ssh/ShellCommand.java
- \* /jline-3-11-0-sources-2-jar/org/jline/terminal/impl/jna/win/JnaWinConsoleWriter.java
- \* /jline-3-11-0-sources-2-jar/org/jline/style/StyleBundle.java
- \* /jline-3-11-0-sources-2-jar/org/jline/terminal/impl/jansi/freebsd/FreeBsdNativePty.java
- \* /jline-3-11-0-sources-2-jar/org/jline/style/NopStyleSource.java
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- /jline-3-11-0-sources-2-jar/org/jline/terminal/impl/jansi/linux/LinuxNativePty.java
- \* /jline-3-11-0-sources-2-jar/org/jline/reader/impl/SimpleMaskingCallback.java
- \* /jline-3-11-0-sources-2-jar/org/jline/terminal/impl/jansi/JansiNativePty.java
- \* /jline-3-11-0-sources-2-jar/org/jline/utils/NonBlockingPumpReader.java
- \* /jline-3-11-0-sources-2-jar/org/jline/builtins/ssh/ShellFactoryImpl.java
- \* /jline-3-11-0-sources-2-jar/org/jline/style/InterpolationHelper.java
- \* /jline-3-11-0-sources-2-jar/org/jline/reader/impl/BufferImpl.java
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- \* /jline-3-11-0-sources-2-jar/org/jline/style/StyledWriter.java
- \* /jline-3-11-0-sources-2-jar/org/jline/style/MemoryStyleSource.java
- \* /jline-3-11-0-sources-2-jar/org/jline/style/StyleResolver.java
- \* /jline-3-11-0-sources-2-jar/org/jline/utils/PumpReader.java
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- \* /jline-3-11-0-sources-2-jar/org/jline/reader/Buffer.java
- \* /jline-3-11-0-sources-2-jar/org/jline/terminal/impl/AbstractWindowsConsoleWriter.java
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